ENCYCLOPEDIA
AMERICANA

ELLESMERE I.
Arctic
Baffin Bay
GREENLAND
WRANGEL I.
VICTORIA I.
BAFFIN I.
USSR
SIBERIA
ALASKA
Nome
Godthaab
Hudson Bay
Bering Sea
Juneau
North
KAMCHATKA PENIN.
CANADA
ALEUTIAN IS.
Vancouver
Montreal
Ottawa
Toronto
Quebec
St. John's
North Pacific
Chicago
Atlantic
UNITED STATES
New York
San Francisco
Denver
Washington
AZORES
Ocean
Los Angeles
New Orleans
Houston
BERMUDA
Ocean
MIDWAY IS.
Gulf of Mexico
MEXICO
BAHAMAS
Havana
Honolulu
HAWAII
CUBA
HAITI
WAKE I.
Mexico City
BR.HON.
VIRGIN IS.
DOM.REP.
PUERTO RICO
GUATEMALA
HON.
Caribbean
EL SALVADOR
NIC.
Sea
Caracas
MARSHALL IS.
CLIPPERTON
COSTA RICA
VENEZUELA
PANAMA
COLOMBIA
Bogotá
GUIANAS
GILBERT IS.
EQUATOR
GALÁPAGOS IS.
Quito
ECUADOR
SOLOMON IS.
ELLICE IS.
MARQUESAS IS.
PERU
BRAZIL
Lima
SAMOA
La Paz
NEW HEBRIDES
TUAMOTU ARCH.
BOLIVIA
Rio de Janeiro
FIJI IS.
Sucre
PARAGUAY
NEW CALEDONIA
SOCIETY IS.
Asunción
São Paulo
PITCAIRN I.
CHILE
South Pacific
Santiago
URUGUAY
Buenos Aires
Montevideo
Tasman Sea
NEW ZEALAND
Wellington
ARGENTINA
Ocean
FALKLAND IS.
N
TIERRA del FUEGO
S. GEORGIA
S. ORKNEY IS.
S. SHETLAND IS.
PALMER PENINSULA
Weddell Sea
ANTARCTICA
MARIE BYRD LAND

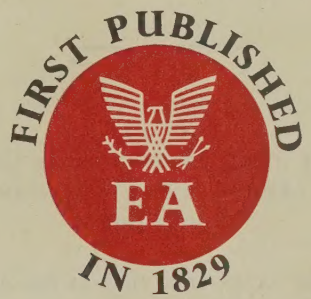
THE WORLD

ENCYCLOPEDIA AMERICANA MAP

BY HAROLD K. FAYE

THE ENCYCLOPEDIA AMERICANA

THE INTERNATIONAL REFERENCE WORK



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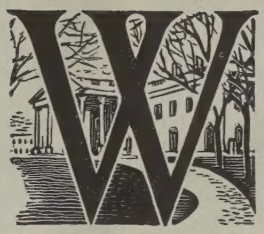
WASPS–ZYMOTIC DISEASE



WASPS, insects of the order Hymenoptera, most typically characterized by a narrow waist connecting the thorax and the abdomen. Ants, bees, sawflies, horntails, and a few others are also Hymenoptera. The remaining families of the order are known loosely as wasps, although the average observer would not think of them as wasps. They are often called flies, but this is a misnomer, as true flies of the order Diptera have only one pair of wings, while Hymenoptera have two pairs. These atypical wasps are mostly parasites and are extremely important in maintaining the balance of nature by destroying the plant-feeding insects which compete with man for food.

Parasitic Wasps.—The parasitic wasps include the ichneumons, braconids, proctotrupids, and chalcidoids and range from large species whose larvae feed internally on the bodies of caterpillars and other insects to minute forms whose entire growth can occur within an egg of a small insect. These minute wasps are among the smallest insects, some of them being only 0.21 millimeters (less than one hundredth of an inch) in length.

The majority of the parasitic wasps insert their eggs into the bodies of their living and active hosts by means of sharp ovipositors. The host insect continues its normal life until killed by the growing wasp larva or grub within. Most such wasps do not use their ovipositors as stings to defend themselves. A few, however, temporarily inactivate their hosts by means of a poison injected through the ovipositor. Such wasps may also sting in defense if picked up in the fingers. In more typical wasps the ovipositor has lost its original egg-laying function and serves only as a sting. The eggs are too large to pass through the sting and are laid from an aperture at its base. As the sting is a modified ovipositor, it is absent in all male Hymenoptera.

Typical Wasps.—It is an easily understood step from stinging parasitic wasps to certain more typical wasps such as Scoliidae which search for their prey, usually white grubs—larvae of June beetles (Scarabaeidae)—in the soil. Such a grub is paralyzed with a sting and an egg laid on it, after which the wasp goes on. Several of the natural enemies of the Japanese beetle, introduced from Japan in an attempt to control that pest, have such habits.

Nonsocial Wasps.—The next important step in wasp evolution appears to have been the establishment of a home, a nest, to which the wasp returns with its prey. (See NESTS AND NEST BUILDING.) The wasps discussed above have no such home, but simply wander about in search of hosts or prey. Most typical wasps, however, construct a nest, then paralyze the prey with a sting and carry it to the nest. The wasp places the prey in a small enclosed space (cell), lays an egg, seals the cell, and goes on to construct and provision other cells. This manner of providing food for the young is called mass provisioning. Such mother wasps never see their own young, for the cells are sealed immediately after egg laying and the mother is dead before her progeny mature and emerge. The advantage of paralyzing rather than killing the prey stored in the nest seems to be that the growing wasp grubs have fresh, in fact living, food to eat.

Among the many wasps whose behavior is as described above are the tarantula hawk (*Pepsis*), blue-black with red wings, and large enough to overpower and paralyze tarantulas; the cicada killer (*Sphecius*), a giant yellow-banded wasp that captures and paralyzes cicadas or locusts; the thread-waisted sand wasps (*Ammophila*), which put paralyzed caterpillars in holes in the soil as food for their larvae; the familiar mud daubers (*Sceliphron*) which make their mud nests on walls; and tiny black wasps (*Stigmus*) which fill their cells in pithy stems with paralyzed aphids or plant lice.

Wasps such as the above are called solitary or nonsocial because each female makes her own nest and never lives with her progeny. Some wasps, however, have become subsocial, that is, the food is provided progressively as needed by the larva. Some eumenid wasps provide whole caterpillars progressively, others partly chewed caterpillars, and a few chew up caterpillars into masses of tissue.

Social Wasps.—The latter method of feeding is that used by the social wasps (family Vespidae). These wasps are termed social because the mother is sufficiently long-lived to live with her mature progeny. The resulting colony is held together partly by exchange of food; the adults feed the larvae but also crave a secretion of the larvae. This mutual exchange of food is called trophallaxis. In such a colony the mother is the queen, while her female progeny are mostly slightly smaller, do not lay eggs, and are called workers. Nests of social wasps are nearly all made of wasp paper. Such paper, made from wood and stem fibers, was made by wasps millions of years before man learned the art.

The common social wasps of temperate climates pass the winter as fertilized young queens hidden in protected places. In the spring they come forth and usually each builds a small nest to rear her first progeny, all of which are females and mature as workers. After they are mature the queen ceases foraging and spends her time in the nest, where she lays eggs while the workers do

the foraging, enlarge the nest, and defend it. In late summer the queen's eggs, for reasons that are little understood, develop not into workers but into males and young queens. With cold weather all die except the young fertilized queens.

In North America there are two principal types of social wasps, each represented by numerous species. One type, the common paper wasps (*Polistes*), have small and usually timid colonies on exposed combs of paper cells hanging from eaves of buildings, branches of bushes or trees, and many similar localities. In fall the young fertilized queens often work into houses while searching for hibernating quarters. The other type constructs combs surrounded by paper envelopes. The colonies are much larger than in *Polistes,* and consist of hundreds or thousands of individuals having exceedingly painful stings. Those that nest in cavities in the soil (*Vespula*) are called yellow jackets while those that place their nests on branches of bushes or trees (*Dolichovespula*) may be called yellow jackets, although the larger species are often termed hornets. A single species introduced from Europe (*Vespa crabro*) nests in hollow trees and similar places and is called the European hornet.

Consult Wheeler, William M., *Social Life Among the Insects* (New York 1923); Michener, Charles D., and Michener, Mary H., *American Social Insects* (New York 1951); Richards, Owain W., *The Social Insects* (New York 1953).

CHARLES D. MICHENER,
and MARY H. MICHENER.

WASSAIL, wŏs"l (Anglo-Saxon *wes hāl,* be whole or have health), a greeting or toast on a special occasion, at the same time offering a beverage and drinking a health. In medieval times and earlier, a bowl was prepared with ale or wine, flavored with sugar, spices, toast, and fruit, like the modern punch, probably heated by plunging a redhot poker in the mixture. Groups of people went from house to house on Christmas and Twelfth Night, singing carols, and were offered the wassail bowl at each stop. This is the origin of the old English carol *Here we come a-wassailing* . . . In Shakespeare's *Hamlet,* Act I, scene 4, Hamlet says:

> The king doth wake tonight and takes his rouse,
> Keeps wassail . . .

An old poem of Robert de Brunne (13th century) describes the custom of offering the wassail bowl to a guest, with the proper response, "Drink hail." A wassail is sometimes used to denote a drinking song, and wassailers came to mean drunkards, as in John Milton's *Comus.*

WASSERMANN, väs'ĕr-män, **August von,** German bacteriologist: b. Bamberg, Bavaria, Feb. 21, 1866; d. Berlin, Germany, March 15, 1925. After studying at the universities of Munich, Erlangen, Strasbourg, and Vienna, Wassermann began practice as a physician in Strasbourg in 1888. Under Robert Koch (q.v.) he was director of the department of experimental therapy and biochemistry at the Koch Institute for Infectious Diseases, Berlin, and later was director at the Kaiser Wilhelm Institute in Berlin-Dahlem (1913). He developed antitoxin treatment of diphtheria, inoculation against typhoid, cholera, and tetanus, and did valuable work in pre-tuberculosis cases. He also worked out a differentiation classification for blood groups. His work in diagnosing syphilis is best known. Working with Albert Neisser and Carl Bruck on the Bordet-Gengou reaction, he discovered a complement-fixation test for syphilis, which is called by his name (1906).

Wassermann Reaction or Test.—A serum composed of an extract of the *Spirochaeta pallida* is used to test the presence in the blood or spinal fluid of antibodies which have been formed as the result of an infection of syphilis which affected tissue cells. This may be found even though evidence of the disease is not observable at the time. If the patient is syphilitic the complement in the serum will not dissolve the red blood cells; if syphilis is absent, the cells are dissolved, producing a clear fluid in the test tube. Sometimes a positive reaction is obtained from yaws, leprosy, malaria, and infectious mononucleosis. Also, a positive reaction may be had from the spinal fluid, and a negative from the blood. Nevertheless, the Wassermann test, even though simplified by later research, is still considered the most reliable, and in some states, the test is required for a premarital medical certificate.

WASSERMANN, Jakob, German-Jewish novelist: b. Fürth, Bavaria, March 10, 1873; d. Alt-Aussee, Austria, Jan. 1, 1934. Wassermann's early years were spent in extreme hardship, but after his stories and poems appeared in *Simplicissimus,* he went on to attain fame and recognition as one of the foremost German writers. In 1896 his novel *Die Juden von Zirndorf* (tr. as both *The Jews of Zirndorf* and *The Dark Pilgrimage,* 1933), introduced a writer of great narrative ability who employed strange characters and posed interesting problems. In 1898 he went to live in Austria. Among his novels were *Caspar Hauser* (1908; Eng. tr., 1928); *Das Gänsemännchen* (1915; Eng. tr., *The Goose Man,* 1922); *Christian Wahnschaffe* (1919; Eng. tr., *The World's Illusion,* 1920); *Der Fall Maurizius* (1928; Eng. tr., *The Maurizius Case,* 1929); *Etzel Andergast* (1931; Eng. tr., 1928); its sequel, *Joseph Kerkhoven's dritte Existenz* (1934; Eng. tr., *Kerkhoven's Third Existence,* 1934). His autobiography, *Mein Weg als Deutscher und Jude* (1921; Eng. tr., *My Life as German and Jew,* 1933), expressed the difficulties of the Jew in Europe even before the Nazi anti-Semitism.

Consult Blankenagel, John Carl, *Writings of Jakob Wassermann* (Boston 1942).

WASTE, *in law,* the result of any act or omission by the tenant of any particular estate by which it is rendered of less permanent value. Waste is of two sorts, *voluntary* and *permissive.* The former is that caused by active procedure on the part of the tenant, such as the destruction or alteration of buildings, the removal of fixtures, the cutting down of fruit or shade trees or ornamental shrubs, or in the case of a wood lot, the removal of timber trees and cordwood and their sale for the benefit of the tenant. The latter may, however, cut such timber as is needed and used in the repair of the buildings on the estate. Permissive waste is that caused by negligence, such as the allowing of buildings to fall out of repair. Under the law of waste a tenant may work any mine or quarry already in existence on the leased property unless specifically forbidden in the lease. But he is not permitted to open and operate for his own gain either mine or quarry. In some states of the United States the tenant is permitted to clear up wild land for agricultural

purposes; but he must not sell the product of such clearing in cordwood or lumber for his own emolument. On the theory of permissive waste as developed at common law is based the rule which throws upon the tenant the responsibility of making all ordinary repairs in the premises which he occupies. Though he cannot strictly be required to make repairs, and is not liable in damages for any failure so to do, yet in case of an action for waste against him his only defense is a demonstration that he has repaired the waste, and he, therefore, prefers to maintain the premises in repair.

WASTE, or BY-PRODUCTS. Waste is that portion of raw material used in any specific manufacture which is in the process rendered useless for that particular line. However, the name is sometimes retained long after a substance, at one time of little or no value, has been utilized as raw material in some other industry. In every manufacturing process, mechanical or chemical, there is more or less left over material which becomes waste. The examples given below relate to new waste, but nearly everything we use wears or corrodes, or gets broken or unshapely, and so rags and rust and scraps arise. On the other hand, the rust which arises from corroding iron is utter waste, since it can never be profitably collected at all. There is a kind of waste, for the most part difficult to prevent, which goes on in the consumption of fuel, and in certain processes of roasting or calcination in the smelting of metals. Roundly speaking, the best designed steam-engines and boilers require only half as much coal per horse power per hour as those less skilfully constructed, and the fuel unnecessarily consumed by bad boiler furnaces is largely wasted as smoke through imperfect combustion. The utilization of blast furnaces gases for heating purposes, and the recovery of tar and ammonia also produced at the same time from the coal consumed in these furnaces, form an instance of a double saving from the same source. In the report of the chief inspector of alkali works for 1891, it is stated that the plant put up in recent years for collecting tar, ammonia, etc., at 57 Scotch blast furnaces cost $2,223,000, a sum fully equal to the cost of building the furnaces themselves. The condensing flues, miles in length, connected with some lead-smelting furnaces are modern examples for appliances to condense lead fumes or vapor which formerly was allowed to escape, causing much loss of the metal.

Some instances of how waste in a solid form arises in working rock and other mineral substances may now be given. In shaping and dressing granite paving stones as much as three-fourths of the rock quarried is, in some instances at least, wasted. This waste is as yet only in very small part utilized for road metal, and for "granolithic" pavements. Blast-furnace slag is now utilized in several ways, notably in the manufacture of Portland cement. In a number of cases the accumulations of other kinds of slag on the sites of ancient smelting works have, in modern times, been again put through the furnace to extract the metals left in them, with profitable results. Some of the refuse from the old silver mines of Laurium has been bought up by capitalists for this purpose. One instance though not of very recent date, may be given where, by the salvaging of a by-product, a fortune was very quickly amassed. About 1840 Mr. Askin of Birmingham discovered a method of separating cobalt, in the form of oxide, from nickel, two metals which were very difficult to separate. This oxide of cobalt was at first a waste product, but before very long it was put into the hands of potters, who readily bought it up to produce a blue color on their ware, at the rate of two guineas per pound. Among comparatively recent instances of utilization of by-products and waste products in the chemical industries, we may refer to the importance of the substances now developed from coal tar (q.v.), and the great value of some of them in the manufacture of dyes. Another example is the recovery of binoxide of manganese in the production of chlorine for the manufacture of bleaching powder by Weldon's beautiful process. Formerly for every 100 pounds of bleaching powder made about 100 pounds of the native oxide of manganese were required. Now this manganese is recovered and used again and again in the process, with only a loss of about 5 per cent to make up each time it is returned to the chlorine still. The earlier methods of recovering manganese were not nearly so perfect, and, therefore, were not much used. A process for the utilization of chemical waste on a great scale is Chance's method, patented in 1888, of recovering sulphur from alkali makers' black-ash refuse. A British automobile manufacturing concern salvages 1,200 gallons of cutting oil a week from scrap metal, this oil being used again with the addition of 10 per cent of new oil, the latter being the actual amount of unrecoverable waste. Another establishment treated in one year 83,400 pounds of lathe waste, recovering 2,292 gallons of cutting oil. Large quantities of machine oil are recoverable from rags and cotton waste used for wiping machinery. The process of oil recovery so cleanses the wipers that they are useful again. The year's report shows 350,000 wipers treated, and an annual replacement of only 15,000 new cloths required; and a recovery of more than 5,000 gallons of oil — the total cost of the operation being less than $1,000.

Passing to vegetable substances, the various materials besides rags used in the manufacture of paper may be first noticed. Straw, wood, and esparto fibre, if not exactly waste products, were at least undeveloped substances before they became, as they now are, so largely used in paper making. Old ropes, flax and jute-mill waste, old or torn pieces of paper of every kind, are all serviceable in paper-mills or in the manufacture of millboard. In the pulp of the latter old newspapers bulk largely. Cotton waste is much used by mechanical engineers for cleaning purposes. Sawdust is employed in several ways: in the manufacture of artificial wood, which is pressed into many architectural forms; as a source of oxalic acid, and of pyroligneous acid; and, when compounded with magnesium chloride, as a durable, warm and resilient coating for the cement floors of fireproof buildings. Chips of yellow pine from Southern shipyards yield turpentine and rosin to the waste industry. One of the most interesting developments of all is the manufacture of artificial silk from the wood waste of saw-mills and carpenter shops. The timber

wastes of the United States are prodigious; the estimate for 1913 placing the total at 150,000,000 tons. One of the most effective activities of the Forest Service is directing the salvaging of this waste and its delivery into the hands of establishments which will utilize it. The waste liquors of the wood-pulp industry yield alcohol, adhesives, tanning agents and thymol; and a recently discovered Norwegian process for separating the lignin makes that substance available for fuel — in amount nearly or quite enough to furnish all the heat required in making the pulp. Molasses, a waste product of sugar making, besides being a food, yields large quantities of industrial alcohol at low cost; and, as a by-product to this manufacture, yields valuable potash salts. Corkcutter's waste has become of high importance in the manufacture of linoleum and cork carpet. Cork mattresses and life-preservers, compressed with shellac into new bottle corks, for lining refrigerators and as a substitute for shavings in vinegar making. From the bark stripped from osier wands the useful medicine salicin is now made. In days not so long past the spent madder of our large dyeworks was suddenly raised from a useless to a valuable material by treatment with sulphuric acid, which converted it into the dye called garancin. One of the most interesting examples of what has been done in converting a waste animal product into a highly useful material is seen in the case of waste silk. Cocoons do not yield half their weight of reeled silk, but the remaining «waste» portion has, through the ingenuity of an English inventor, become the raw material for a large spun silk industry. In Venice artificial flowers for ladies' headdresses are made of imperfect cocoons. The various kinds of waste from woolen mills and from the cutting up of woolen fabrics are either worked up again, the short fibre into mungo and the long fibre into shoddy, or it is used for felt or ground into flock for paper hangings. Glue (q.v.) is made from parings of hide and bone, which also yield glycerine. The turnings and dust of the ivory and bone turner have various useful applications. From almost any waste animal matter, such as parings of horns and hoofs, hair, blood, leather cuttings and even field mice, is made the whole list of the invaluable cyanides. The waste of leather cutting is compounded with waste or scrap rubber in the production of a waterproof artificial sole leather. Clippings of fur skins are made into hats and fish scales into artificial pearls. The waste of mother-of-pearl left by button cutters is converted into a fine powder of peculiarly beautiful silky lustre, and used in making artificial flowers and fine wallpapers. The skim-milk residue of butter factories is made into a grade of condensed milk or treated as a source of commercial casein, the whey being worked for its content of milk sugar. The waste bone-charcoal of the sugar refineries is treated with sulphuric acid to make the valued bone phosphate fertilizer. Other materials regularly dealt in by the dealers in waste include old twine, old oilcloth and carpets, books and magazines, old hats, broken glass and old bottles, moss, hair, fur, bones and many others.

The enormously increased prices following the entrance of the United States into the World War gave a market stimulus to the waste industry, owing to the increased values which waste assumed. The larger establishments found it profitable to organize individual salvage departments, in some cases costing into the millions; equipped with complete outfits for treating all sorts of waste. It has been stated that the national savings during the war in scrap metal, wool waste, paper, rags, bags and cotton linters were more than $1,500,000,000.

By destructive distillation of coal Ford converts a ton of bituminous into 8,000 cu. ft. of gas, 10 gals. of gasoline, 20 lbs. ammonium sulphate, 30 gals. crude light tar, 3 gals. creosote oil, 2 gals. crude lubricating oil, 10 lbs. grease and has left 1,500 lbs. coke. The net money loss of present practises is estimated at $2,000,000,000 which could be salvaged by the proper use of coal including doubling the horse-power and salvaging the ammonium sulphate, benzol, tar, creosote oil, etc.

Smaller establishments disposed of their waste at good prices to one of a large and competitive throng of dealers. The waste trade has its own directory which lists more than 30,000 concerns who either deal in wastes or who use these wastes as raw material in their own industries. Some 6,000 of these dealers are in foreign countries, and not only sell their own domestic waste, but buy at good prices the wastes of American industries. Consult Koller, T., 'The Utilization of Waste Products' (London 1918); Kershaw, J. B. C., 'Recovery and Use of Waste' in 'Industrial Chemist' (1926).

WASTE LANDS, uncultivated and unprofitable tracts in populous and cultivated countries. The term waste lands is not employed with reference to land not reduced to cultivation in countries only partially settled. There is a large extent of waste lands even in Great Britain. Of the total 56,107,000 acres which it contains (excluding water), only 30,280,000 acres are arable land and improved pastures; 2,736,000 acres are occupied by woods and plantations. In Scotland 9,710,000 acres were rough grazing land in 1926, generally at considerable elevation and little improved by art. In a recent year in Ireland 8,000,000 acres were uninclosed pasture, 3,000,000 acres were mountain and bog; and the remainder was unimproved and unproductive.

In the United States, much of the land now practically waste is in this condition merely because the time has not yet come for profitable development of its capacities. That brought under cultivation is remarkably productive. The report of the Department of the Interior declares that on 1 July, 1931, the acreage of «unappropriated and unreserved lands» in the United States was as follows:

	Surveyed lands	Unsurveyed lands	Total
Arizona	7,489,400	6,877,000	14,366,400
Arkansas	184,170	.....	184,170
California	10,833,154	5,213,794	16,046,948
Colorado	6,536,475	1,120,665	7,657,140
Florida	15,807	5,900	21,707
Idaho	9,676,675	1,809,252	11,485,927
Minnesota	193,090	.....	193,090
Montana	6,319,052	90,980	6,410,032
Nebraska	20,805	.....	20,805
Nevada	30,133,644	21,265,652	51,399,296
New Mexico	13,198,947	1,185,048	14,383,995
No. Dakota	146,349	.....	146,349
Oregon	12,889,846	92,411	12,982,257
So. Dakota	459,516	.....	459,516
Utah	13,533,638	11,623,362	25,157,000

	Surveyed lands	Unsurveyed lands	Total
Washington	923,539	6,850	930,389
Wyoming	14,711,778	544,752	15,256,530
Total	127,265,885	49,835,666	177,101,551
Alaska	.....	346,201,925	346,201,925
Grand total ..	127,265,885	396,037,591	523,303,476

WASTES, Disposal of City.—The public wastes of a city may be grouped into two very broad classes: sewage, including industrial chemical wastes; and refuse. The first class is specifically treated under the title SANITARY ENGINEERING and elsewhere in these volumes.

Refuse.—This second broad class of city wastes includes garbage, ashes, street sweepings, rubbish, dead animals, night soil, swill, slops, offal, trade wastes, and other putrescible and nonputrescible wastes, except the liquid-carried wastes normally discharged into sewers. With the increased use of garbage grinders quantities of garbage are being discharged into the sewerage system and handled in the same manner as the wastes discussed under SANITARY ENGINEERING—*Sewage Treatment.*

The primary consideration of the problem of refuse collection and disposal is proper sanitation. The public health significance of the problem differs with the nature of the waste material. Sanitary methods of handling and disposal of garbage, street sweepings which may contain manure, and certain other refuse that contain organic waste constituents are important because these wastes may attract and serve as food supplies for flies, cockroaches, and rodents. Rubbish, paper, and other dry wastes may serve as harborage for rats and insects. Nuisances resulting from improper handling of garbage and refuse include disagreeable odors, breeding of insects and rodents, and unsightly, filthy esthetic conditions.

The second most important consideration is the attainment of satisfactory results with a minimum expenditure of funds. Refuse collection, storage, and disposal are fundamentally engineering problems requiring the application of the principles of engineering design and management. The problems vary in each community but their complexity is common to all. A thorough study of local conditions and technical problems that are encountered in the initiation and operation of a satisfactory refuse disposal program at lowest possble cost should come under the jurisdiction of a sanitary engineer or sanitarian qualified to undertake this type of study.

Refuse is a general term that includes many different substances from a great number of sources, including all solid or semisolid waste materials with the exception of excreta. It may be classified as to source, examples being market refuse, stable refuse, house refuse, and street refuse; but it is generally divided into several classifications as to type: (1) garbage; (2) ashes; (3) rubbish; (4) dead animals; (5) night soil; (6) street sweepings; and (7) mixed refuse. Each of these classes of refuse will be described briefly and the different methods of collection and disposal will be discussed subsequently.

(1) Garbage comprises all putrescible wastes of vegetable or animal matter originally intended for or associated with food for human consumption. It includes all waste materials from kitchens of homes, restaurants, hotels, and institutions, together with the putrescible organic waste materials from markets, groceries, and abattoirs. It requires careful collection, storage, and handling, especially during warm weather, when it decomposes quickly and gives off offensive odors. As mentioned previously, it also attracts flies, insects and rodents. However, garbage is also the most valuable of any of the classes of refuse, as it may be used in feeding hogs and it may yield grease and fertilizer by reduction processes which are described under methods of refuse disposal. Research is being carried on in the United States at the present time to improve the methods of composting garbage to convert the easily putrescible organic matter into a stabilized humus usable as fertilizer.

(2) Ashes are the waste products of coal and other fuels used for cooking, in the heating of homes and for industrial purposes. The amount of ashes produced fluctuates with the seasons, being highest in the winter. The amount also is dependent upon the geographical location and climatic conditions. Ashes may differ considerably in quality depending upon their source and the type of fuel used. They may also contain considerable amounts of unburned combustible material, some incombustible material, such as tin cans and other metallic substances, broken glassware, and crockery. The amounts of ashes being produced have decreased considerably in the past few years because of the increased amounts of gas and oil being used as fuels.

(3) Rubbish is any dry nonputrescible household or business wastes that are not classified as garbage or ashes. It includes paper, rubber, rags, cartons, excelsior and other packing, discarded furniture and other wood, glass, crockery, leather, sweepings, metal, and other articles. It is synonymous with the term "trash." Rubbish is normally not putrescible, but may contain floor sweepings contaminated with pathogenic bacteria or cans containing small amounts of putrescible materials.

(4) Dead animals may be collected by the municipal refuse collection service from stables, riding academies, dairies, zoos, race tracks, and even visiting circuses and rodeo troupes. In some cities private companies may perform this service, although they usually do not collect small animals, the latter being collected by the cities. Dead animals are usually disposed of by burial, incineration, or reduction. They should be buried deep enough to prevent dogs or other carnivorous animals from digging them up. Larger animals, such as horses, cattle and mules, are generally skinned and their hides sold.

(5) Night soil is a term applied to the solid and liquid human excrement collected from box-and-can toilets, private privy vaults, and other receptacles for excreta disposal in those areas without water-carriage sewer systems. The term "night soil" originated from the fact that before the advent of sewer systems large numbers of privy vaults were then in use and when they became full were emptied at night. This method of human waste disposal has been outlawed in the cities of the United States although many are still in use throughout the country in outlying sections of the larger cities as well as in the smaller towns and rural areas. It is primarily a rural problem.

In many parts of the world, notably Formosa, Japan, China, and India, the night soil is of con-

siderable economic value as fertilizer. In South Africa over 100 cities and towns mix night soil with garbage and other putrescible organic waste materials in compost pits to produce fertilizer for their agriculture.

(6) Street sweepings consist of the dust from the wear and tear of the road surfaces, paper, leaves, branches of weeds and trees, cigarette and cigar butts, sweepings from stores and sidewalks, materials that have fallen from vehicles, and many other types of litter. Education of the general public, backed up by effective police control, can help to reduce, if not eliminate, unnecessary littering of the streets which adds to the expense of street cleaning. New York City has recently instituted a program to promote a cleaner city by empowering all supervisory personnel of the Department of Sanitation with police power to hand out summons to appear in court for any violation of the Sanitary Code, including the promiscuous littering of streets with paper and other refuse. (See STREET CLEANING.)

(7) Mixed refuse consists of one or more combinations of the various refuse materials of a community to facilitate their collection and disposal. Rubbish and garbage are often collected together, when the mixture will be disposed of by incineration. Other common combinations are rubbish and ashes, combustible, and noncombustible mixtures, one mixture being placed in one container and the remainder in another, dependent upon the final method of disposal. With the sanitary land-fill method it is unnecessary to separate the refuse into its component parts.

Quantities and Characteristics of Refuse.—The quantities of refuse in any community are dependent on many factors, including climate, season, habits of the people, geographical location of the community, nature or type of community, economic period, and efficiency of collection service.

Garbage weighs between 30 to 55 pounds per cubic foot, dependent on moisture content, which varies from 50 to 70 per cent. Ashes weigh from 40 to 50 pounds per cubic foot, while rubbish is much lighter in weight, varying from 20 to 25 pounds per cubic foot. In cities requiring that garbage be drained and wrapped the weight is lowered proportionately to the amount of moisture removed.

The total weight of refuse in a city varies considerably but averages about 2 pounds per capita per day. Of the total weight, garbage constitutes about one fourth of the weight and one fifth of the volume, or varies from a minimum of about 0.3 pounds to a maximum of 2.3 pounds per capita per day in different cities. Rubbish constitutes about one third of the weight and one half of the volume of the total amount of refuse of a city. This variation in weight and volume must be carefully considered in providing an efficient, economical, and sanitary refuse collection service.

The composition of refuse varies widely, making it almost impossible to predict the amounts of its different components. Therefore, it is very essential to obtain accurate weights and volumes and to maintain accurate records to determine costs of refuse collection and disposal. Chemical analyses may aid in determining the value of by-products obtainable, such as grease, feed for hogs and cattle, or fertilizer.

Municipal Refuse Disposal.—The problem of municipal refuse disposal is divided into three separate phases: house treatment; collection; and disposal.

House Treatment.—This consists of the handling or treatment of refuse by the producer in the home or business place before collection. The treatment that it receives plays an important role in sanitation. Odors may be almost eliminated or reduced for several days if garbage is drained and wrapped, or mixed with ashes and rubbish in the receptacle for collection. The most important nuisance from rubbish is due to loose paper. Mixing of garbage with the rubbish moistens the paper and helps to eliminate this problem.

The most common method of house treatment in the United States is the separation of the refuse into two cans. The garbage is usually placed in one can, and the rubbish and ashes are placed in another. This is a very satisfactory method where either hog feeding or reduction is the method of disposal.

The receptacle used for the storage of refuse before collection should be of material suitable to receive the wastes and be provided with a tight-fitting cover. In most cities metal receptacles are recommended for storage of garbage and ashes. The size of the container required is partly dependent upon the amount of garbage and refuse to be stored between collections, but it must not be so large that it is difficult to empty into the collection vehicle. The maximum size recommended for separate garbage storage and collection is 10 or 12 gallons, and for combined garbage and domestic refuse a 30-gallon container with a weight limit of 65 pounds when full is preferable for easier handling.

In New York City very large enclosed metal containers are placed in certain locations where large volumes of refuse are produced, such as at hospitals, schools, markets, and apartments. When full, they are lifted onto a large truck by means of a hoist, an empty container is substituted, and the full container is hauled away.

Collection of Refuse.—The method used in most communities in the United States for the collection of refuse consists of a gang of two or three men with a vehicle. The men pick up the refuse containers from each house and place the cans or their contents into the vehicle and transport it to the place of disposal. The vehicle may be an open-body type or the more sanitary, enclosed, compaction-type truck, of which there are several designs. The vehicles with compacting units have a hauling capacity of 35 to 50 per cent more than the open-body trucks. Based on an average wage of $1.50 per hour, it was shown in a 1952 survey of several California towns that the average labor cost of the pickup operation was $3.71 per ton and the total collection operation amounted to $5.37 per ton.

Problems considered in the efficient operation of any refuse collection system are: frequency of collection; time of collection; type and size of vehicles; number and efficiency of men in collection crews; length of haul to place of disposal; method of administration, whether by municipal personnel, by private contractors, or by a combination of the two.

Factors considered in the selection of refuse collection trucks are: ease of loading; low-loading height; speed of loading; compactability; reliability; maintenance costs; and original cost of vehicle.

Disposal of Refuse.—The method selected for the disposal of refuse should perform its function with the least production of nuisances and in the most economical manner. The refuse disposal methods include the following: dumping upon the land; dumping into the sea; incineration; sanitary landfill; hog feeding; garbage grinding; reduction; and composting.

Sufficient space is not available to discuss all of these methods in detail, and since dumping on land, dumping at sea, and incineration have already been covered adequately under the title SANITARY ENGINEERING, they will not be discussed in this article. An excellent discussion of sanitary landfill, hog feeding, and garbage grinding will also be found in the above-mentioned article but additional comments will be made here. The two other methods, reduction and composting, will be discussed in subsequent paragraphs, as they have not been included elsewhere in these volumes.

Sanitary Landfill: This method of refuse disposal is distinguished from the open dump by the fact that the garbage, ashes, street sweepings, and rubbish are dumped in layers of controlled depth and width in a trench or depression and the material compacted and covered at the end of each working day with a layer of clean dirt, sand, or ashes to a depth of 2 or 3 feet, to exclude rodents and prevent the escape of odors or the outbreak of fires. A single bulldozer or dragline with an operator can operate a landfill handling 3,000 to 4,000 cubic yards of refuse per year. An area of 0.75 to 1.5 acres per 10,000 population per year is sufficient where the refuse is placed in layers to an average depth of 6 feet.

Hog Feeding: The feeding of garbage to hogs is operated as a profit-making venture. With this being the primary objective, public health departments have considerable difficulty in attempting to persuade hog farmers to maintain some semblance of sanitation in their operations. The nature of the activity itself together with economic and political considerations makes it almost an impossibility.

In the United States most public health authorities frown on hog feeding as a method for the disposal of raw garbage because of the high incidence of trichinosis infestation among these hogs. The United States Quarantine Regulations now require that garbage fed to hogs to be sold in interstate commerce must be heated at 212° F. for 30 minutes. Most health authorities recommend the heating of garbage which may contain trichinae larvae to prevent hogs from becoming infected with these worms that may infect man upon the consumption of insufficiently cooked meats from garbage-fed hogs.

Many states have recently required the heating of garbage at a minimum temperature of 145°F. for not less than 30 minutes to prevent the transmission of vesicular exanthema, a disease of hogs almost wholly confined to farms feeding raw garbage.

In England and Wales in 1940 a program for the separate collection of garbage was instituted on a national scale in order to salvage this material for the feeding of hogs due to the serious shortage of imported animal foods. Over 60 sterilization stations were built for the purpose of heating the garbage to 212° F. for 1 hour to destroy the virus of foot-and-mouth disease which had caused many extremely costly and wasteful outbreaks of this disease on their hog farms.

Garbage Grinding: Every year, increasing numbers of garbage grinders are being installed in homes for the disposal of garbage into sewers. In the past few years several municipalities, following the example of Jasper, Indiana, have installed home grinders on a citywide basis. Jasper purchased the units in large quantities at a low price, resold them at cost to the home owner under a monthly-payment arrangement, and provided maintenance, all for a total cost of $0.66 per family per month, including interest. Many cities prohibit the installation of home grinding units because of the increased amount of organic sludge load placed on the municipal sewage sludge digestion facilities already operating at maximum capacity.

Reduction: This is a method of processing garbage and dead animals to recover grease and produce tankage used as livestock feed or as fertilizer. Two general procedures for garbage reduction are in use, the cooking method and the extraction method. In the cooking method the garbage is cooked in closed tanks to prevent the escape of odors. The grease and water are then pressed out of the cooked material and the grease is skimmed from the surface of the water. Additional grease is extracted from the filter cake by an organic solvent such as naphtha or gasoline. The filter cake is then dried, ground, and sold as tankage for the manufacture of fertilizer or cattle feed. In the extraction method, the garbage is first ground, dried, and then treated with an organic solvent as by the previous method. About 1 to 8 per cent of grease and from 10 to 20 per cent of tankage by weight may be recovered from garbage. During the past few years many plants have been abandoned as unprofitable either because of operating difficulties from escape of odors or because of explosive hazards.

Composting: This is a biological method of altering the composition of garbage and other organic material, resulting in a stable humus-like end product usable as fertilizer. The composting process consists of placing the raw materials in piles or in concrete or brick cells, then allowing the mass to ferment through the action of bacteria and other microorganisms. Heat is generated, and the resulting high temperature, 140° F. to 180° F., is sufficient to destroy pathogenic organisms. Mixing of the mass is essential, varying from one or two manual turnings to continuous mixing by mechanical means. The mixing provides aeration so that the fermentation will proceed under aerobic conditions in preference to the slower-acting anaerobic process.

This is an age-old process for the conservation of organic waste products, including night soil, which has been developed with considerable success in many countries, notably Denmark, France, Italy, and throughout the British Empire. In South Africa this method of composting has been developed by using garbage, night soil, bat and kangaroo manure, farm manure, and abattoir wastes as raw materials for the production of fertilizer. The chief operating difficulties with composting are fly breeding, odors, and proper drainage.

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WATAUGA ASSOCIATION. See TENNESSEE—*History.*

WATCH HILL, post village in Westerly Township, Washington County, R.I., on the Atlantic Ocean, and about three miles southeast of Stonington, Conn. It is near Watch Hill Point, a promontory forming the extreme southwest point of Rhode Island. The place has a fine beach and ranks next to Newport and Narragansett Pier, in Rhode Island, as a popular summer resort. Pop. (1950) c.500.

WATCHMAKING, Modern. The history of watchmaking covers nearly 500 years of dramatic technical progress and intense international rivalries. In that period four nations have struggled for supremacy in the industry, even resorting to the use of spies and smuggling, and today (1950) the competition is as keen as ever.

Structure of Watch Movements.—The jeweled watch of quality (15 to 23 jewels) is a complex mechanism consisting of 135 to 140 pieces and requiring from 2,500 to 3,000 manufacturing operations. Its structure is described by Walter Kleinlein of the Waltham Watch Company as follows. There are four principal assemblies in a watch movement: (1) the power plant consisting of the barrel, the mainspring, and its attachments; (2) the train of toothed wheels and pinions, through which the power of the mainspring is transmitted; (3) the escapement assembly, which stops and releases the transmission of power; (4) the balance and hairspring assembly, which governs the period of time in which each release of power is made. The hands and dial assembly complete the operations by indicating the timekeeping performance of a watch.

The escapement is one of the most important elements in the watch, and its operation is worthy of more detailed description.

Fig. 1 shows a diagram of the detached lever escapement, which consists of four parts: (1) the escape wheel; (2) the pallet and arbor assembly; (3) the adjustable banking pins; (4) the balance staff and roller assembly. The energy of the mainspring is transmitted through the train to the escape wheel. Pressure of the teeth of the escape wheel on the pallet jewels sets up an oscillating motion of the pallet and fork, which is transmitted to the balance wheel and hairspring. The accuracy of the watch is controlled by the precise design and adjustment of these parts to each other, and by the reduction of friction through the use of jeweled bearings. Quality jeweled watches require adjustment for four basic factors: (1) isochronism, (2) timing, (3) temperature, and (4) position.

Isochronism is the maintenance of a constant rate of operation as the watch runs down after winding. In a clock this is accomplished by the use of a pendulum of constant length and weight swinging under the constant influence of gravity. In a watch the rate is kept relatively independent of the changing force of the mainspring by the oscillation of a poised balance wheel of constant mass and fixed center of gravity, operating under the constant influence of the hairspring.

Isochronism involves two major problems of design: (1) The balance wheel must be poised, that is, its weight must be uniformly distributed so that the force of gravity will not affect its oscillation. (2) The design of the balance wheel and the hairspring must be such that their oscillating motion does not alter the force exerted by the hairspring or the resistance offered by the inertia of the balance wheel.

Poise is obtained by the adjustment of radial screws in the rim of the balance wheel. Metal is removed from the underside of the head, or heavier screws are added above, until the wheel, when mounted in poising calipers or poising tool, rotates freely and is not more disposed to stop in one position than in another.

Timing.—Timing is obtained by adjusting the

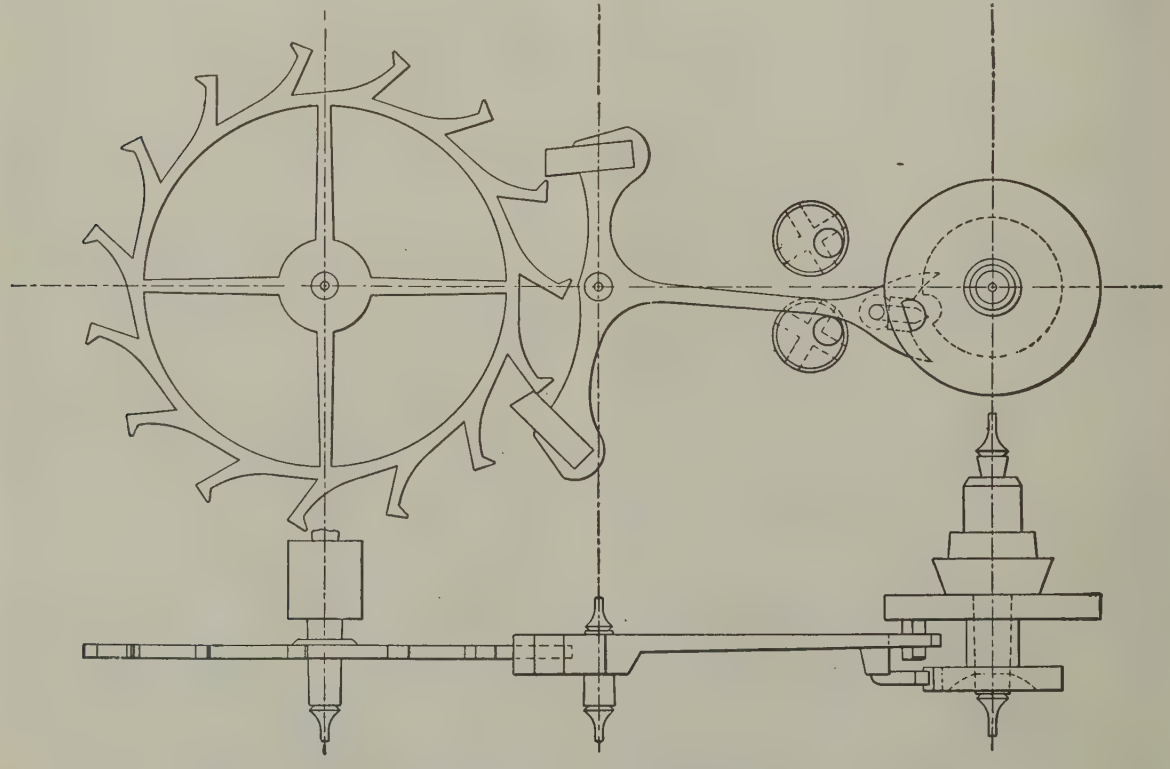

Fig. 1. Double roller escapement.

strength of the hairspring to the oscillating force of the balance wheel. This is called vibrating, and involves obtaining the correct number of oscillations per hour for which the watch was built. In modern watches this consists of 18,000 oscillations per hour. This means that through the operation of the escapement, the balance, and the hairspring, the train of wheels (and therefore the timing) of a modern watch is stopped and again released 18,000 times per hour, or 432,000 times in a 24-hour period.

Adjustment of steel hairsprings for changes in temperature is accomplished by making the rim of the compensation balance wheel of two

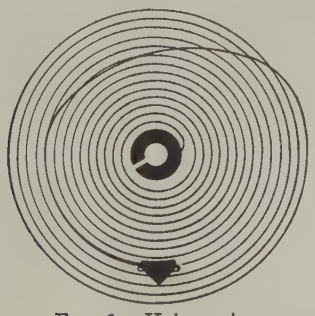

FIG. 2. Hair spring.

sections of bimetallic metal, fitted with adjustment screws (Fig. 3). The outer strip of brass is brazed to the inner strip of steel. An increase in temperature expands the whole wheel, tending to increase its inertia, but the greater expansion of brass compared to steel shortens the radius of curvature, as in Fig. 4, counteracting the effect of simple expansion. Adjustment is accomplished by shifting the screws to various positions on the rim.

Methods of Correcting Temperature Variation.—Fig. 4 shows an extreme distortion of both sections of a bimetallic compensation balance wheel in high temperature. The free ends curve

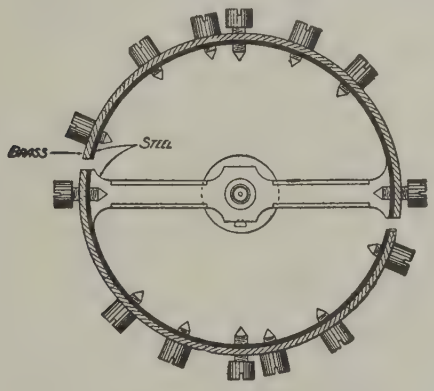

FIG. 3. Bimetallic balance wheel.

inward from true concentric as the temperature increases from normal; shifting screws to different holes toward the cuts and in opposite pairs causes additional weight to move nearer center. This alteration supplies a gaining rate to overcome the loss produced by the increased length and lessening of elasticity of the steel hairspring.

Inversely when the temperature decreases the free ends curve outside of true concentric. This causes a loss at the same time that the hairspring supplies a gaining rate due to its becoming shorter and stronger. In this case screws are moved away from the cuts when the variation is above tolerance and a correction is required.

By using a solid monometallic balance wheel and a hairspring, each containing alloys with a very low coefficient of expansion for temperature changes, there is no need for mechanical temperature adjustment. These alloys have the further advantages of being virtually nonmagnetic and rustproof.

A solid rim monometallic balance wheel is shown in Fig. 5.

Adjustments are made for as many as six positions: stem up, left, right, down; dial up and dial down. Approximate adjustment is obtained by poising the balance wheel, thereby

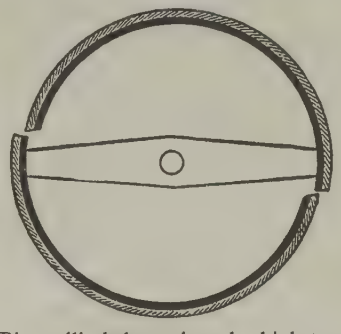

FIG. 4. Bimetallic balance bent by high temperature.

eliminating the effect of gravity upon the oscillation of the wheel. Other adjustments are made to correct the effect of gravity on the hairspring and the various jeweled bearings of the movement.

Production.—The production of watches began in central Germany about 1500, and from this section came the bulky timepieces known as Nürnberg eggs. Two hundred years later the leadership of the industry passed to the English, for German ingenuity was no match for specialized English craftsmanship. English leadership lasted some 140 years, but by 1840 the Swiss had

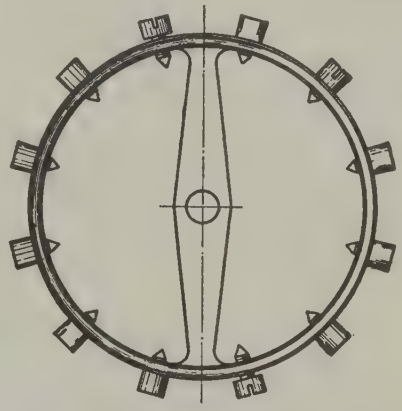

FIG. 5. Monometallic balance wheel.

acquired such superlative skill in the same manufacturing methods used by the English that they, in turn, seized the dominant position in the watch industry. The craftsmanship of Swiss watchmakers has probably never been surpassed, but in the 19th century manual skill was not sufficient to maintain a position of leadership in the industry, and first place was forfeited to the United States. Beginning in 1850, a new firm, later known as the Waltham Watch Company, applied to watchmaking a combination of mechanical ingenuity and organizing skill that we have since come to call mass production. It was clearly demonstrated in Philadelphia at the Centennial

Exhibition of 1876 that better watches could be made for less money by this revolutionary "American system," introduced by Aaron Lufkin Dennison in 1850 and developed by Waltham. The results were so spectacular that the methods were soon copied both at home and abroad, and eventually they were adopted as standard in the industry.

The first successful domestic competition came from the Elgin National Watch Company, which was founded in 1864. There followed a series of nearly 60 American firms which depended largely on domestic parts (except jewels) for the production of complete watches. Of these firms only Elgin, Hamilton, and Waltham remain.

In the early years of the industrial revolution, English methods of watch manufacture were the acme of manufacturing efficiency, but by 1850 they were fast becoming archaic. In that year Aaron Lufkin Dennison, founder of the Waltham Watch Company, visited England in search of technical information and reported as follows:

> "I found that the party setting up as manufacturer of watches bought his Lancashire movements—a conglomeration of rough materials—and gave them to A, B, C, and D, to have them finished; and that A, B, C, and D gave out the different jobs of pivoting certain wheels of the train to E, certain other parts to F, and the fusee cutting to G—dial making, jeweling, gilding, motioning, etc., to others, down almost the entire length of the alphabet."

He returned home convinced that competition with English firms would present no real difficulties to American watchmakers, if the latter used the interchangeable system and if manufacture on a large scale was adopted.

The interchangeable, or American, system, as it is called in the watch industry, was not originated by Dennison. He found it in a high state of development at the Springfield (Mass.) Arsenal, where it was used in the manufacture of rifles. The fundamentals of mass production had been employed by Eli Whitney (q.v.) in making firearms in 1798, and the system had been in successful use for over 50 years, when Dennison attempted to apply the same principles to watchmaking. It seemed obvious to Dennison that these mass production methods were applicable to the watch industry, but the sober judgment of the times was against him, and he was dubbed the "Boston Lunatic." There were, in fact, four major problems, the magnitude of which was not adequately foreseen. The seriousness of each problem was discovered separately, and each required a fresh start, one of them involving bankruptcy.

The first problem was to design a watch that could be produced efficiently by mass production methods. It was also desired to offer a conspicuous improvement over the watches then commonly in use, so that novel design would help to gain public acceptance for the product and the new method of manufacture. With these ends in mind, the first model produced by the Waltham Company was an eight-day watch having two mainsprings to furnish the additional power required for an interval of eight days with one winding. A few of these watches were made, but, as they did not keep good time, the model was promptly abandoned in favor of a standard 36-hour watch of the English lever type.

The second error was in design and construction of machine tools, sufficiently accurate for watchmaking and dependable enough as regards uniformity of output, for use in a mass production factory. Before the company was started, Dennison designed, built, and tested some of the key machines that were needed. Unfortunately the tests were not as exhaustive as the circumstances required, and the machine failed to meet the necessary standards of accuracy and uniformity. The machine-tool industry of that day had no equipment capable of such precision as four ten-thousandths of an inch when working on parts so small that a magnifying glass is needed to inspect them. It was therefore necessary to redesign the machines, to test and redesign again, until satisfactory accuracy and uniformity could be maintained day after day on many thousands of watch parts.

The tremendous capacity that is the great virtue of mass production requires that operations be conducted on a grand scale, and Dennison miscalculated the size of the undertaking. Having little capital of his own, he sought financial assistance from the Boston firm of Howard and Davis, and from Edward Howard's father-in-law, Samuel Curtis. With $30,000 obtained from these sources, the original firm attempted to mass-produce a watch containing approximately 150 parts and requiring some 3,700 distinct operations. The time and money required to bring such a venture to the point of profitable operation, and the ultimate size of the undertaking, were beyond the range of foresight. "It was more than three years," wrote Edward Howard, "before the establishment had fairly and fully started in the business of making watches, and then it was found that it would require ten times as much room as had been provided, and we set about building a very much larger factory." The new factory was built in 1854 on the banks of the Charles River at Waltham, Mass.

The most serious of the many problems facing the watch industry then and later was that of mass distribution, the Siamese twin of mass production. Little thought was given to marketing when the business was started. Both Howard and Dennison were widely acquainted in the jewelry trade, Howard as a manufacturer of clocks and Dennison through 10 years' experience as a wholesaler of watches in Boston. There was no difficulty in disposing of the output of the original plant in Roxbury, just outside of Boston, but when production in the new plant at Waltham reached 100 watches per month, marketing became the crucial function of the business. The need for wider markets came at a time (1857) when general business was in a state of severe depression. The problem of expanding the company's markets in the face of a collapse of general business activity put too great a strain on financial resources which had never been really adequate. As a consequence, the company went into bankruptcy and was sold at auction to Royal E. Robbins, a New York importer of watches.

The bankruptcy of the Waltham Watch Company throws dramatic emphasis on the hazardous nature of mass production. Four New England businessmen lost about $150,000 in the original Waltham venture, and Dennison failed three times more before he finally applied his ideas successfully to the manufacture of watch cases in Birmingham, England. The difficulties experienced in 1850 still handicap the efforts of businessmen in the use of these principles, and the number of failures in mass production industries is alarmingly high.

The chief causes of these failures are three

in number. To begin with, few, if any, complex products are mass-produced in their entirety; some parts can be made more efficiently by less highly mechanized methods. In 1863, Edward Howard wrote: "The interchangeability of parts, however, was found not to be practical in the finer parts; never has been to this day and never will be." This is the technical hazard in the use of mass production. Suppose, however, that automatic machinery *can* be used for most of the expensive operations, financial problems then become paramount. The purchase of so much intricate machinery calls for a vast outlay of funds, and it may require more money than can be attracted to the venture by the prospect of large profits. As the need for more and more capital develops, investors become reluctant to increase their contributions, and if profits are not promptly realized, the business is likely to die of financial strangulation. But even though the technical and financial problems are successfully solved, the enterprise may fail by reason of its own fecundity. The volume of output tends to increase with each rise in productive efficiency until it reaches unforeseen proportions and becomes a drug on the market. The venture then suffers that most common of all business disasters, failure in the field of marketing.

Marketing.—The production of watches by modern methods has been limited by the means for marketing them. Each improvement in watchmaking machinery and methods poured a new flood of watches on the market and forced the development of better and cheaper methods of distribution. The production of watches in the United States increased more than a thousandfold after 1854, and the resulting competition became extremely sharp. Only a few domestic concerns have been able to solve the problems of marketing on such a rapidly rising scale. In all, there have been more than 10 failures for every success in the American watch industry.

The machine tools used in the early years of the American system were an improvement over the standard English equipment in that they could be made to "repeat" the production of a given part easily and with great exactness. They were better machines, but they were not fundamentally different; the second major development —that of automatic machines—was accomplished gradually.

At first, automatic machines were frowned upon by management as well as workmen. Each machine in use required the entire attention of an operator, and the notion that a mechanical device could produce precision parts while the operator's back was turned did not seem practical. The first semiautomatic machines were therefore built and tested by Waltham inventors without the knowledge of management, but the results of the test were so remarkable that policy was reversed and subsequent developments were rapid. Even with the combined support of management and labor, the task of the inventors was a long one. The design of fully automatic equipment for multiple operations on plates and pinions was not completed until the last decade of the 19th century. Much of the best work in this field was done by Duane H. Church, who was employed by the Waltham Company from 1882 to 1905.

By 1879, the development of semiautomatic machinery had carried production at Waltham over 98,000 watches per year, and competitors—both domestic and foreign—were expanding their production by the same means. The market could not absorb so much at customary prices, and price cutting became common.

In addition to this, other efforts were made to expand the market without resorting to major changes in distribution methods. The appeals of variety and style were used in an effort to reach more customers and to stimulate repeat sales. There was also increased activity in foreign markets, particularly in Latin America, in England, and in the British Dominions. These measures were effective for the time being, but the continued improvements in production methods and the rising output kept an unremitting pressure on prices, and new economies were necessary. By 1910 a change in the channels of distribution could no longer be postponed.

The channels of distribution for watches prior to 1850 started with the foreign manufacturer, who sold to a domestic importer, from whom the watches passed to the wholesaler, the retailer, and the consumer. This method of selling watches entailed four separate business risks and four layers of expense and profit, all added to the cost of manufacture. Although this may sound cumbersome and inefficient, it was well suited to the distribution problems of that time. In fact, it stood the test of use for centuries. In 1910, however, the manufacturer's agent (who had replaced the importer when production started in the United States) was dropped by the Waltham Company from the chain of distribution. Thereafter Waltham watches were sold by the factory sales force direct to the jewelry wholesaler. The economies achieved in this fashion were adequate for a considerable period of years, but Swiss competition inaugurated changes both in production and distribution that called for further readjustments in the industry.

The Swiss were not slow to grasp the significance of the American system of watch manufacture, nor did they hesitate in dealing with this menace to one of their most important industries. Their first step was frankly to admit the facts. In 1876 one of the Swiss commissioners to the United States, Édouard Favre-Perret, addressed his countrymen most earnestly on the subject. He said in part:

> "For a long time we have heard here of an American competition, without believing it. The skeptics—and there were many of them—denied the possibility of a competition at once so rapid and so important. . . . I sincerely confess that I personally have doubted that competition. But now I have seen—I have felt it—and am terrified by the danger to which our industry is exposed."

Swiss producers rose to the occasion with changes in many phases of the industry. They were quick to seize the essential elements of the American system and put them to use. But they were not content merely to copy; they developed a new variation of the method that was particularly well suited to their conditions. Watch movements, produced wholly or in part in Switzerland, were shipped to the United States to be completed, sometimes merely to be cased. This arrangement had many advantages. It permitted a maximum use of Swiss labor at a very favorable scale of wages, yet made it possible to market these watches as a domestic product. It also permitted the Swiss to take advantage of any differential in tariff between completed watches and parts. Advances in Swiss merchandising also were notable, especially of the wrist watch which became popular about the time of World War I.

In the matter of watchmaking machinery Swiss designers were particularly successful.

The Swiss government was active in support of the industry. Measures were taken to prevent overproduction. Schools were established to ensure an adequate supply of skilled watchmakers and designers. The watch industry of the nation was organized into a trust for large producers and a superholding company for smaller manufacturers. Through these organizations the Swiss government was able to take such measures as seemed desirable for protecting interests of the industry.

The aggressive efforts of the Swiss were so successful that imports of watches, movements, and materials from Switzerland into the United States exceeded $12,000,000 in 1929, but countermeasures were soon forthcoming. The Smoot-Hawley Tariff Act, passed by the United States in 1930, sharply reduced Swiss imports. The higher tariffs, combined with the depression in general business, carried Swiss imports of watches and parts down to $1,300,000 in 1932. Unfortunately for the American industry, the official figures on imports did not represent the true total; smuggling (judging by the newspaper reports and the court records) was a thriving industry. One American producer estimated that smugglers brought in between one and two million movements per year.

In the attempt to increase sales, Swiss ingenuity turned to devices for expanding the market as a whole. Manufacturers with Swiss affiliations were particularly active in radio advertising; one firm is reported to have spent $1,250,000 in 1937 on this form of advertising alone. Sales by the factory direct to retailers, and extensive consumer credit, were also employed to facilitate the rapid flow of watches to the widest possible market at the lowest possible price. These practices have been adopted by some of the old-line American producers, illustrating again the vigorous give and take of international competition. On the whole, progress in the marketing of watches has lagged behind production, and further substantial improvements in marketing methods are to be expected.

The watch industry as it existed just prior to World War II was largely confined to Switzerland and the United States (See U.S. Tariff Commission, *Watches,* pp. 3-6, Washington, 1946). There were then four producers of essentially complete jeweled watches of quality in the United States: Elgin, Hamilton, Waltham, and the Bulova Company. The Bulova Company was also an importer of Swiss movements and an assembler of Swiss parts. About 100 other firms fell in the class of importers and assemblers. In Switzerland there were 68 manufacturers of complete watches and 350 assemblers. In 1941 domestic manufacturers had about 38 per cent of the United States market, the remainder going to importers and assemblers of Swiss goods. Exports of the Swiss watch industry to the United States were from 10 to 27 per cent of the total value of all Swiss exports.

War Production.—M. Favre-Perret sounded the keynote of past rivalries in the watch industry, when he referred to the American market as the "milch cow" of the Swiss producers. In the future, however, military necessity will be added to the economic motives that have driven international competition at such a hard pace. It is even conceivable that national survival may hinge on the existence of a large and thriving domestic watch industry.

War has always been a stimulus to the American watch industry, but it was not until World War I that its essentially military character began to appear. During that conflict the government's demand for watches grew with the increasing importance of precise timing and coordination in military operations. At this point, also, there arose a demand for a new class of product, not directly related to watches, but requiring the same unique skills and the same, or similar, equipment. The first of the strictly military products of the watch industry was the time fuze for controlling the burst of shrapnel. This item was developed and produced—in cooperation with the government—at the Waltham plant during World War I. As the tools of war have become more intricate and powerful, the devices for controlling them have become more numerous, more delicate, and more precise; as the scope of war expands, the need for mass production becomes imperative. Productive capacity for a large volume and variety of precision parts is essential to military preparedness.

In World War II the entire watch industry was mobilized. The tremendous increase in the number of tanks, aircraft, and naval units established a new peak in the demand for military watches, especially the precision models for use in navigation. In addition to watches, chronometers, and small clocks, the industry produced a wide variety of precision parts and equipment. The line of fuzes was expanded to include percussion and base-detonating types. Other items in the list of war material were tachometers, speedometers, compasses, recording drift sights, precision springs, and rifle parts. Exact figures on the value of the munitions turned out by the watch industry during World War II are not available at the time of writing this article (1947), but the total has been estimated at between 100 and 200 million dollars. This figure, large as it is, does not give a true gauge of the importance of the industry to military operations. The items produced are vital to the navigation of ships and planes, to the effective operation of tanks, to the control of burst of heavy projectiles, and to a host of minor uses where timing is the essence of successful action.

It is customary in the United States to think of war production as infinitely expandable by converting peacetime industries. This has been approximately true, but the capacity of the watch industry is limited by the number of skilled workers. The peacetime force cannot be augmented by newly trained workers within the time permitted by the pattern of modern war. For example, it requires an average training period of one year to produce a fully skilled machine operator, and six years to train a die maker. Experienced finishers who assemble the components and adjust the finished mechanism need three years to become masters of their trade, and so on through the wide variety of special skills which require training and experience not provided in other peacetime industries. Carefully planned training programs were arranged by the industry with the cooperation of the government during World War II, but such programs are of limited value unless there is a large force of fully trained workers to carry on the conversion of equipment from the production of civilian goods to the manufacture of military items. At best, it

requires one to two years to develop and to put into production a new military watch or similar device.

Labor Relations.—The workers of the watch industry as a whole have been doubly fortunate: first, in the liberal policies of the watch companies, and second, in the exceptionally able leadership displayed by their union organizer. With the growth of the Waltham Company some of the personal contact between management and the workers was lost, as was the case in most other industries. Under these circumstances the organization of the employees into a labor union was a logical development. In 1941 an organizing campaign was successfully conducted at Waltham under the auspices of the American Federation of Labor (AFL). The union subsequently retired from the AFL and set up an independent Watch Workers Union, extending the organization to include the employees of the Hamilton and Elgin companies.

The union has shown a sound regard for the difficult business problems of the industry, and has avoided the use of tactics that impede the successful conclusion of collective bargaining. Good relations have been further promoted by a temperate and cooperative attitude on the part of management. Industrial peace has been maintained through the reconversion period following World War II, in spite of the controversial issues arising from wartime inflation and Swiss competition. In regard to foreign competition and its effect on employment and wages, the union is exerting its major pressure on Congress for the raising of import duties on watches. The government must balance the advantages of a brisk foreign trade with Switzerland against the requirements of national security and domestic prosperity in the watch industry. See also Clocks.

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Charles W. Moore.

WATCHUNG or **ORANGE MOUNTAINS,** in New Jersey; a range of hills west of Paterson, Plainfield, and Orange, extending north and south, but curving westward at each end. Length, about 40 miles. There are three divisions of the range, each composed of trap-rock, which was a lava flow about the time other portions of New Jersey were in a more advanced stage of formation. The mud and sand covering followed and now the ranges are mostly shale and sandstone. The traprock, in places, forms elevations from 300 to 400 feet high; the soft sedimentary beds once enclosing it, yielded more rapidly to erosion. There is a similarity in the material composition of the Watchung Mountains and the Palisades, the difference being more in the direction of the original lava flow. The Palisades sheet was not a surface flow, but was forced between the sedimentary beds.

WATELET, vä-tê-lā′, **Claude Henri,** French writer and artist: b. Paris, 1718; d. there, 1786. The son of a receiver general of finances for the Orléans district, he succeeded his father in that office, but continued to cultivate a taste for painting, sculpture and engraving. He obtained admission to the Académie Française through his authorship of a didactic poem, *l'Art de peindre* (1760). He built a charming country place on the banks of the Seine, naming it "Moulin-Joli." Its grounds became the classic model of "English Gardens," so much in vogue in France in the epoch just prior to the Revolution. His *Essai sur les jardins* (1774) helped considerably toward popularizing landscape gardening. He also compiled a dictionary of painting, engraving, and sculpture, published posthumously in 1792.

WATELET, Louis Étienne, French painter and lithographer: b. Paris, 1782; d. there, 1866. Commencing his career in 1799, his first canvasses were tritely traditional landscapes with the usual ruined castles. During the decade 1810–1820 he tried to escape the trammels of convention in several French and Italian views. Later he followed the romantic movement. Among his best works are *Lac Némi, Canal près de Bruges, Terrasse à Richemond,* and *Vue d'Inspruck.*

WATER, a universally diffused liquid, the true nature of which was not discovered until toward the close of the 18th century. In 1781 Henry Cavendish carried out a series of experiments by detonating mixtures of common air and hydrogen or dephlogisticated air, as it was termed. He showed that by regulating the relative quantities "almost the whole of the inflammable and dephlogisticated air is converted into pure water." Although Cavendish showed experimentally that water is produced by bringing together oxygen and hydrogen, yet to Antoine Lavoisier, who received information regarding Cavendish's experiments, must be assigned the merit of interpreting aright the experimental results, and of proving that water was a compound substance—a compound of hydrogen and oxygen.

Water may be produced by exploding a mixture of two volumes of hydrogen with one volume of oxygen at a temperature above 1190° F. Below that temperature the gases will not unite. It may also be produced by passing hydrogen over the heated oxides of several of the metals—and in various other ways. It exists, although never in a perfectly pure state, in immense quantities in nature. The composition of water has been determined by two distinct methods: (1) by volumetric synthesis; (2) by gravimetric synthesis. In volumetric synthesis of water measured volumes of pure dry hydrogen and of pure dry oxygen are mixed and the mixture is exploded by the electric spark while standing over mercury; the residual volume of gas is then measured; it is found that two volumes of hydrogen invariably unite with one volume of oxygen. In the second method a weighed quantity of a metallic oxide (usually cupric oxide) is decomposed by means of pure dry hydrogen at a high temperature and the water which is produced is weighed. The decrease in weight of the oxide gives the quantity of oxygen in the water formed; while the difference between the total weight of water and the weight of the oxygen gives the weight of hydrogen used. It is found that 16 parts by weight of oxygen are always united with two parts by weight of hydrogen to form 18 parts by weight of water. In the scale in which 16 is adopted as the atomic weight of oxygen the formula of water is H_2O. The molecular weight of water has been variously

decided upon; first as 18, later as 36, and it is now accepted as probably 72.

Water is a tasteless, inodorous liquid, under usual conditions, colorless; but when a great thickness of it is examined, as in looking endwise through a pipe filled with it, it is found to have a distinctly blue tint. At all temperatures below 32° F. it is a solid and at all temperatures above 212° F. it is a gas. When water at 32° is heated it contracts until it reaches the temperature of 39.2°, after which it expands; conversely, when water at 212° is cooled it contracts until it reaches the temperature of 39.2°, after which it expands; 39.2° F. is called the point of maximum density of water; the specific gravity of water is greater at this than at any other temperature. The fact that water expands on cooling from 39.2° to 32° is a most important one. If a sheet of fresh water be cooled, the upper layers become more and more dense; they, therefore, tend to sink, and so fresh surfaces are exposed to the cooling influences. But when the temperature of the mass of water has reached 39.2° further cooling of the surface causes an expansion of the upper layers, which continues until these solidify into ice; these layers of cold water consequently float upon the warmer water underneath; hence it is impossible for the mass of water to suddenly freeze throughout. When water passes from the liquid to the solid state it expands to the amount of about 1-11th of its volume; that is, one volume of water forms 1.0908 volume of ice. This expansion is sufficient to bring about a large quantity of mechanical work, and to it the bursting of water-pipes during frost is to be largely traced. When solid water becomes liquid, or when liquid water becomes gaseous, a considerable quantity of heat is absorbed and disappears, or, as the expression is, is rendered "latent" Steam issuing from boiling water is no hotter than the water itself; water formed when ice is melting is no hotter than the ice itself; yet heat is being communicated to the ice and to the water. The latent heat of water is 79 thermal units; the latent heat of steam is 536 thermal units, although by the thermometer the temperature remains unchanged. In other words, in order to convert unit weight of ice at 32° into water at 32° a quantity of heat must be communicated to the ice, which, if communicated to unit weight of water at 32°, would raise its temperature to 79° C. In order to convert unit weight of water at 212° into steam at 212° such a quantity of heat must be communicated to the water as would suffice to raise the temperature of that weight of water through 536° C., or 536 times that weight of water through 1° C. Before water can become steam the upward pressure of its vapor must overcome the downward pressure of the atmosphere; hence it follows that the boiling point of water is conditioned by the atmospheric pressure. Water boils at a much lower temperature on mountain tops, where the pressure is comparatively small, than in the valleys. Water is almost incompressible. At 32° it is diminished in volume only by the fraction .0000462 for each atmosphere (14.7 pounds) of pressure added.

The solvent power of water is very large. As a rule hot water dissolves larger quantities of solid matter than cold. Water is found in nature in many forms — vapor, dew, hoar-frost, rain, hail, snow; besides the several distinct variations of spring water, well water, river water, surface water, sea water, etc. As has been mentioned it is never found in a state of purity. Analyses of dew and hoar frost show from 2.64 to 8.00 parts of solid impurities in 100,000 parts of water. These are organic carbon, organic nitrogen, ammonia, nitrates and nitrites, chlorine, lime and magnesia. These substances have been held in solution in the vapor of water in the air. Snow will gain in ammonia content the longer it lies on the ground.

Rain water, when collected before it touches the earth, contains only such impurities as may be derived from the atmosphere, chiefly consisting of oxygen, nitrogen and carbon dioxide, with more or less nitric acid and ammonia in the case of thunder showers. The rain water of towns contains comparatively large quantities of sulphurous and sulphuric acids and of soluble salts. The amount of these substances may be taken as an estimate of the comparative purities of the atmospheres of different towns. Rain water collected near the sea is rich in chlorides. Samples of rain water taken in a farming country near the sea have shown 42.8 parts of solid impurities per 100,000.

River water varies greatly in so far as the nature and quantity of the substances held in solution by it are concerned. The soluble constituents of river water are chiefly such as may be derived from the rocks through which the water of the springs which have fed the river has percolated and the amount of surface water it has received owing to storms. The dilution of the original spring water by the continual influx of tributaries reduces the relative quantity of solid matter held in solution, while the escape of carbon dioxide during the exposure of the surface water to the air causes the precipitation of those salts which were held in solution by the aid of the carbonic acid. River water is often largely contaminated by the drainage of towns or of manufactories situated on the river banks.

Spring Waters.— The soluble constituents of spring waters are various. In some springs the quantity of dissolved solid matter is but trifling, while in others it amounts to 2,000 grains per gallon. Spring waters are usually divided into classes in accordance as one or other dissolved constituent predominates. See MINERAL WATERS.

Sea water is essentially an alkaline chlorinated water. The quantity of solid matter held in solution varies in the waters of different seas. Inland seas, as a rule, contain less solid matter than the ocean; thus the solid content of the water of the Black Sea amounts to about 1,760 parts per million, while that of the Baltic averages 17,700, and that of the Atlantic Ocean 36,000 parts per million. The substances held in solution in sea water are chiefly chlorides and sulphates of sodium, magnesium and potassium, together with iodides, bromides and carbonates, chiefly of potassium and calcium.

Use of Water.— In considering the suitableness of a water for domestic use attention should be principally paid to (1) the source of the supply, (2) the total solid matter held

in solution by the water, (3) the organic matter held in solution and (4) the action which is likely to be exercised on the water by the means of supply. In examining the source of a water supply attention should be paid especially to the proximity of drains or sewers of any description, and to the likelihood of contamination from these sources. The nature of the soil through which the water percolates should also be inquired into. The solid substances held in solution by a sample of water may be estimated by evaporating a measured quantity of the water to dryness in a platinum basin heated by steam and weighing the residue. From a knowledge of the total solids in a water, unaccompanied by any further information, no reliable conclusion as to the suitability of such a water for potable purposes can be deduced. In seeking to determine whether a sample of water has undergone contamination with hurtful organic matter the following points are to be more particularly attended to: (1) Estimation of the amount of chlorine, whether existing as hydrochloric acid or as a chloride; (2) estimation of ammonia; (3) estimation of nitrates, and (4) detection and estimation, if necessary, of poisonous metals. The presence of an undue amount of chlorine generally points to contamination with animal matter. Pure waters do not as a rule contain more than three to four grains of chlorine per gallon. It must, however, be borne in mind that such waters as flow through a soil rich in chlorides — such, for instance, as the waters found in the neighborhood of salt-beds — always contain large quantities of chlorine. The sudden appearance of chlorides in a water previously free or nearly free from these substances points to animal contamination.

Ammonia may be obtained from most waters by distillation after the addition of a little sodium carbonate; when the whole of this ammonia has been driven off it not unfrequently happens that the addition of an alkaline solution of permanganate of potassium and heating results in the production of a further quantity of ammonia. The ammonia obtained by the first distillation is usually spoken of as "free ammonia," while to that obtained by the second distillation the name of "albumenoid ammonia" is given. The presence of even small quantities of albumenoid ammonia points unmistakably to organic contamination. Such ammonia is derived from the decomposition, by the agency of the alkaline permanganate liquid, of nitrogenous matter of animal or vegetable origin. Pure water should not contain more than 0.10 parts of "free" ammonia per million, nor more than 0.08 parts of "albumenoid" per million.

If nitrogenous matter has become thoroughly oxidized it gives rise to the formation of nitric and nitrous acids. The presence of these acids or of their salts, therefore, generally points to previous contamination of some organic nature. As, however, these things are the harmless — that is, in the quantities in which they occur in waters — products of the decomposition, and, therefore, of the removal, of hurtful substances, their presence, even when in comparatively large quantities, ought not of itself to condemn a water. The poisonous metals which are most likely to occur in drinking waters are lead and copper. These may be easily detected and estimated even when present in exceedingly minute quantities. For details of the analytical methods of water analysis reference must be made to manuals of applied chemistry. It is evident that in a water analysis we look for symptoms of a disease; not for substances which are in themselves hurtful, but for substances whose presence is associated more or less invariably with others, the action of which upon the system cannot but be pernicious.

In storing water for domestic purposes the water may undergo contamination from the vessels containing it or from proximity to drains or other places emitting noxious gases. It is certain that water exercises a solvent action upon lead; but our ordinary leaden water pipes and tanks become coated with a comparatively insoluble compound of lead, so that the danger of contamination from this source is not great. Hot water should never be stored in leaden tanks; it very quickly corrodes and dissolves the metal. Aerated waters act rapidly on lead: for this reason they should never be prepared or stored in leaden vessels. The solvent action of water on copper is very small. The system of storing water for drinking or cooking in cisterns close to, or even communicating with, the house drainage system, is a very bad one. (See SANITARY SCIENCE; PUBLIC HEALTH). In some circumstances, as in the case of swimming-baths, large quantities of water have to be heated to a certain temperature and kept at the same for a considerable time while the water has to be maintained in a due condition of purity. For industrial purposes also most waters require purification of a kind, depending upon the processes of manufacture in which they are employed. The most common treatment is that known as "softening," for the removal of lime and magnesia carbonates, chlorine and other lesser impurities. See WATER SOFTENING; WATER SUPPLY.

WATER, ITS RELATION TO DISEASE. See WATER SUPPLY.

WATER BABIES, The. This story, by Charles Kingsley, written originally for the amusement of his youngest son "and all other good little boys," and published in 1863, remains perhaps the most popular of the author's works, with the possible exception of the historical novel 'Westward Ho.' It is on the face of it a fairy story. Tom, a little friendless chimney sweep, falls asleep in a fine house where he is working and is transformed into a water baby, being in most respects like a land baby, except for the presence of gills and other necessities of aqueous life. As a water baby he has many charming and attractive adventures of the kind since made more popular as well as more fantastic through Lewis Carroll's 'Alice in Wonderland.' In addition to these merely odd happenings, the book is, characteristically, a treatise on belief and education. As in 'Alton Locke,' 'Yeast,' 'Westward Ho,' 'Hypatia' and other Kingsley novels, there is a fundamental moral thesis. In this book it is that one must not be too prone to dispute the existence of this or that simply because he has not seen it. This idea comes out most clearly in the clever argument of Kingsley's to demonstrate the existence of water babies. From this

point of view the book is a vivacious argument for faith, designed on the one hand to make readers less assertive and dogmatic and also to render them more receptive of the underlying, if undemonstrable, mysteries of the Christian religion.

WILLIAM T. BREWSTER.

WATER BALANCE, an oscillating pendulous frame, having a series of troughs in vertical series and inclined in alternate directions, so that, as the frame oscillates, the water dipped by the lower one shall be poured into the next above, which, on the return motion, shall pour it into the next, and so on.

WATER BAROMETER. See BAROMETER.

WATER-BEARS. See TARDIGRADA.

WATER BED, a watertight mattress or bed for relieving any partial pressure of the body of a patient long confined to bed and so preventing the formation of ulcers which arise from such local pressure. One form is that of a trough half-filled with water, covered by a loose lining of india-rubber sheeting attached all around to the upper edge of the trough so as to be watertight, a mattress being laid between the invalid and the lining. Another form is that of a large waterproof bag which is laid upon an ordinary mattress and half-filled with water, the weight of the body resting upon this directly or with bed clothes between.

WATER-BEETLES, the numerous species of beetles which inhabit water. A common mode of life does not indicate blood relationship, and the various aquatic beetles belong to a number of quite distinct families. Besides those which are aquatic throughout their lives quite a large number of beetles live in or near the water only during the larval period. The strictly and permanently aquatic beetles belong chiefly to three families. The diving beetles (*Dytiscidæ*) are predaceous throughout life and represent in the water the *Carabidæ,* to which they are somewhat closely related, on land. The legs in these insects are adapted for swimming, the two hinder pairs being flattened and fringed with hairs. The body is oval and flattened. The mandibles are short and strong and the thorax is broad. The front legs are short and the antennæ long and filiform. In the genus *Dytiscus* the tarsi of the males are wide, flat and provided with sucking discs, while those of the females are unmodified. The females are of two forms, the one having the wing-covers smooth, the other grooved. The head is short and received into the thorax. *D. fasciventris* is the common water-beetle of our ponds. These insects carry a supply of air for breathing beneath the *elytra* or wing-covers. At evening they fly in the air. They are eminently carnivorous in habits and feed on other insects. The larvæ are active creatures and are also aquatic; their noteworthy rapacity has gained for them the name of water-tigers, which they well merit, for they will not hesitate to seize in their sharp sickle-like jaws any insect-larvae, small fish or tadpole that comes within reach, and after draining its juices discard the dead body. The tail is terminated by a pair of respiratory tubes which are raised above the surface of the water to effect respiration. Besides this large species the family includes numerous small ones having similar habits. The other two families have club-shape instead of filiform antennæ.

The *Gyrinidæ,* or whirligig beetles, have the antennæ short, the front legs long, clawed, and in the males provided with a spongy disc, the second and third pairs of legs very short, broad and paddle-shaped, and the elytra do not cover the tip of the oval body. They derive their familiar name from their peculiar habit of describing circles on the surface of the pools they inhabit. When alarmed these insects dive to the bottom and anchor themselves for a time by means of the strong front legs, carrying with them a small bubble of air on the tip of the abdomen. Owing to their smooth, polished and oily surface they are unaffected by the water. The facets of the compound eyes are divided into two groups on each side, one adapted for vision in the water, and looking downward, the other for looking upward in the air — an important adaptation to the peculiar mode of life of these insects on the surface. When handled, the whirligigs emit from the joints a peculiar strong-smelling milky fluid. Although, like the *Dytiscus* larvæ, the young of the whirligigs are predaceous, their appearance is totally different; they are of slender form and, instead of a single pair of caudal respiratory tubes or gills, they bear 10 pairs of fringed lateral gills on the sides of as many abdominal segments. Several other genera and species are common in ponds.

The largest of the common water-beetles belong to the family *Hydrophilidæ,* which also includes numerous small and inconspicuous species. In the form of the body and the fringed oar-like middle and hind legs they resemble the *Dytiscidæ,* from which all the members of this family are distinguished by their short strongly-clubbed antennæ. The eggs are deposited in silken cocoons attached to water-plants or carried by the female. In general resembling the water-tigers in form, the larvæ have shorter, thicker, solid jaws, much less prominent respiratory tubes and are less active, although, like them, carnivorous. They pupate in burrows in the banks of the ponds which they inhabit. The great water-beetle (*Hydrophilus triangularis*) is a pitchy black polished beetle an inch and a half long, often seen flying at night or during the day rising to the surface of clear weed-grown ponds for air and, unlike the *Dytiscidæ,* usually resting head upward. In adult life they forsake the predaceous habits and animal diet of their larvæ and become scavengers, finding their food chiefly in the vegetable debris at the bottom of ponds. Few inhabitants of fresh-water ponds and ditches are better suited to life in an aquarium than these beetles and few present a greater variety or more interesting habits. Consult standard works, especially Miall, 'The Natural History of Aquatic Insects' (New York 1895) and Morgan, A., 'Field Book of Ponds and Streams' (1930). See FRESH-WATER INSECTS.

WATER-BOA, the anaconda snake. See BOA.

WATER-BOATMAN. See BOAT-FLY; WATER-BUG.

WATER BRASH. See PYROSIS.

WATER-BUG, an aquatic bug of the hemipterous family *Notonectidæ*. The hind legs are long and adapted for swimming by being provided with a fringe of stiff hairs. The body is prismatic in form, convex above and flat beneath, and the head is as large and as wide as the body. *Notonecta* is the typical genus of the family and *N. irrorata* and *undulata* are two of the common species. These and others abound in ponds and streams, where they rest on their backs at the surface, occasionally striking out with a vigorous oar-like movement of the hind legs, or dive to the bottom and cling to plants or stones. They are constantly buoyed up by a film of air which surrounds the abdomen, partly entangled in a coat of close fine hairs, partly held between the wings and the abdomen in a space into which the spiracles open and partly between the joints of the abdominal and thoracic segments. On land the water boatman are at a disadvantage and progress by a series of spasmodic leaps; but they are agile fliers. As larvæ, nymphs and imagoes they are predaceous and, besides strictly aquatic insects, young fishes, etc., they attack and suck the juices of flying insects which happen to fall into the water or approach its margin to drink. Various other hemipterous insects, such as the water-scorpions (q.v.), are aquatic. The croton bug is not truly aquatic, but is called a water-bug because it frequents water-pipes in cities.

WATER-CLOCK. See CLEPSYDRA.

WATER-COLOR. See PAINTING, TECHNIQUE OF.

WATER-COLOR PAINTING, in contradistinction to oil painting, the use of water generally interfused with gum arabic as a vehicle for applying colors, very often transparently, to a white surface. Anciently, there were three distinct methods of water-color painting, and these were known as tempera, encaustic and fresco. Tempera, or as it was sometimes called, distemper painting, was common in early Italian art. (See PAINTING). The colors were ground and mixed with the beaten-up white and yolk of an egg, or with the white juice of the fig tree, and sometimes with ox-gall. Encaustic painting was a process in which the colors were mixed with wax and laid in a thin coating, then fixed by the application of hot irons. The early Flemish and Dutch painters attained considerable success by the use of water colors in the medium of tempera, long previous to the invention of oil painting by the Van Eyck brothers. The Italian frescoes are painted in water color, on damp plaster and have retained their colors scarcely impaired for centuries. See FRESCO PAINTING.

But when we speak of water-color painting in a modern sense we refer to the aquarelle. The ancient Egyptians used water-color to decorate their papyrus rolls, and the monks of the Middle Ages employed it to adorn vellum manuscripts; but this was all impasto, not the transparent washes, as in modern English work. This process and manipulation was the outgrowth of the methods worked out by Paul Sandby (1725–1809) and advanced by Alexander Cozens, creating an entirely new type of fine art productions known as aquarelles. The former treatment of the water-color work on white paper was really a species of sketching in outline certain scenes then filling in the spaces with water-color (color printing). In the aquarelles the brush supersedes the pen (or pencil). Thomas Girtin (1775–1802) perfected the method and produced pictures disclosing consummate genius, and the novel charm of light and shade in nature as a fine art with transparent washes was revealed to admiring connoisseurs. These were the precursors of a talented English school. In the English school there has been no exclusive use made of what is known as body color. The lightness and darkness of each tint have generally been determined by the degree of their dilution with pure water, not by their modification through an admixture of Chinese white.

In early painting the pigments employed were generally mineral earths or juices pressed from plants. The colors found in antique frescoes were few but permanent in value. In the Middle Ages chemistry came to the aid of the fresco painter and supplied him with many brilliant and permanent tints, which is some instances vied with the lustre with which the church window maker stained his glass. The modern water-color painter has gained innumerable additions to the color range of his palette, and the freshness, crispness and unerring certainty of his touch have been largely due to the beauty, clearness and permanency of the colors in which he has worked. Manufacturers have, indeed, vied with each other in providing him with pigments which shall flow smoothly from his brush and stand projected with nature's beauty upon his paper. While the modern water-color painter aims at producing his effects by means of transparent washes, artists have not always considered it illegitimate to resort to the use of body color in their efforts to impart to their work the depth and solidity of oil painting.

Technique.— The necessary apparatus of a water-color artist's studio is simple and consists of paper, drawing-board and drawing-pins (push pins), palette pigments and brushes. Many use an easel, but a number rest the drawing-board on their knees or on an adjacent piece of furniture (table, etc.). To avoid the paper from crinkling or cockling when the water washes are applied it is necessary to stretch the paper, by wetting it with water and fastening it firmly to the board by pins or mucilage around the border. While there are differences of opinion as to what paper to select, there is a limit to the number of makes acceptable to any artist. All used surfaces, grains, textures, etc., are comprised in the following list: Whitman, Allenjé, Michallet, David Cox, Creswick, Varley, cartridge, Van Gelder, white Canson and Burlington.

Pigments.— The colors used by the early aquarelle masters were made up into little hard bricks (cakes) and were rubbed out in water on a porcelain surface, but a more recent, perhaps more convenient, form of pigment preparation consists of moist colors, requiring less manipulation before being ready for the brush. Light-red, yellow ochre, cyanine blue, ivory black and burnt sienna are the colors which are the mainstay of artists. From these basic pigments can be produced every ordinary color effect in nature directly or by blending. But, in these days of rapid action, many or most artists add an

array of other paints to the color-box, care being taken that they are not such as fade quickly in the light, as do prussian blue, antwerp blue, etc. French ultramarine (pure ultramarine being altogether too expensive), Indian ink, rose madder, sepia, oxide of chromium, vermilion and naples yellow are considered safe for use. Brushes are peculiarly a matter of choice of individual artists, their sense of touch differing greatly. The number selected is not so much a matter of importance as their being kept *absolutely* clean and carefully dried after use.

But the full capacity of the water-color medium was not known before the pictures of Joseph Mallard William Turner (1775–1851) (an early student of John Cozens' works and a constant coworker with Girtin till the latter's premature death), were exhibited to the world. His early water-colors were, indeed, low in tone and gloomy, though forcible and convincing. What he came to do in the way of color is shown best in his Venetian studies, originally made on the spot in water-colors. Turner, however, did not confine himself to the water wash; when he thought it necessary he employed body color in parts of his work, and even, on occasion, pastels; or it may be pencil or pen. But he never revealed to anyone the secrets of a technique which made him the greatest landscape painter in water-colors which the world has ever seen. The foundation of the Old Water-Color Society, in 1800, and of the new society, in 1863, gave a great impulse to the art, among whose representatives may be mentioned Copley Fielding (d. 1855); Peter de Wint (d. 1849); Samuel Prout (d. 1852), the master of architectural painting; David Cox (d. 1859) and the brilliant executer of Oriental genre, Lewis (d. 1876). Taylor and Landseer, as animal painters, found this a successful and pliant medium, and among the Pre-Raphaelites who were eminent aquarellists may be mentioned Rosetti, Madox Brown, Burne-Jones, Holman Hunt and Millais.

Prominent Aquarellists.—A partial list of the aquarelle artists of the English school whose works are appreciated by connoisseurs at sales must include the following; there are, of course, a number of noted artists who use the water-color medium as a side issue for «studies» but do not specialize on aquarelles. Earliest masters: Alexander Cozens and his son John Robert, Girtin, Turner, De Wint, David Cox, J. S. Cotman, Copley Fielding, S. Prout, Devis, Hearne, Bonington, Rooker, the two Cleveleys, W. Payne and N. Pocock. Belonging to the latter half of the 19th century we have F. Walker, G. J. Pinwell, Sir John Gilbert, G. Cattermole, E. J. Gregory, M. Birket Foster, J. M. Swan. Recent artists: R. W. Allen, Mrs. Allingham, Wilfrid Ball, F. Brangwyn, Sir Alfred East, G. S. Elgood, W. R. Flint, A. Goodwin, A. Ingram, F. E. James, H. Marshall, E. Noble, A. Powell, A. Rackham, A. Wardle, Sir E Waterlow, J. R. Weguelin, J. W. West, M. Fisher, M. Hale, Hughes-Stanton, Lamorna Birch, A. W. Rich, C. M. Gere, C. J. Holmes, etc.

In France, among able landscape painters in water colors, were conspicuous I. B. Isabey (1767–1855); Hubert, J. Ouvrié, Sué and Fort. They pretty generally employed body color (*gouache*) in their composition, the transparent wash being much less frequently employed in France. In portraits, Olivier Grand; in flower painting and still life, Redonté (1759–1840), the best painter of this class France has ever produced. But the art was not tried to its full capacity until the oriental sketches of Eugene Delacroix (1798–1863) proved to the French art world that there was something to be sought for fresher and more inspiring than the frigid classicalism of David. His lead was followed by Descamps (1803–60), one of the best colorists and most original painters of the modern French school, who taught his countrymen that it was possible to represent in water-colors the broad blaze of open sunlight in an African sand-plain; or in the streets of Smyrna and Constantinople. The powerful genres of Gavarni (1804–66) made a sensation even in England, the native home of water colors.

The German school of water-color painting began with the illuminating or tinting by hand of copper plate engravings. An independent and distinct department of aquarelle came late in the history of German art. The first notable aquarellists in that country were Karl Werner of Leipzig and Edward Hildebrandt of Berlin — Viermann, Otto, Grael of Berlin, Heindrich, Stöckles, R. Stieles of Munich and a circle in Düsseldorf, including Scheuren and Mintrop, kept up the traditions of German water-color painting. A new path was struck out by Menzel, who obtained a great following. He adopted a broad, frank and dashing style which was much admired. The Berlin painters, such as Franz Skarbina and Paul Mayerheim, vied with him in this method of handling. But German aquarelle has never been distinguished for the lightness of touch, the brilliant and transparent coloring, the powerful and vivid landscape effects which we find in the productions of English and French artists. Italy and Russia on the other hand have many skilful adepts in this art. The vivid coloring of such masters as Corelli, Zezzos and Mainella has a light and vividness all its own and the creations of these painters are worthy of comparison with many of the most eminent workers in their own department of art in other parts of Europe. The same may be said of the Russians, Benkendorf, Bergholz, Karafin, Heftler, Jegornow, Pissemski and Ehrenon.

Water-color painting has always formed a very living section of American art life. When Vassili Verestchagin, the great Russian war painter, was in America, he was astonished, according to his own account, that native artists were not more alive to the possibilities of American scenery and American life as subjects for the pencil. He was not sufficiently acquainted with the history of art in the country to which he had come a stranger, to be aware of the fact that local art had long flourished there. The Hudson River School of painters produced many noble transcripts from the scenery of that river, mostly in large canvases, and by employing oil as a favorite medium, but several of them have also executed gems of art in water-colors after the style of the best masters. Among those who have done some good water-color sketching among the sublime scenery of the West may be named Albert Bierstadt, some of whose views are correct in drawing and rich in coloring, albeit they owed their original impressiveness to the novelty of the effects in atmosphere and moun-

tain contour or coloring which they reproduced. The same in a less degree may be said of the drawings of F. E. Church. Neither of these painters was, however, as triumphant in water as in oil. The New York Water Color Club has done much to foster a revived interest in this most difficult yet most effective and delightful department of the painter's art and among the most successful of those who cultivate it may be enumerated James McNeill Whistler, John Singer Sargent, Childe Hassam, Abbey, Moran, Parton, Murphy, Parsons, Shurtleef, Tryon, etc. Louis C. Tiffany is a colorist of rare gifts and although his natural predilection leads him to the representation of still life, yet his water-color landscapes have a value of their own. Charles Sanderson is well known for his lovely water-color studies of the shores of Lake Michigan. At the end of the 19th century there was suddenly a new movement developed in this department, principally through the influence of John H. Twachtman, whose early death was a sad blow to the cause he had most at heart in his native country. In 1898 the Ten American Artists crystallized into a new school of painting in New York. As far as this movement was represented by Twachtman it stood for a distinct advance in water-color art. There can be no doubt that he reflected in the practice of his art the very best features of that style which in Europe was embodied in the work of Girtin, Cozens and Turner. Water-color painting in the United States numbers among its devotees many other great names. Homer D. Martin's few water-colors are of the highest value. Frederic Crowninshield shows in his water-colors a noble sense of the form of hills and cliffs and the greater forms of the landscape, as well as of tree-form. Winslow Homer's many water-colors are about as important a contribution to American art as any other group of works. They are extremely vigorous and impressive, they sell at high prices and among lovers of modern painting there are certainly none more esteemed. Winslow Homer is essentially a «painter's painter» and no single artist in the whole group is more admired by his fellow-artists. John La Farge's water-colors are what have chiefly made his great reputation. There are hundreds of them in private collections in Boston, New York and neighboring towns and the show of the South Sea Island collection at the Paris Salon in 1898 or 1899 occupied a hall especially set aside for it and made a great sensation. There is nothing in modern art more rich in color than these La Farge drawings, which were produced during the years 1865 to 1895 chiefly; for from that time he became thoroughly absorbed in decorating work, glass and the like. The work of Robert F. Blum and that of Irving R. Wiles commands the admiration of their brother artists. Francis Hopkinson Smith was a master of loaded color, that which is mixed with white (the French *gouache*). There are women artists who excel in water-color work of each kind.

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CLEMENT W. COUMBE.

WATER CRESS, WINTER CRESS. See CRESS.

WATER CURE. See HYDROTHERAPY.

WATER DISTRICT. See DISTRICT.

WATER-DOG, a salamander. See MUD PUPPY.

WATER-FLEA. See CYPRIS; DAPHNIA.

WATER GAPS. See DELAWARE WATER GAP; STREAM PIRACY; TRELLISED DRAINAGE.

WATER-GAS, a mixture of gases produced by the action of steam on incandescent carbon. The carbon first decomposes the steam, forming hydrogen and carbon dioxide, and the latter gas then combines with more carbon to form the inflammable carbon monoxide. Thus water-gas may be considered economically a mixture of hydrogen and carbon monoxide with certain impurities. Its especial value as a fuel lies in the fact that 90 per cent of its volume is combustible, while the ordinary producer-gas is but 30 per cent combustion. Pure water-gas is non-luminous, but it is rendered luminous by mixing with it various gases obtained from petroleum, the luminous mixture being known as carbureted water-gas. Two chief methods are employed for the manufacture of water-gas for illuminating purposes. In the first of these, the Lowe process, the preparation of the pure gas and the carbureting are performed in one operation. The apparatus consists essentially of a generator, filled with anthracite or coke, in which the non-carbureted gas is produced; a carbureter, a circular chamber lined with fire-brick and filled with a checkerwork of the same material; and a superheater, a taller circular chamber similarly filled. By means of air-blasts and the producer-gas from the anthracite of the generator, the fire-bricks of the carbureter and the superheater are raised to a red heat, and then superheated steam is passed through the incandescent carbon. The product at this stage is known as «blue water-gas» and burns with a very hot, non-luminous flame. It is useful for many manufacturing purposes. To make it available for illuminating the water-gas formed is carried over into the carbureter, where it becomes mixed with the highly carbureted gases formed by the action of the heated bricks on mineral oil, which is introduced from above. This process is completed in the superheater, and the carbureted gas is then ready for purification process in which the

sulphureted hydrogen and carbon dioxide components are removed. In the Wilkinson process the operations of making the gas and carbureting are separate. In the United States carbureted water-gas has largely replaced coal-gas as an illuminant, partly because of its brighter light and partly because it can be more cheaply manufactured. Illuminating gas made from coal is often mixed with carbureted water-gas in order to increase its illuminating power. The chief objection to the use of water-gas as an illuminant is the highly poisonous nature of one of its largest constituents, carbon monoxide. By keeping the percentage of this constituent down to 16 per cent of the total volume, the mixture is not more dangerous to inhale than ordinary coal-gas. See GAS, NATURAL.

WATER GLASS, a substance which, when solid, resembles glass, but is slowly soluble in boiling water, although it remains unaffected by ordinary atmospheric changes. It consists of soluble silicates of potash or soda, or a mixture of both. The soda glass has the formula, $Na_2O.3SiO_2$. A substance of this kind was first discovered, so far as is known, by Van Helmont in 1640. In the 19th century Dr. Johann Fuchs of Munich did much to improve the mode of preparing and applying it. Water glass may be prepared in two ways, called wet and dry. The former method is used where the proportion of alkali may be so large as 50 per cent, in which case the sand and alkali may be simply boiled together. Where a water glass richer in silica is required the mode of preparation consists in breaking down and calcining flint nodules, the fragments or particles of which are then added to a solution of caustic potash or soda, whereupon the whole is exposed for a time to intense heat at 60 pounds pressure. Sand may be used instead of the flint. According to the product when prepared in this way is viscid, and may be used in this state or further diluted. In this method of manufacture the caustic soda or potash may be replaced by the carbonate or the sulphate. Potash water glass is more soluble than soda water glass, and if both metals be present a still more soluble glass, called double soluble glass, is obtained. Among the purposes to which water glass is applied are painting on glass, coating stone, wood and other materials to render them waterproof or fireproof, glazing scenery and paintings, etc. It is also used mixed with sand to make an artificial stone, and it forms an ingredient indispensable in the manufacture of fireproof cements, such as are used in joining firebricks in furnace construction. For this purpose it is commonly mixed with lime. One of the most valuable of its applications is in the fixing of wall-paintings, by spraying with the water glass. They are thus rendered more durable than in the ordinary process of fresco-painting.

WATER HAMMER, the name applied in the laboratory to a vessel partly filled with water, exhausted of air and hermetically sealed. When reversed or shaken, the water being unimpeded by air, strikes the sides with a sound like that of a metal striking against glass. In hydraulics the term is used to designate the sudden rise of pressure in a pipeline due to the check of flow of the liquid running in it — as by the sudden closing of a valve. The strain on the pipe and any motor connected openly with it is often very serious. The formulas which are used to calculate this strain are $\frac{pr}{t}$ = the circumferential stress in the pipe walls; and $\frac{pr}{2t}$ the longitudinal stress — where p represents the increase in pressure in pounds per square foot; r the radius of the pipe in feet; and t the thickness of the pipe in feet. The hydraulic ram (q.v.) operates by water hammer. The technics of water hammer is exhaustively discussed in Gibson, A. H., 'Water Hammer in Hydraulic Pipe Lines' (Manchester, England, 1908).

WATER-HEMLOCK, deadly poisonous plants (*Cicuta*) of the carrot family, known also by many other names, such as beaver-poison, spotted parsley, muskrat-weed and musquash-root, the latter names being borrowed from the muskrat, which inhabits such swamps as the *Cicuta* affects; and the odor of the roots of certain species of the latter also recalls the musk-scented rodent. *Cicuta maculata* is a tall biennial, reaching eight feet in height, with a rigid, hollow stem marked with purple lines, that grows in swamps and wet lands throughout the northeastern United States. The leaves are decompound, even three-pinnate, having coarsely serrate leaflets, with veins apparently ending in notches instead of at the points of the teeth, as in ordinary foliage. The flowers are very tiny and white, in decompound, terminal umbels, with unequal pedicels. The fruits are ovate-oblong, glabrous and slightly flattened laterally. The ribs are corky, the lateral ones being strongest. Spindle-shaped, tuberous roots cluster about the base of the stem, and are the cause of many deaths. They have an aromatic flavor and fleshy substance, and are frequently mistaken, especially by children, for the roots of sweet cicely, parsnips, artichokes, or even horse-radish, and are sometimes eaten for no particular reason except that they are fleshy and exposed by washouts, freezing or digging-operations. Even livestock are killed, not only by feeding on the tubers themselves but by drinking water poisoned by roots which have been crushed under the cattle's hoofs. The poisonous element in this *Cicuta* is an aromatic oily fluid, which permeates the whole plant, but is found chiefly in the roots, and probably contains the alkaloid conine and the bitter principle cicutoxin. When eaten *Cicuta* produces vomiting, colic, staggering and unconsciousness, and finally frightful convulsions which end in death. No chemical antidote being known, the only treatment possible is to cleanse thoroughly the digestive system, and treat each stage of the attack with such medicines as seem necessary. Cattle may sometimes be saved by timely and repeated doses of melted lard. The elongated spindling-roots of the Wyoming water-hemlock, *Cicuta occidentalis,* which in Montana is known as the wild parsnip, has a characteristic musky odor, and stock are poisoned either by the young plants or by the roots. Other species of *Cicuta* have a similar appearance above ground and are equally poisonous.

WATER-HEN, or **MOOR-HEN,** a rail (*Gallinula chloropus*), generally distributed throughout Europe, Asia and Africa. Its length is about 13 inches; back, wings, rump and tail rich dark olive-brown; head, neck, breast and sides dark slate gray; thighs and flanks streaked with white, belly and vent grayish white; beak yellowish, becoming red; naked patch on forehead red; legs and toes greenish-yellow, claws dark-brown. The female is rather larger and more vividly colored than the male. They frequent ponds covered with aquatic herbage, overgrown water-courses and the banks of slow rivers, swimming and diving with facility, assisted by an expansion of the membrane along the sides of the toes. The water-hen is representative of the sub-family *Gallinulinæ* of the rail family (*Rallidæ*) which comprises 30 or 40 species found in all parts of the world. In the United States they are generally known as gallinules or mud-hens, and are represented by the purple gallinule (*Ionornis martinica*) and the Florida, or common gallinule (*Gallinula galeata*). The American coot (*Fulica americana*) is also frequently called a water-hen.

WATER-HICKORY. See HICKORY.

WATER INCH, *in hydraulics,* a measure of water equal to the quantity discharged in the 24 hours through a circular opening of one inch diameter leading from a reservoir under the least pressure, that is, when the water is only so high as to cover the orifice. This quantity is about 500 cubic feet. In irrigation, the term is used synonymously with "miner's inch," which is the volume of water which flows in one hour through an aperture one inch square, the sides being horizontal and vertical, under a head of six inches measured from the upper edge of the aperture. The flow amounts to 673.2 gallons per hour.

WATER LAWS, the body of legislative enactment and legal decisions governing the rights to the use of water. In comparison with the laws concerning ownership of land and of other property the water laws, particularly in the United States, are extremely complicated. There is a great amount of law with apparent lack of consistency in the prevailing legislation and decisions. The cause of this lies largely in the physical fact that water as a substance varies in quantity from day to day and until recent years the principles governing its occurrence and the methods of measurements have not been well understood. In fact they are still more or less of a mystery to many members of law-making bodies. More than this there has been an attempt to apply rules of law which while suitable for permanent or fixed objects are hardly applicable to a substance the component particles of which are ever flowing away and are ever renewed, but in fluctuating quantity. To illustrate some of the different conditions and viewpoints take first the case of a natural spring or pond on a certain tract of land. It is generally conceded that ownership of the land carries with it the full right to the use of this small body of water. If, however, the spring or pond discharges onto a piece of land belonging to another proprietor, it is obvious that the second owner has certain rights due to the fact that the stream flows along or across his land. Under ordinary conditions the upper owner may not deprive the lower of his fair share of the water, at least for drinking purposes for man and beast. The stream flows on continually, joins with others and becomes a boundary line between proprietors Each through his ownership of the land claims certain riparian rights in the flowing water. The stream finally becomes of such size as to be of importance to the whole community or State and the latter sometimes claims proprietorship in the bed and banks, these being held by the State for the benefit of the public. It finally becomes of navigable capacity, and, under the terms of the prevailing interpretation of the Constitution of the United States regarding commerce, the control is vested in Congress. In the older part of the country where, under humid conditions, there is usually ample water and to spare, the rule is that each riparian proprietor shall permit the stream to flow through or along his land undisturbed in quantity and unchanged or unpolluted as to quality — his rights being bounded by those of all his neighbors above and below, each having a fair share in the use of the water provided he does not interfere with rights of others. He may utilize the water for power if in so doing he does not overflow the lands of others nor interfere with established usages nor with the enjoyment of similar opportunities by others. If, however, a municipality finds it necessary to take water from a stream, it must be prepared to make compensation for any possible rights which may be interfered with. As a rule it cannot exercise the right of eminent domain outside of the borders of the State in which the city is located. It may be thus narrowly circumscribed and hindered from its best growth because of artificial restrictions imposed by State lines.

In the arid and semi-arid regions in the western part of the United States the common law of England, which has been followed in the humid East, is not in accord with the common necessities of the people. There it is possible to cultivate the ground successfully only through the artificial application of water. The lands will remain unproductive and population cannot increase unless the waters are taken from their natural channels to be spread over the ground and the stream channels left practically dry. The rights of riparian proprietors can be no longer observed, as in Eastern States, where under ordinary circumstances there is enough water for all. Out of the necessity of the people has thus grown an entirely different theory, namely, that of appropriation — this being limited to beneficial use, each appropriator being permitted to take usually only so much water as is needed for the irrigation of his land; even in this he may be required to show an economic use. In the case of two or more appropriators not finding enough water to satisfy their needs, the rule is usually enforced to the effect that first in time is first in right, although this rule is being modified in practice in accordance with larger equity, for example, if the first in time is at a place where there results great waste in getting

the water to him, consideration may be taken of the fact that to irrigate one acre thus situated many acres better located must be left dry.

The common law of riparian rights such as prevails in the eastern or humid part of the United States, but modified to a considerable extent, is recognized in California, Kansas, Montana and Washington. The civil-law doctrine declaring that the waters are the property of the state is contained in the constitution of Wyoming; similar declarations are made in the laws of Idaho, Nevada and Texas. By the constitution of Colorado the water of every natural stream is declared to be the property of the public and dedicated to the use of the people of the state. Similar declarations are contained in the water laws of Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota and Utah. Under the so-called Wyoming system the water rights are in theory acquired by grant from the state. There is great difference among the Western states with reference to the control of appropriation. In some states this control is vested in a state board with right of appeal, however, to the courts. In others adjudication proceedings are initiated in the courts. Because of the difficulty of ascertaining the ordinary supply of water and because of the exaggerated claims which are made to its use there have arisen innumerable controversies so that in some parts of the arid region more money is being expended in litigation than in actual irrigation. In most states in which water rights are adjudicated by courts, the law provides that all parties claiming rights to water from the same source shall be made parties to the action so that all rights may be determined in a single action. Without such provision, there may be an interminable succession of suits, A bringing B into court to determine their respective rights, then C coming in and upsetting the arrangements and so on through the entire alphabet. The interest of the public or of the state is not necessarily taken into consideration at any time.

There are conflicting theories which arise from a difference of opinion as to the origin of rights to water Throughout a greater part of the East there is insistence upon the conception that all rights to the use of water abide in and are derived from private or personal proprietorship of land and that any attempt at the invasion of the sanctity of property will result disastrously. Nevertheless attempts have been made and are continually being made to preserve the rights of the public and by asserting the theory of state ownership and control of water, to set a limit to the broad claims of riparian owners. Further than this there is still a third class who claim that the federal government has the right and duty on behalf of all the people and for the general welfare to extend its authority beyond the narrow limitations of preventing interference with navigation, and to legislate in such a way as to prevent this great natural resource from being exploited wholly for private gain, especially as to those waters which have not already been appropriated or put to beneficial use. There is continual attempt of riparian owners and of large moneyed interests to extend and strengthen their control of water rights. At the same time efforts are being made by the state legislatures and by the federal Congress to enact legislation protecting the general public in the proper enjoyment of water, which, like air, is essential to all life whether human, animal or vegetable. The conflict between these opposing theories and views is resulting in innumerable statutes and court decisions, many of them apparently irreconcilable. The unfortunate feature is that, besides provoking litigation, the largest and best uses of the waters of the country are not being given full consideration.

F. H. Newell.

WATER LEMON. See Passion Flower.

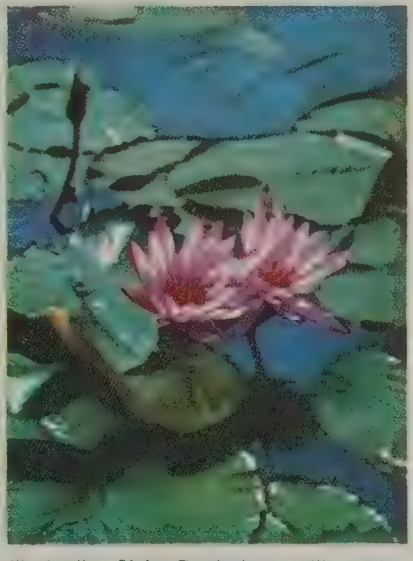
WATER LETTUCE, a fresh water herb (*Pistia stratiotes*) of the Arum family, indigenous to tropical and subtropical regions. It is a perennial, with long cordate leaves, and feathery roots. It bears pea-green velvety rosettes of wedge-shaped leaves about six inches in length and resembling the lettuce plant which gives it its name. In the cup-like rosettes are centered small white blossoms. In the United States it grows from Florida to Texas. It is often cultivated in aquariums.

WATER LILY, a plant of the aquatic family Nymphaeaceae, and of the genus *Nymphaea.* These are found in fresh, still waters throughout the warm and temperate regions, and are often cultivated. Some can be raised easily from seed, and those which are hardy in the North will stand a very low temperature without damage, even to be encased in ice. They may be grown in tanks, or even in half-barrels, as well as in ponds. The tropical species must be raised nearly to blooming size in a greenhouse before being planted outside. The water lilies are handsome plants, having more or less orbicular leaves, either floating, or more rarely emersed, and solitary flowers, of similar varying habit. The blossoms have four sepals and many petals, stamens, and carpels, the latter united and immersed in a thickened receptacle; in color they may be white, pink, yellow or blue, and are sometimes very fragrant. The flowers of some species open by day and close at night; others open at night and close by day. The duration of one flower is usually three days. If pollinated the flower is drawn to the bottom of the pond or tank by a bending or spiral coiling of the stalk.

The fruit is indehiscent, somewhat fleshy, and like a large berry filled with seeds. The seeds have small embryos and abundant starchy perisperm, and are enclosed in pulpy arils. When the seeds are ripe the pod breaks open irregularly. The seeds are borne to the surface of the water by the buoyant arils, where they repel each other and float far and wide by changes in surface tension and by currents of water and wind. After one or two hours the aril contracts, breaks loose, and lets the seed drop to the bottom of the pond. Nearly all of the known 40 species have been brought into cultivation, and countless hybrids have been produced, both in the hardy and tropical groups. One of the finest is the Australian water lily (*Nymphaea gigantea*). Its flowers are sometimes a foot across, with hundreds of stamens, and the color is blue, pink, or white. It does not close so completely at night as do other water lilies. The Egyptian lotus (*Nymphaea caerulea*) that was a favorite plant of the ancient Egyptians is often confounded with the Indian lotus (*Nelumbo,* q.v.), but is really a blue flowered water lily, with flowers borne on stiff stalks a foot above the water. It was a valuable plant to the decorators of that country,

WATER LILY

Tropical water lilies (*Nymphaea*) shown above, *left to right*, bear the popular names Blue Beauty and Mrs. C. W. Ward.



Above left: American lotus (*Nelumbo*) named Sunrise Queen, related to the water lily family. *Right:* Tropical water lily, Jupiter.

Above left: Golden West tropical lily with yellow water poppies *(Hydrocleis Nymphoides)*. *Right:* Tropical water lily named Director George T. Moore.

All Kodachromes by John J. Smith

WATER LILY

Photographs courtesy New York Botanical Garden

Top: Nymphaea (Castalia) americana. Bottom: Nymphaea (Castalia) capensis.

who copied it, and conventionalized its form in many of their architectural ornaments, and also introduced it constantly into their painted pictures of life and customs. Its rootstock and seeds served as food. (See LOTUS.) The European water lily (*Nymphaea alba*) has white flowers that usually float upon the surface of the water. The flowers are not fragrant, as are those of the American water lily (*Nymphaea odorata*). The latter lovely water lily rides upon the water, with snow-white petals radiating in circles, the inner gradually narrowing, and passing by various stages into golden stamens in the center. They open in sunshine about 6 A.M., and close in the early afternoon. The fruit is ovate and baccate and ripens under water. The leaves, or lily pads, a favorite food of deer, are ovate-orbicular, with a deep sinus, and have very long cylindrical stems of unvarying thickness, great flexibility, and toughness. The thick, fleshy creeping rootstock furnished a brown dye for the early settlers, and was also used as a styptic, and tonic. A variety of this water lily is smaller and has rose-colored flowers. There are four other species of *Nymphaea* in the United States, including the handsome golden-flowered water lily (*Nymphaea mexicana*) of Florida and Mexico. See also LOTUS; NYMPHAEACEAE; VICTORIA.

HENRY S. CONARD.

WATER LINE, (1) a nautical term which describes any of several lines marked upon a vessel, corresponding with the surface of the water when the vessel is afloat on an even keel. The lowest line indicates the vessel's proper submergence when not loaded; the highest line the vessel's proper submergence when loaded.

(2) The term is used in shipbuilding to designate on the model or plan the surface of the water at various heights from the keel.

(3) A line produced as a watermark on paper.

(4) The level represented by the uppermost limit of ground saturated with water; a water table.

(5) A line of stain marking the junction of a former leaning roof.

(6) A shore line.

(7) The desired or actual level of water in a tank or boiler.

WATER LOCUST or **SWAMP LOCUST,** of the genus *Gleditsia aquatica,* and family Leguminosae. It is a variety of the honey locust indigenous to the Southern states. It is found from Kentucky to the Gulf of Mexico, and from South Carolina to Florida. It is a beautiful tall tree, with enormous spines, and reddish oval pods. Its dark, heavy wood takes a very high polish. See also LOCUST.

WATER MARK, (1) The mark or limit of the rise of a flood or the mark indicating the rise and fall of the tide. (2) In paper-making, any distinguishing device or devices appearing in translucent lines in the substance of a sheet of paper. It is produced by a pattern of wire built upon the web and receiving heavy pressure from the rolls as the film of pulp passes through them while yet in a damp or pulpy condition. The water marks used by the earlier paper-makers have given names to several of the present standard sizes of paper, as foolscap, crown, elephant.

Although the Chinese are credited with the invention of paper, the Italian papermakers of the late 13th century were the first to use water marks. These were usually simple geometrical designs that could be twisted easily in wire. Animals were also favorite water marks of the early papermakers. In 1818 Sir William Congreve (q.v.) invented water marking in color and obtained a patent for it in December 1819.

WATER METER, a mechanism by which the quantity of water or any other liquid flowing through pipes is measured and recorded automatically. They are of three general types—the "positive," the "inferential" and the "proportional" meters.

Positive meters measure the actual volume of the water, by the action of a piston working in a cylinder which is successively emptied and filled at the completion of each stroke. The cylinder being of known dimensions affords a measure of the quantity of water introduced. The pistons are either reciprocating or rotary, or of the oscillating or gyrating disc patterns and they may be single or double. When single, a weight or spring produces the return stroke, but in the case of the double arrangement, the reciprocal action of the two pistons is controlled by the action of each other, as in the case of a duplex pump. In rotary piston meters, which may also be of the single or double type, the pistons have interlocking faces and rotate in an airtight chamber. Upon the outer surfaces of the pistons are a series of projections and recesses which correspond to similar shapes on the inner walls of the cylinder. The pressure of the flowing water causes the piston to turn so that a series of recesses or chambers in the cylinder are successively filled and discharged from the inlet to the outlet of the meter. When oscillating or gyrating discs are employed in the place of pistons, the wabbling motion of the discs alternately empties and fills the cylinder. Inferential meters measure the velocity of the flowing water by recording the revolutions of a turbine or other water-wheel attachment, and the quantity is deduced by computation from that record. Proportional meters measure a fractional part of the full flow and are, therefore, capable of being set on a small by-pass pipe which branches from and subsequently rejoins the main pipe, but being only approximately accurate their use is limited.

The registering mechanisms consist of a series of gear wheels and dials. The flow of the water actuates the gear wheels, and the number of revolutions are recorded on the dials. The arrangement of the mechanism converts the number of revolutions into any desired unit of volume, so that the reading of the dials is termed straight and gives the quantity direct, in cubic feet, the unit generally adopted, particularly in the United States.

The working parts of meters are made light and durable. Serviceability and accuracy are the qualities required, and in their design the support of the water pressure is employed to reduce to a minimum the loss of head, and the wear and tear of the working parts, and although a high degree of accuracy is not generally required, the meters are made sufficiently sensitive to measure the small flows incident to leakage. Hard rubber is generally used for the discs, and also for the rotary pistons of some meters, but where the liquids are hot, or consist of chemical solutions, brass is generally

employed. Possible damage due to clogging by the introduction of fish or gravel is prevented by various forms of strainers and sieves, while effect of frost is guarded against by frost cases.

There are several forms of meters which do not come under the general classes already described. Of these the "Venturi," constructed by Clemens Herschel of New York, in 1886, is the superior and most useful on account of its simplicity and durability. Its basic principles — the relation between the reduction of pressure and the increase of velocity of water flowing through a contracted pipe, was discovered by Venturi in 1796. In construction it consists of two conical shaped pipes with their smaller ends joined together by a collar or throat-piece, resulting in a shape similar to a pipe contracted at one point of its length. By gauging the pressure of the water at a point just before, and also directly at the point of contraction, and the relation of these pressures to the diameter of the pipe, the volume of the flow is computed. The tubes are usually constructed of cast iron or riveted steel, but they may also be constructed of masonry or wood. The length of the meter varies from 8 to 16 times the diameter of the uncontracted portion, while the diameter of the contraction ranges from one-fourth to one-half of the full diameter of the tube. They are made in sizes varying from two to about 100 inches, with practically no limit to the possible maximum size, but for practical use where meters of diameters less than six inches are required those with moving parts are cheaper. Waste-water meters are employed in connection with waterworks to measure the rate of consumption per unit of time, instead of the total volume. They consist usually of a disc placed horizontally in a cone-shaped chamber. The disc is lifted or lowered according to the greater or lesser volume of water passing through the pipe in which it is set, and being connected by a wire with counterweight and pencil which follow the movements of the disc, records the nature and amount of those movements on a paper carried by a drum which is revolved by clockwork. The vertical rulings of the record sheet indicate the time intervals, while the horizontal lines represents the units of volume. Since all the water consumed in a given district must pass through such a meter, by comparing the rates of consumption of the various districts, the causes of abnormal waste are readily determined and localized.

Another form of water meters, more particularly known as current meters, are employed in hydraulic engineering to measure the velocity and volume of flow of the waters in rivers, large aqueducts and sewers. See CURRENT METER.

WATER-MOCCASIN, a snake. See MOCCASIN.

WATER-MOLDS. See FUNGI.

WATER MOTOR. In its broadest sense the term is applicable to all forms of machines or systems of machinery operated by water under the force of gravity, or in other words, by which the energy inherent in a natural waterfall is utilized to perform mechanical work. There are three types of such motors, classified as (1) gravity motors; (2) pressure motors, and (3) impulse motors. Of these machines, the water-wheel (q.v.), the turbine (q.v.) and the pump (q.v.) have been treated under their respective titles, but in this article the term will be considered as designating those machines which are operated by the element of pressure only, such as hydraulic lifts and water pressure engines.

The Hydraulic Lift, used in elevator service, is the simplest of all water motors. The direct-acting lift consists of a cylinder in which a ram or piston of equal length, with a cage attached to its upper end, works up and down. The level of the water supply must be necessarily above that of the maximum height through which the cage may be lifted, so that when the water is admitted to the cylinder at its lower end, the pressure forces the ram upward and thus lifts the cage. The descent of the ram is accomplished by closing the supply valve and opening the discharge valve, the ram descending by its own weight. As the weight of the ram is greater than necessary to bring down the cage, a part of that weight is balanced by a counterweight attached to the end of a chain that works over a pulley at the top of the lift and is connected to the cage. The most familiar examples are the high-speed hydraulic passenger elevators. They are operated by the pressure of water pumped into tanks situated on the roofs of the buildings in which they are installed, while the operating machinery is located in the basement. (See ELEVATORS). The hydraulic press and the hydraulic ram are devices operated practically under similar principles. In the former, the action depends upon the principle of hydrostatics that a pressure applied to any part of the surface of a liquid is transmitted in all directions and throughout the mass without diminution. For example, if a cylinder filled with water has a plunger one inch square working through one end and another 10 inches square working through the other end, and a pressure of one pound is exerted on the smaller plunger, this pressure will be transmitted to the larger plunger and be delivered by the latter in a multiplied amount equal to the square of its face area expressed in pounds. In this example that pressure would be 100 pounds. Such presses consist essentially of two cylinders connected by piping. The pressure is applied to the plunger of the smaller cylinder and the multiplied pressure is transmitted by that of the larger to the object to be raised or pressed. In construction they vary greatly with the purpose for which they are employed. Those used as hay, cotton and oil presses consist of four strong iron pillars arranged in the form of a square, which carry a cast-iron plate solidly attached to their tops. A similar casting is situated at the bottom of the pillars. Through a circular hole in the centre of the lower plate, a plunger carrying a square platen on its head works with an upward motion and presses the material placed between the platen and the under face of the top plate. In presses used for hydraulic forging, the cylinder and plunger are carried by the top plate, while the bottom plate carries the anvil. The plungers work downward in the act of pressing or hammering. They are made of various sizes and are generally provided with two pressure plungers and cylinders and they are adapted for purposes varying from the manufacture of revolver cartridge cases to the

forging of armor plate, guns and steamship shafts. Armor plate presses capable of exerting a pressure of 14,000 tons are in use, while 7,000-ton fluid compressors are employed in many of the larger steel manufacturing plants. A brief description of the construction and working of one of the last-named capacity will serve to illustrate the mammoth proportions and enormous power of these machines. It consists of an upper head weighing 120 tons carrying the plunger and a 135-ton base plate containing the hydraulic cylinder. These are supported and held in place by four vertical connecting columns each 50 feet long, and 19 inches in diameter. In operation, the molten metal is poured into a mold built up in sections and the mold is raised under a hydraulic pressure of 7,000 tons, while a plunger attached to the upper head bears down upon the fluid metal and compresses it.

Hydraulic Ram.— In the hydraulic ram the force of water flowing by gravity is utilized to raise a portion of its volume to a height above that of the source of supply. Two pipes are employed. The water in flowing through the main or drive pipe acquires sufficient momentum to close a valve at the foot of the pipe, and the water thus confined automatically opens another valve, partially fills an air chamber situated over the foot of the main pipe and compresses the air in it until the pressure within balances the column of water in the main pipe. Then the foot valve of the main pipe opens again and the action described is repeated. In the meantime, the pressure in the air chamber forces the water through a small service pipe leading out of its bottom, to the required height. See HYDROSTATIC PRESS; HYDRAULIC RAM; POWER TRANSMISSION; PUMPS AND PUMPING MACHINERY.

Hydraulic Engines.— In the hydraulic lifts or elevators, the admission and discharge valves are worked by hand at the will of the operator, but in the engines the mechanism actuates the valves automatically and periodically, thus converting the lift into a machine with a continuous action. Unlike the vertical water wheels and turbines, the efficiency of which depends upon the weight of a large body of water falling from a comparatively small height, the water engines work under the pressure of a small column of water descending from a considerable elevation. They are of three types — the "single action," in which a piston working in a cylinder is moved upward by the pressure of the water, and downward by the weight of the piston itself; the "double action," in which the cylinder is closed at the top as well as at the bottom, and the water admitted to it by supply pipes at those points, acts reciprocally on the piston from above and below; and the "rotary," in which the water pressure acts on a revolving piston similar to that of a rotary steam-engine. Rotary engines may be of the single-acting or double-acting type, the advantage being with the former, since the pressure of the piston is always exerted on the crank pin in one direction and the dead centres are passed without knocking. Generally three single-acting cylinders formed in one casting are used in connection with a disc valve with segmental posts which pass over corresponding apertures in the valve seating, during rotation and the engine will readily start in all positions. The first engine of this kind was constructed by Sir William Armstrong, who also subsequently designed one of the reciprocating pattern. Since then a great variety of hydraulic engines have been invented, the greater number of them being of the last-named type. (See HYDRAULIC ENGINE). They have a wide field of usefulness, especially as auxiliary motors for driving small machinery such as hoists, swing-bridges, capstans, cranes, winches, etc. The employment of superheated water motors is one of the latest developments in the methods for railroad traction. In the earlier forms of engines operated by superheated water, the storage tank being charged with water at a temperature corresponding to several hundred pounds of pressure, only the steam from the water was utilized in the cylinders of the motor, in a manner similar to the utilization of steam from the boiler of a locomotive engine by expansion in its cylinders. Their operation was based upon the relation of temperature and pressure to the vaporization of liquids and the steam was drawn off from its point of formation at the top of the storage tank to the cylinders. Under these conditions, with each revolution the new steam was supplied by water which boiled at continually lower and lower pressures and reduced temperatures, until the pressure fell to a point at which it was not available for use in the motor; and only about one-ninth of the energy of the heated water was actually used in the cylinders. W. E. Prall of Washington, D. C., suggested the utilization of the power in the storage tank by withdrawing the superheated water directly from the bottom of the tank instead of steam from the top and allowing the water thus withdrawn to expand into steam within the cylinders of the engine itself. In the latest motors, this is accomplished by a generator composed of a nest of tubes coupled into manifolds at the top and bottom. The working pressure is about 700 pounds to the square inch and the water is drawn off from the generator into three insulated storage tanks with a total capacity of 7,000 pounds, carried beneath the car. From the bottom of the tanks the water is delivered through three Tappet valves provided with screw and nut adjustment to regulate the amount of feed. In operation, under the decreasing pressure caused by the movement of the piston through its stroke, the water resolves into steam in a continuous series of flashes, the steam and the unevaporated portion of the water from the high-pressure cylinders passing out through the ports in its bottom and draining off through valves in the lower face of the valve chest. The exhaust steam from the high-pressure cylinder passes in the usual way to the low-pressure cylinder and is eventually exhausted into the atmosphere. A car equipped with two compound engines and three tanks charged with water at a pressure of 700 pounds to the square inch and a corresponding temperature of 500° is capable of running 40 miles at a speed of from 30 to 40 miles an hour.

Bibliography.— Church, I. P., 'Hydraulic Motors' (New York 1911); Gibson, A. H.,

Hydraulics and Its Applications (New York 1915); Innes, C. H., *Centrifugal Pumps, Turbines and Water Motors* (Manchester, England, 1904).

WATER PLANTAIN, an aquatic or marsh herb of the genus *Alisma,* family Alismaceae, of which *Sagittaria* is also a member. The plant most commonly known as water plantain is that found also in Europe and Asia (*Alisma plantago aquatica*), which grows in mud or shallow water. It has a circle of radical long-petioled leaves, ribbed ovate and strongly resembling those of the common plantain. The scape, which is usually solitary, branches verticillately, and forms a large, open pyramidal, flowing panicle; the blossoms are very small, white or rose-colored and have their parts in threes.

WATER POLO, a game played by opposing teams of swimmers in both indoor and outdoor pools. Invented in England in the 1870's, it became popular in other countries a decade or more later. In the early 1900's "American Water Polo," a soft-ball variety, was popular; but it was soon superseded by the faster, more scientific European hard-ball game, played in Olympic contests.

WATER POWER. Water power is one of the important sources of energy required for operation of the ever increasing machines and equipment of modern civilization. The most extensively used sources of energy are the fuels produced through the action of sunlight millions of years ago. These fuels, coal, oil, and natural gas, are practically irreplaceable and on the basis of estimates the latter fuels will be exhausted in about 300 years with the coal supply limited to less than 3,000 years. Other sources of energy will become increasingly important with time. Such power sources include atomic, solar, tidal, wind, and water. At the present time, water power is extensively used on a large-scale commercial basis, atomic power gives great promise but much development work remains to be done before it can compete successfully as a power source, and the others have been demonstrated to work but they are not of practical importance in the industrial sense. Solar energy is important as combined with plants and soils it is capable of supplying energy in the forms of food, wood, and alcohols. In this sense it is a perpetual source of energy similar to water, but when considering the total amount of power required, the output from this source for industrial purposes is much less important. In the United States, about one third of the power produced by the public utility power plants is from water, the remaining two thirds being from fuels. In the state of California, where high mountains and reasonable rainfall exist, water power accounts for about two thirds of the total power used. The ratio of water to fuel power varies widely from country to country depending upon the availability of hydrocarbon fuels and water power sources.

In a water power system, water in one form or another is the working substance. Evaporation takes place from water surfaces exposed to sunlight and winds. Since a majority of the earth's surface is covered with water, the magnitude of the quantity evaporated is enormous. The evaporation process removes water from the source and adds to the water vapor content in the air over the source. By this process the relative humidity of the air is increased. At the same time, industrial applications of the loss in water from the source serves as the process for producing salt from sea water, dehydrating fruits, etc. Under average conditions prevailing in the United States, more than 0.1 inches of water are evaporated each day from the water surface of a fresh water lake. Due to density currents, the air and water vapor at a low elevation will be moved, both horizontally and vertically to a new location on the earth's surface. Under appropriate conditions, instability may occur and the water vapor become separated from the air in the form of rain, snow, or ice. Water in these forms is heavier than the surrounding air, thus under the action of gravity, the rain, snow, or ice falls to the earth. When these phenomena take place in the high mountains, water collects on the earth's surface at a high elevation. Under natural processes this water will flow to the ocean through a network of rivers, using up its potential energy in soil erosion and the production of heat through turbulence and viscous action. Through construction of proper works and machines, a portion of this wasted potential energy may be made available for the use of man. In any event, the water flows to an area where it is evaporated and the process repeated. If all rain and snow falling on the surface of the earth were made to pass through suitable machines for converting all of the potential energy of the water above sea level to mechanical work, it has been estimated that this would provide enough power to maintain our present energy requirements indefinitely. Such a system is impractical. On the basis of present economics, about a tenfold increase in water power throughout the world appears to be the optimun to be expected, the greatest contributions coming from the countries that are not at present highly industrialized.

A complete water power plant consists of many elements. The prime mover for converting the energy in the water to mechanical energy is the key piece of equipment. This may be a water wheel or hydraulic turbine (see TURBINE —*Hydraulic*). In the case of a large hydroelectric plant, the prime mover shaft is connected (usually directly) to the shaft of an electric generator, the electrical output passing through transformers and high voltage transmission lines to the location for application of electrical energy. In some cases, particularly smaller plants, the shaft of the prime mover is connected directly to mechanical equipment requiring the energy for operation. Normally, the prime mover must operate at constant speed of rotation under variable hydraulic head and output load. Auxiliary control equipment such as speed governors, wicket gates, and control valves, are essential parts of the prime mover. Since river flow is variable as well as the load demands on the water power plant, some type of water storage system becomes necessary for dependable and efficient plant operation. This involves storage reservoirs usually formed by some type of dam with flumes or penstocks to convey the water to the prime mover and associated installations as trash racks, ice protection equipment, surge chambers, and draft tubes.

The first hydroelectric central station in the United States was installed at Appleton, Wis., in 1882. The use of hydroelectric power for lighting advanced rapidly during the 80's, this advance following quickly the invention of the

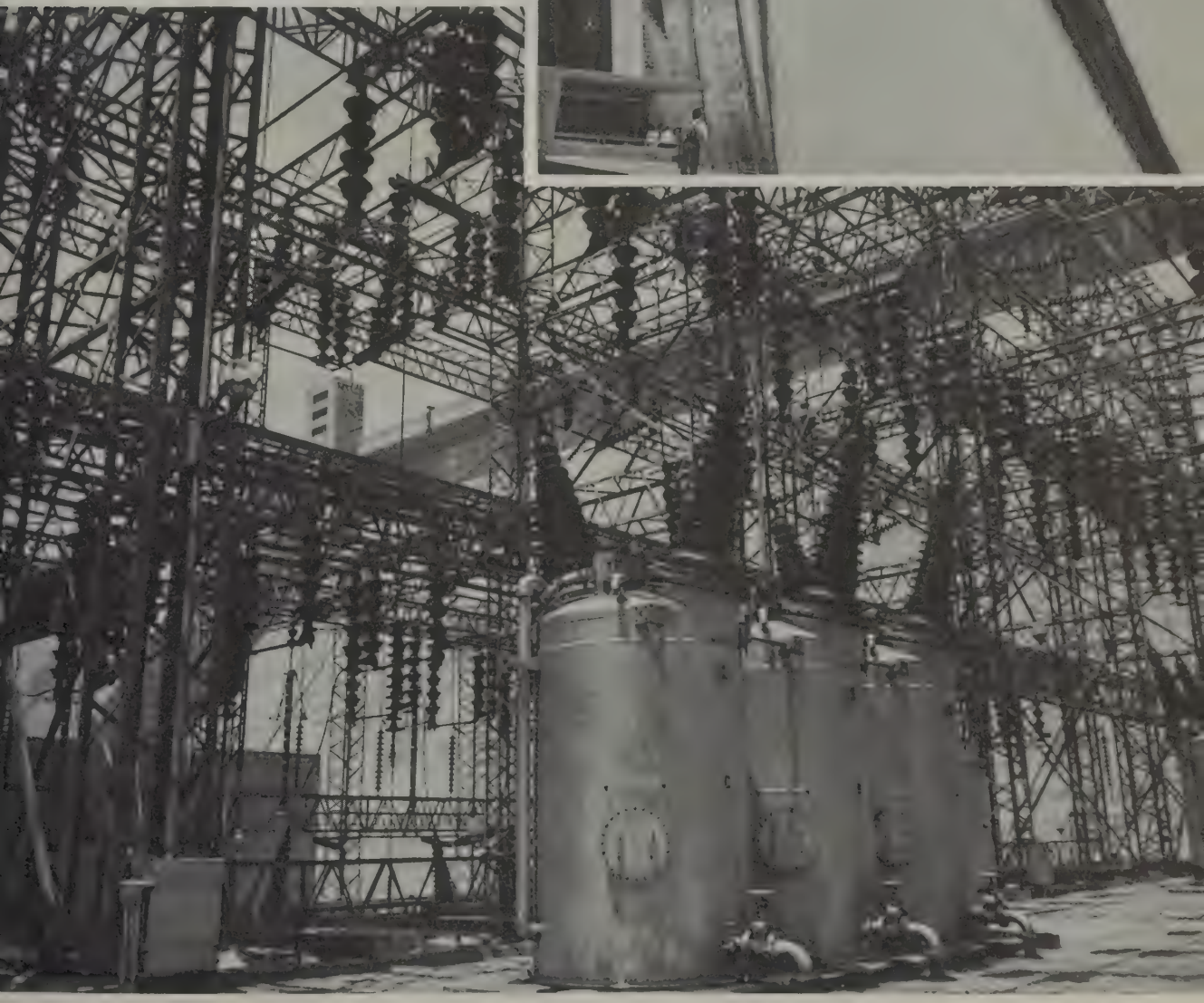
Above: Water wheels had obvious advantages over muscle power but wasted much of the energy of moving water.

WATER POWER

Right: Modern hydroelectric plants can efficiently convert the vast energy of water falling hundreds of feet. Here water pours from floodgates at Shasta Dam, California.

Below: Transformers and connecting lines dramatize the complexity of a modern hydroelectric station.

(Above) Sawders from Cushing; (right) Acme Photo; (below) Post Dispatch from Black Star



Above: The Stuart River hydroelectric plant, near Glen Falls, N. Y., generates power from a relatively low head of water. This station does not need a high dam.

Left: Power units shine in the sunlight at Wheeler Dam, an installation of the Tennessee Valley Authority.

Below: Rows of transformers as seen from the top of Fontana Dam, on the Little Tennessee River in the Great Smokies National Park.

(Above) Herbert Lanks from Black Star; (left) Philip Gendreau; (below) Renfroe from Black Star

incandescent lamp by Thomas A. Edison in 1879. While there were some previous experiments carried out, the first large-scale successful long distance power transmission was that from Lauffen to Frankfort, completed in 1891, by which 110 horsepower was transmitted a distance of 112 miles at 12,000 volts. This provided the initial stimulus for extensive hydroelectric power development. Prior to that date, water power was not much used for the generation of electric current unless the water power happened to be located very near the site where the current was to be used.

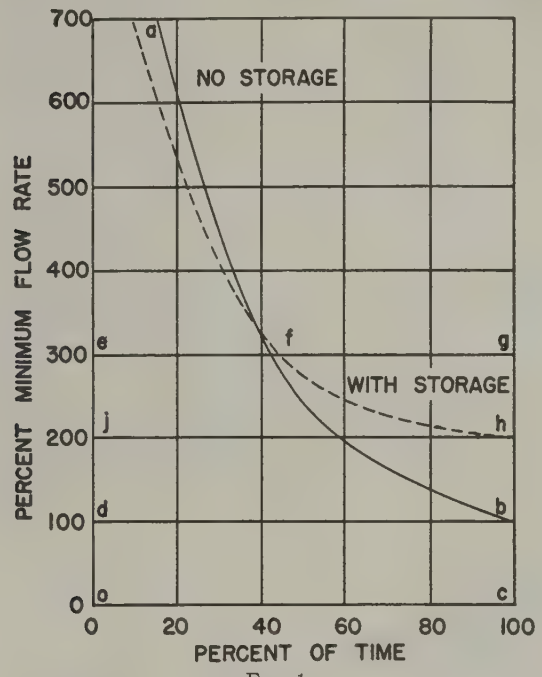


FIG. 1.

The growth of hydroelectric power development has taken place mainly along natural economic lines. The general water powers near large industrial centers were developed first, and of these, those involving the lowest primary investment have been given preference; furthermore, the first water power developed in a locality has generally been that having the size suited to the demands of the immediate future. Thus it happens that some of the very largest water powers, as well as numerous smaller ones, have thus far remained undeveloped. The necessity of developing powers of a size suited to the existing market conditions at the time of development is emphasized by the fact that many of the larger hydroelectric developments in the eastern United States passed through bankruptcy, but are now operating successfully. The cause of the financial difficulties was in general that it took too much time to build up an adequate market for the output of a power larger than the immediate demand, and during this time the revenue was insufficient to meet interest payments and other fixed charges on the large investment.

When the water power plant is small, its operation does not interfere appreciably with other water users due to the small water drainage area involved and the corresponding small changes in river hydraulic characteristics at any given location. With the advent of efficient electrical machinery and electrical transmission lines near the turn of the century, the size of individual water power plants increased rapidly. This growth introduced three problems, the amount of firm (primary) or continuous power that could be developed at a given installation, how to operate the plant to develop and use the maximum surplus (secondary) power, and what considerations must be made for other water users. It is seldom that a large water power plant installation is a single purpose project, generally the rights of one or more other water users are involved, that is for irrigation, flood control, navigation, water supply, recreation or wild life. Utility companies, both private and public, have solved the firm and surplus power problems by interconnected electrical distribution systems with proper proportion of installed capacity of hydroelectric plants and fuel-electric (coal, gas, and oil fired steam plants). For an isolated plant, a storage reservoir may be used to accumulate surplus water during periods of small plant output in order to provide an adequate water supply when required to meet peak loads. In some of the more modern water power plant systems, the financial requirements and the legal complexities have been such that large power development programs have been constructed and operated by the federal government. A few examples are the Tennessee Valley Authority, Hoover Dam and powerhouse on the Colorado river, Grand Coulee Dam and powerhouse, and California Central Valley project. The complexities of the Colorado River power and water usage problems are indicated by the number of states, municipalities, industrial companies, irrigation districts and even a foreign country that have important interests. Large European water power developments face similar complications due to the relatively small area included in each country.

The application of the principle of the conservation of energy demonstrates that mechanical work may be accomplished by water when the pressure, elevation of the free surface, or a change in the average velocity takes place in a suitable flow system. Several devices in common use involve one or more of these energy changes in their operation. W pounds of a liquid possess potential energy in the amount $W \times h$ foot-pounds when the center of gravity is at an elevation h feet above the reference plan from which potential energy is measured. When the water is allowed to pass through a conduit of proper proportions in flowing from a high to a low elevation, the potential energy is changed to kinetic energy and friction losses. Mechanical work may be obtained when the water flows through a suitable water motor or turbine, the magnitude of work being a maximum when the water is discharged at the lower elevation with a minimum of pressure and velocity. Neglecting all losses, the theoretical power available from a steady stream of water going from a large pool with surface elevation h feet above a similar large pool at a lower elevation may be determined from the relationship:

$$\frac{62.4 \times Q \times h}{550} = \text{horsepower (theoretical)}$$

when Q is the rate of flow in cubic feet per second. The overall efficiency of a water power plant is the power output (mechanical or electrical) divided by the theoretical power available from the water, the result generally being expressed as a per cent. Maximum overall plant efficiencies (electrical energy output to available

theoretical hydraulic energy input) of greater than 80 per cent are achieved in modern large installations.

When the load on a hydraulic turbine changes, the water flow control valve setting must be altered correspondingly or the turbine rotative speed will change. Since load changes may occur very rapidly, for example a short circuit in the transmission will trip the generator overload protection device and the whole load on the hydraulic turbine generator unit may be removed in a matter of microseconds, it may be desirable to operate the control valve rapidly. If the penstock is of appreciable length, the valve cannot be closed in a time less than about $10 \frac{L}{C}$ (L = length of penstock, feet; C = velocity of sound in water in the penstock, feet per second) without producing pressure surges. In the event the closure time is less than $2 \frac{L}{C}$, the full water hammer pressure surge is developed with a magnitude of rise about equal to 60 ΔV pounds per square inch where ΔV is the change in average velocity in feet per second in the penstock produced by the valve action. Surge chambers are installed to protect the penstock from failure. Since the water hammer waves may be reflected as negative pressure waves, pressures corresponding to vapor pressure of cold water may occur and it becomes necessary to include protection for the penstock against collapse due to internal high vacuum conditions.

made of partial rainfall records, crop records, thickness of tree rings, and similar indirect methods to estimate water flow magnitudes. Records from adjacent drainage areas are sometimes used as a basis for water flow estimates but due to geographical and meteorological phenomena, the comparison is seldom valid without large and frequently not well known correction factors. Water flow rates vary greatly throughout the year as well as from year to year. In addition to the normal variable of precipitation and snow fall, the runoff is influenced by evaporation and transpiration losses as well as ground storage and percolation. Management of a drainage area includes control of such factors as soil erosion, crops, ground cover, and storage as well as measurements of precipitation, snowfall, and runoff. A knowledge and application of modern meteorology is becoming more important. The results of these studies are expected magnitudes of minimum, maximum, and average daily flows and expected frequency of each. The minimum flow is used as the basis to determine available primary power, the maximum flow indicates flood conditions, and the daily average provides information fundamental to the design of a storage reservoir and to estimate the amount of secondary power available. These data may be presented in several ways but the most useful are the hydrograph and flow-duration curves. The hydrograph is a time history of flow rates plotted with discharge rates as ordinates and the time of occurrence in sequence as abscissas. The flow-

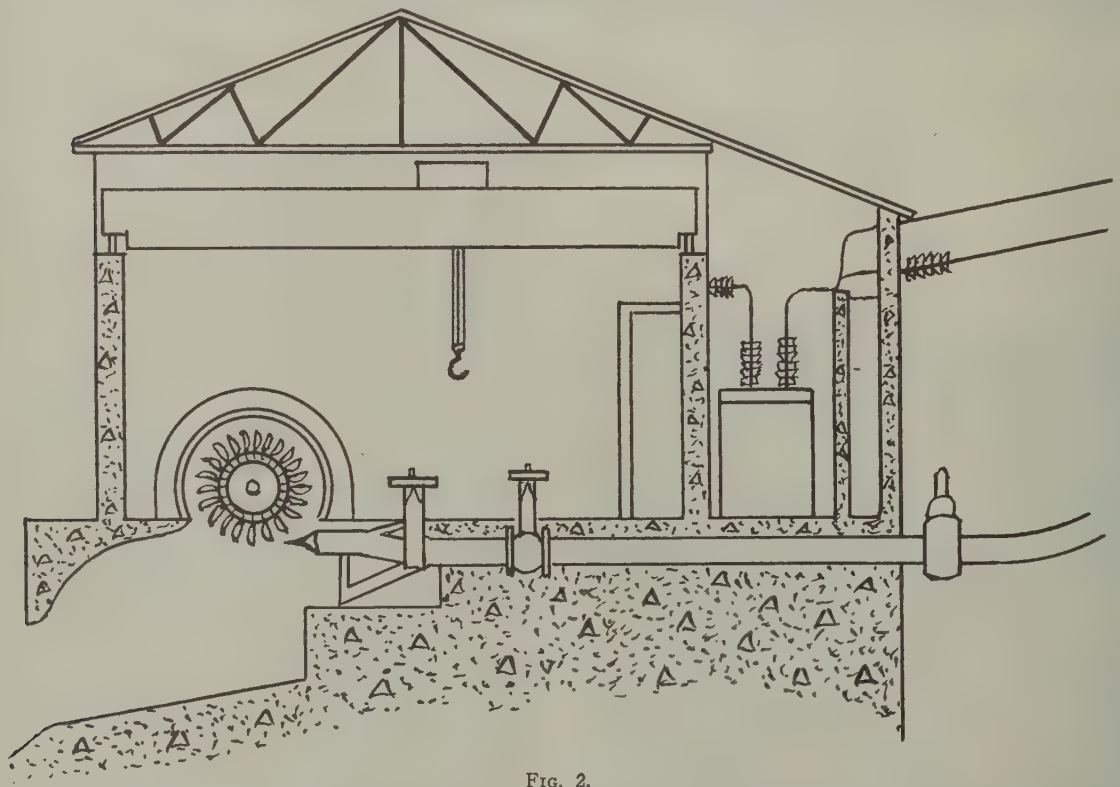


Fig. 2.

For the determination of locations for water power plants and the selection of proper size of equipment, studies are made of the available records of water flow at the proposed sites over long periods of time. Unfortunately, in all cases records of length sufficient to produce statistically significant data are not available and recourse must be had to secondary methods. Use has been

duration curves are plotted with (daily, weekly, or monthly) flow rates or any proportional factor like power (when the head available is fixed) as ordinates versus the percentage of time for a year during which the flow rate equals or exceeds the given quantity. Fig. 1 presents a dimensionless flow duration curve where the ordinates are expressed as a per cent of the minimum flow

rate which in turn establishes the amount of firm power to be expected from the unregulated flow. The area oabc on this curve represents the total amount of power available during a year. The area odbc is proportional to the annual primary or firm power. For a proposed water power plant having in installed capacity three times (300 per cent) the firm power capacity, the area defb is proportional to the annual secondary or surplus power. The power of area eaf is wasted. By construction of a storage reservoir it is possible to store some water during flood periods and release it during periods of low flow, thus increasing the primary power to the area ojhc and changing the flow duration curve at the power site to the curve in the figure marked "with storage." The economics of proposed installations can be investigated with the aid of this curve to ascertain the significance of changes in selected power capacity and reservoir capacity.

Water storage or pondage is used with water power plants in order to generate a larger portion of the available energy than would otherwise be possible. Storage volume is usually obtained through the construction of a dam in a suitable location. The dam may serve the dual purpose of creating storage and increasing the elevation of the water at the power plant and thus the energy that can be generated. Several types of materials for dams are in common usage. (Masonry or concrete, earth fill with and without cores, rock fill, wooden, and combinations.) High dams are concrete and examples constructed for reservoir and power purposes are the Hoover Dam, 726 feet in height and the Shasta Dam, 602 feet in height. Dams are of the gravity, arch and multiple arch types. The type of dam, materials for construction, and location will depend upon the foundation, earth or rock which is determined by a suitable number of cores taken from appropriate borings in the proposed foundation area, the topography and geology of the dam site, the availability of construction materials, the methods to handle the water flow during construction, methods to by-pass flood waters, and the height of the dam. The establishment of a reservoir involves factors other than design and constructional, in that land, real estate, water rights, railroad and highway rights of way and similar items must be considered. In some cases, whole towns have been moved to allow construction to proceed. Usually the area to be covered to the high water elevation is cleared of all brush, trees, etc. in order to eliminate debris that would interfere with flow into penstocks and spillways. Dams are designed to be safe against overturning, sliding, and excessive stresses. The action of surface water waves and ice frequently becomes an important problem. Head gates of different types are used to control the outlet of the normal flow and flood flows from the reservoir. Trash racks are installed upstream from such gates. An unobstructed spillway is most satisfactory for passing flood flows but often other requirements make it desirable to install various gates (Tainter gates, flashboard, etc.) with the spillway in order to control water level elevations. Special purpose structures as siphon spillways sometimes find applications. When the dam is constructed on a natural waterway, it may be necessary to provide fishways. On the west coast the salmon industry is important and dams constructed on the Columbia River include adequate fishways; Bonneville Dam has fish ladders and fish elevators.

In many water power plants the powerhouse is located at some distance from the dam and storage reservoir. This arrangement has the advantage of using additional head over that which would be available at the dam sight but is subject to the disadvantage of the requirement of a waterway to conduct water from the dam outlet to the turbines at the powerhouse. Particularly in precipitous terrain, additional power can be generated by locating the power plant downstream from the dam or even in a different watershed. The waterway is designed for low head loss and may be an open channel or canal, a closed conduit, or combinations. Canals are constructed along surface contours and are usually lined to prevent bank erosion and provide a minimum loss of head for a given cross-sectional area. Flumes or open channels carried on supports are economical for making short length crossings of valleys or ravines. Flumes are constructed from wood, metal, or concrete. Tunnels become practical when carrying water from one watershed to another, or in mountainous country where canals involve construction in rocks and are subject to ice, snow, and landslide hazards. Penstocks are pipes conveying water from the waterway to the turbines. For low pressures penstocks may be constructed from wood or reinforced concrete but the most common installations are riveted or welded steel pipe. Transition sections are necessary when the cross-sectional shape of the waterway changes. These sections require careful design to prevent undesirable flow conditions and excessive loss in head. The waterway includes protective devices as surge tanks, air valves, and air vents. Air vents are installed at the upstream end of a penstock to allow air to enter and prevent collapse of the pipe when the head gates are shut and water is drained from the penstock by opening the valve at the bottom.

When producing electrical energy for commercial use, the speed of rotation of the hydraulic turbine driving the generator must be controlled automatically within small limits to produce electric current of a constant voltage and frequency. The gates regulating the supply of water to the turbine are adjusted each time the generator load changes in order to maintain a constant rotational speed. The weight of these gates and connected parts provide a large inertia load to be overcome rapidly by the turbine governor. The principle of operation of the hydraulic turbine governor is similar to that used by other speed governors, the principal difference being in the use of a powerful servomotor or controlled auxiliary device to exert the very large forces required. The position of a pilot valve (a small valve controlling oil flow for operating a secondary valve), requiring a minimum of force to move, is determined by the difference in actual turbine speed and a constant reference standard. The secondary valves control the oil under pressure to operate the hydraulic piston actuating the turbine gates. The instantaneous relationship between the pilot valve position and the turbine gates is a function of the number and modes of control built into the governor. The governor speed input may be through direct mechanical connection to the turbine shaft, belt connection, or electrical connection with self-synchronous motor and generator. Under certain conditions, the governor action will produce excessive pressures in the turbine case or penstock unless protective equipment as pressure regulators and surge tanks are included in the installation.

The pressure regulator is a governor operated device to keep the pressure in the system within desired limits through by-passing water from the turbine case or lower penstock. The surge tank, either simple or differential, is a reserve capacity used to store or supply water during periods of governor operation to maintain pressure in the penstock within prescribed magnitudes.

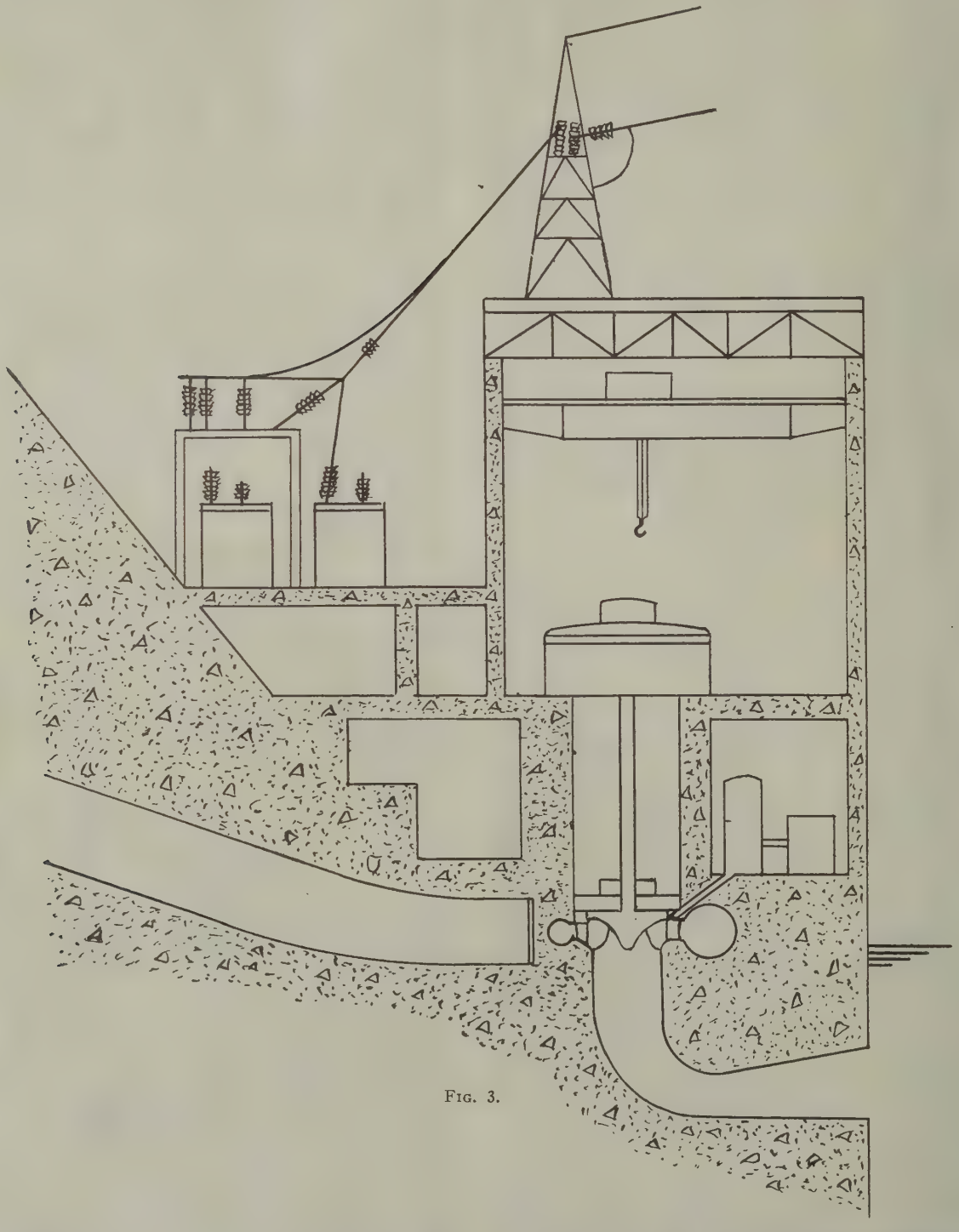


Fig. 3.

Water power plants with water wheels as the prime mover have been in existence for centuries. Such wheels make use of the velocity of the water flowing in a river (much the same as a windmill obtains energy due to the velocity of the wind) or an elevation drop in the water surface about equal to the diameter of the wheel. In both cases the power generated is limited severely and was found adequate only for small mechanical powers to be utilized on or very near the location of the water wheel. Examples include such installations as power for gristmills or power for operation of mechanical equipment in a manufacturing plant by transmission through gears or belting to separate locations desired. The hydraulic turbine is the prime mover for modern water power developments. Turbines were introduced and developed during the 19th century in Europe and America. Early European construction tended to conform to the results of analytical design

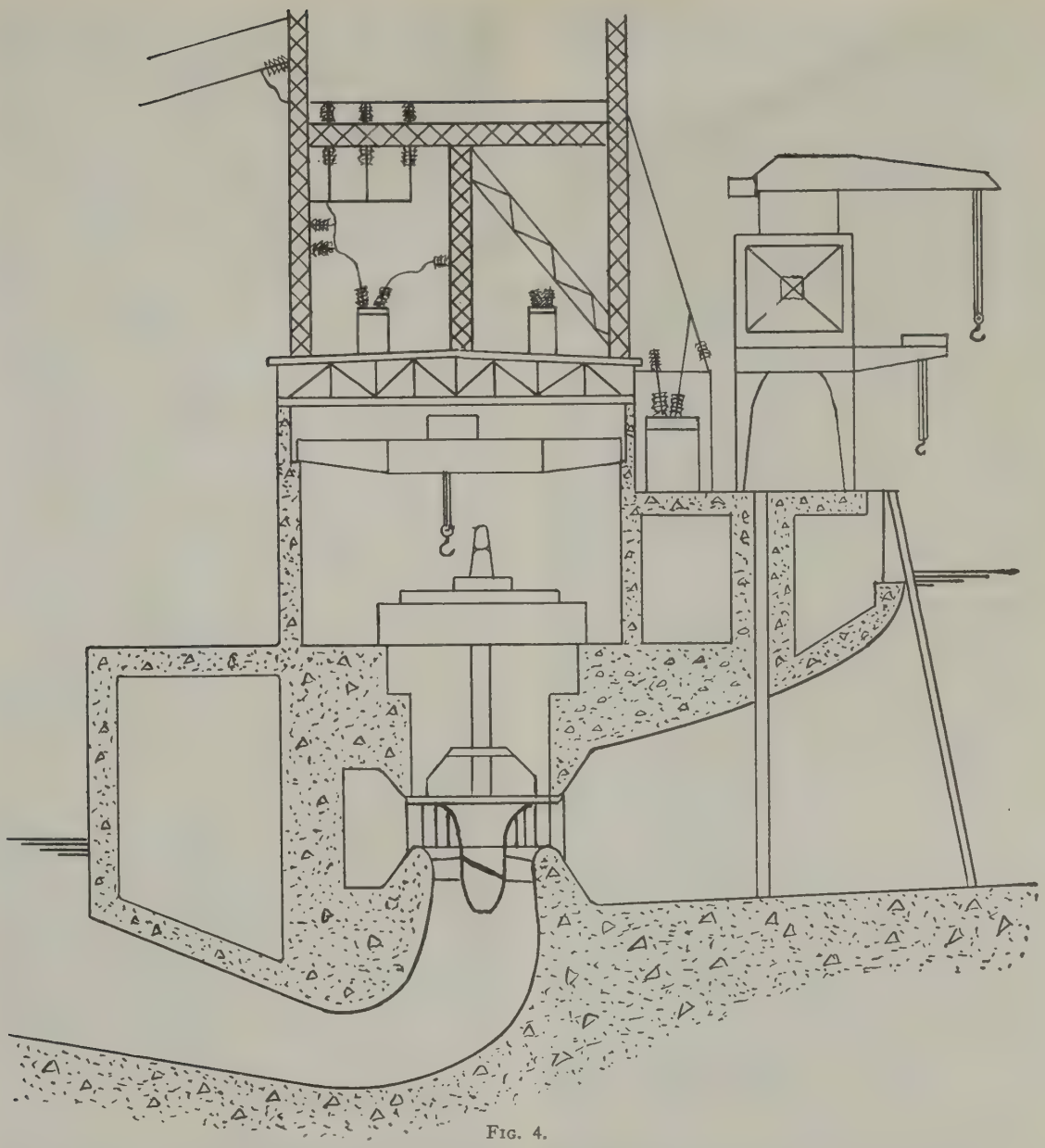


FIG. 4.

studies while American units were the result, to a large extent, of trial and error empirical methods. Since about 1900, all turbines of a given type illustrate striking similarities in design due to intelligent blending of experience from theoretical and experimental sources. By 1920, the Francis type of reaction turbines in large sizes had attained maximum efficiencies in the range of 92 to 94 per cent. By 1940, propeller type reaction and impulse turbines reached maximum efficiencies of 90 per cent and above. These high turbine efficiencies combined with large size and dependable operation with corresponding developments in electrical generators and electrical power distribution systems have made possible the rapid growth of hydroelectric plants during the last half century. Many types of turbines have been constructed but modern commercial units are limited to three types which are known by the name of the principal inventor as well as by the basic physical principle of their operation. The range of application of each type is expressed best in terms of the specific speed defined as the ratio of the product of the speed of shaft rotation (revolutions per minute) and the square root of the horsepower output to the hydraulic head (feet of water) raised to the five fourths power. The table presents the classifications:

Principal inventor	Physical principle	Range specific speed for maximum efficiency
Pelton	Impluse	3.5 to 5.5 *
Francis, James B. (1815–1892)	Reaction	15 to 100
Kaplan	Propeller (axial flow)	90 to 190

* Range for Pelton water wheel with a single nozzle.

All turbines are installed with either horizontal or vertical shafts but the majority of larger installations use horizontal shafts for Pelton wheels and vertical shafts for Francis and Kaplan turbines.

The powerhouse provides protection for the important mechanical and electrical equipment of a water power development. The turbo-generator unit is usually housed for protection against the

weather and to increase the ease of maintenance. In temperate climates, these units may be installed out-of-doors. Switching and transformer facilities are required to handle the electrical power between the generator and the high voltage transmission line. Many stations are constructed with transformer and high tension switching equipment outdoors. Automatic control equipment, operator's control panel, instruments, low tension switching equipment, maintenance shops, office, and storage for supplies are typical items included within the powerhouse. Space and hoisting equipment must be provided for installation, repair and maintenance of the hydraulic turbine and electrical generator units. Normally one or more operators are on duty at the powerhouse but some fully automatic hydroelectric plants only require a maintenance visit and check at infrequent intervals like a week or longer.

Figs. 2, 3 and 4 illustrate various typical hydroelectric station arrangements. Fig. 2 shows a single nozzle horizontal shaft impulse turbine. Units of this type are used for heads of 1,000 feet and greater and in sizes up to about 70,000 horsepower. Most installations use one or two nozzles per wheel but recent developments include efficient operation with four and six nozzles per wheel. The penstock terminates in a needle nozzle which is automatically adjusted by the governor to maintain constant rotative speed of the wheel. The nozzle guides the high velocity water into the buckets mounted on the wheel where the water is deflected in such a fashion that the forward component of velocity approaches zero. The water then falls from the housing and passes into the tail pit. In this illustration all important elements are inside of the powerhouse.

Fig. 3 shows a vertical shaft Francis turbine mounted in a semi-outdoor type of powerhouse located at the base of the dam. Water flows from the conduit through the dam into the spiral case, through the wicket gates, the runner, and the draft tube. The wicket gates are adjusted by governor action to maintain constant speed of rotation. These turbines have been constructed for use with heads between 3 and 1,000 feet, but modern designs are seldom used for heads of less than 50 feet. One of the larger American units is rated at 115,000 horsepower at 475 foot head and 180 revolutions per second.

Fig. 4 illustrates a low head installation with a vertical shaft propeller turbine. Water from the reservoir passes through the trash racks and intake gate into the spiral case and through the wicket gates, propeller, and draft tube into the tailrace. The semi-outdoor type of powerhouse includes crane facilities for cleaning the trash racks. Control of speed of rotation is obtained by governor action of the wicket gates and in some cases the angle of blade setting of the propeller is adjusted also. The units are designed for heads of a few feet up to about 75 feet. One of the larger American units is a 23.3 foot diameter propeller rated at 60,000 horsepower at 69 foot head.

At isolated localities on farms, in mines, lumber mills and similar installations, consideration is frequently given to the establishment of a small water power plant when a stream or large spring as a water supply is readily accessible. Usually competent engineering advice is not obtained as the total expenditure is small and lower first costs are of primary importance. The mechanical work or electrical power output of such a plant may be quite low and yet the user will be satisfied. With the assumption that the usable output is about fifty per cent of the theoretical power available in the water, it takes about 400 gallons per minute through an elevation drop of 20 feet to generate one horsepower. If the head drop is increased, the water required reduces in the inverse ratio and vice versa. To generate more power, the head, water rate, or the product of the two must be increased in the same ratio as the power. A limited number of companies produce small turbines on a standard model basis. The prospective user of small turbines will do well to investigate the application of standard centrifugal pumps in reverse flow and reverse rotation as a suitable prime mover. Suitable pumps will achieve efficiencies of 85 to 90 per cent operating as turbines. The most flexible type of pump for this service is the vertical deepwell turbine (in Europe this is known as a borehole pump) unit, since stages are added or subtracted easily. In large size units, pumped storage systems have made use of a single centrifugal machine as the pump and hydraulic turbine. During period of low power usage on a power system, the excess power is used to pump water from one reservoir to another at a higher elevation and when additional power is needed, the water returns to the lower reservoir by passing through a hydraulic turbine.

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WATER PURIFICATION. See Water Supply; Waterworks.

WATER RAIL, a species of rail (*Rallus aquaticus*) widely distributed over Europe, Asia and North Africa and generally common, but, on account of its retiring habits and shyness, not often seen. It is about 11 inches long, olive brown above streaked with black, the under parts gray and the sides streaked. It frequents marshes and bogs, dives and swims well, but is a poor flyer. It is a delicious tablebird. In North America its nearest representative is the king rail (*R. elegans*).

WATER RIGHTS. See Rivers; Riparian Rights.

WATER SCORPION. See Fresh-Water Insects.

WATER SNAKE, a harmless colubrine American snake (*Natrix fasciata*), closely allied to the garter snakes, but of aquatic habits, swimming and diving with great ease and skill and spending its life largely in streams, ponds and marshes. It lives largely upon fish, either alive or dead, frogs, tadpoles, newts and aquatic insects and other small creatures. It is mottled in variable dull tints and is lively and pugnacious. Its eggs are laid in holes in stream banks and similar places. The common grass snake of Europe, the only British serpent except the viper, is a near relative.

WATER SUPPLY (for Public and Industrial Consumption, Including Its Uses, Sources, Transmission, Treatment, Conservation and Distribution).—Introduction.—This article does not treat of aqueducts, dams, drainage, flood control, hydraulics, hydrology, irrigation, power de-

velopment, rainfall, pumps, transpiration, tunnels or sewerage; *see* articles with these titles for treatment of these aspects of control of water. This article deals with the methods and equipment required to collect, conserve, and deliver to consumers a potable, conditioned product, acceptable to both domestic and industrial users as to quantity, quality and pressures. Quality is important for most uses except street flushing, sewer flushing and fire fighting. John Ray, the 17th century English naturalist advises: "Foul water will quench fire." (*English Proverbs*).

When primitive man found that his land was unfit for producing water from wells, he joined his tribal brethren in a communal enterprise to put down a well, or convey surface water in channels, where all could get water. An early instance of a community well is recorded in the 26th chapter of Genesis; the herdsmen of Isaac struggled with the natives of the valley of Gerar, for the possession of wells in the valley, one of which is reputed dug by Abraham, but filled up by the Philistines. Some centuries later Hezekiah "made a pool, and a conduit and brought water into the city" of Jerusalem (II Kings: 20, 20). The woman of Samaria (John 4: 7) drew water from a public well donated centuries before by Jacob.

Pliny, the Younger, who had been connected with public works in Rome in the 1st century A.D. and who was a friend of Frontinus, the author of a treatise on the water supply of Rome, praised the early artisans: "If we only take into consideration the abundant supply of water to the public, for baths, ponds, canals, household purposes, gardens, places in the suburbs, and villas; and then reflect upon the distances that are traversed, the arches that have been constructed, the mountains that have been pierced, the valleys that have been filled up, we must of necessity admit that there is nothing to be found more worthy of our admiration throughout the whole universe." The conduits of the Romans were of the gravity type, perforce, as they antedated by centuries the invention of pumps, and of pipes that could withstand necessary pressures.

Similarly, of remote antiquity is the appreciation of the relation of the drinking-water supply to disease. In the 4th century before Christ, Hippocrates, termed the Father of Medicine, advocated the boiling and filtering of polluted water before drinking. Pliny, the Elder, in his Natural History (about 70 A.D.) discusses the characteristics of potable water. Water treatment may have originated in China, or India, thousands of years ago. From olden times, the Chinese were accustomed to putting alum in tubs of water to clarify it. The same thing was done in Egypt. Elisha is recorded in II Kings 2: 19-22 as treating a worthless water ("the water is naught") with salt so that it became usable "unto this day." This probably occurred in the reign of Jehosophat about 900 B.C.

The treatment of water to remove pathogenic organisms which are prevalent in many natural sources of water supply after pollution by man, had its beginning about 1892, after Dr. Robert Koch had traced the cholera epidemic in Hamburg, Germany, to its unfiltered raw water supply, by observing that Altona, on the opposite bank of the Elbe, which used the same river water, but filtered it, had no cholera. Previously, since 1855, London had been required by parliamentary statute, to filter its water supply through slow sand filters, but the efficacy of the process was clearly demonstrated by Dr. Koch. Filters were not introduced in America until about 1870 and were of the slow type; the first important modern rapid-sand filtration plant was built in 1902 at Little Falls, New Jersey, and is still used by the Passaic Valley Water Commission.

In 1912, liquid chlorine was developed for the disinfection of water supplies, and the subsequent development of modern equipment for its automatic application has made this procedure standard practice for combatting pathogenic bacteria, with less and less reliance being placed on other treatment processes.

Use and Consumption of Water.—This article deals only with water diverted into waterworks structures, and not with the use of water in its natural channels, where it is beneficial for fishing, shell-fish culture, bathing, boating, navigation, power development, irrigation, and disposal of sewage and wastes by dilution. The uses of water from waterworks are classified by Phelps and Velz [1] as (1) primary, which serve such strictly domestic purposes as drinking, preparation of foods and beverages, bathing, cleansing, and hose-sprinkling of lawns and kitchen gardens; and (2) secondary, which comprise industrial processes, commercial products, watercarriage of wastes in sewers, fire fighting, street sprinkling, swimming pools, and public fountains. Velz finds for a composite community (residential, commercial and industrial, in normal proportions) the reasonable requirements in gallons per capita of resident population per day, to be: residential, 40; commercial, 15; industrial, 30; public, 10; unaccounted for losses, 15; a total of 110. He estimates that the 40 for residential can be cut to a bare necessity of 20, by using 4 for drinking and culinary, 6 for laundry, 5 for bathing, and 5 for two toilet flushings per day. Caleb Mills Saville found in Hartford that a rate of 9 was possible in houses lacking plumbing, but he sets 25 as the minimum in a residential community: "Certainly a minimum of 25 gallons per capita is insufficient to maintain the standard of living desired in most American communities." *

Capen [2] derived from his studies the following relation of population to use:

For completely-metered low-waste systems, $G = 53\ P^{0.11}$

For well-metered average systems, $G = 54\ P^{0.125}$ where G is gallons per capita per day, and P is population in thousands.

Hopkins and Elder [3] conclude that in the larger American cities where industrial demands are heavy, rates (gallons per day per capita) vary from 90 to 300; while in smaller residential communities where industries are a minor factor, they vary from 40 to 140. They deduce from the 1945 inventory made by the Public Health Service of 15,370 water utilities in the United States that the average is 127, varying from 50 to 400; from this same inventory, Langbein brings out the increase of rate with the size of the community: [4]

Population	Gallons per day per capita
500	60
1,000	85
5,000	135
10,000	140
50,000	140
100,000	140

* For footnote references 1-18 consult list of footnotes at end of this article.

Unaccounted for water, which passes through the master meters at the source of supply, but not the meters of the consumers who pay the bills, constitutes 20 to 50 per cent of the master-meter reading. It comprises water lost in leakage in pipes and services, and water used for street sprinkling, snow removal, sewer flushing and fire fighting. Although water must be delivered at high rate of flow for fire fighting, and pumps, tanks and pipes must be proportioned for this high rate, the total quantity so used in a year is insignificant compared to the normal demands. Wegmann [5] lists the rates and quantities used at notable fires. Velz estimates the maximum daily demand over a period of years, as 150 to 200 per cent of the yearly average, and the hourly peak rate at 200 to 300 per cent, dependent on lawn sprinkling, shower baths and air conditioning. As to seasonal changes, he estimates summer at 120 to 140 per cent of the yearly average, and winter at 70 to 90 per cent. As to any one normal day, he estimates the minimum (early morning) use at 40 to 70 per cent of the day's average, and the forenoon maximum at 120 to 170 per cent.

Business depressions have a more pronounced effect on the industrial than on the total consumption. At Newark, New Jersey, in the year of prosperity, 1929, the total rate was 59.1 million gallons per day (mgd.), of which 16.1 was industrial. During the depression, in the year 1932, the total dropped off 14.7 per cent, to 50.4, while industrial demand dropped off 37.5 per cent, to 9.9.

Of recent years, the water requirements of the rapidly growing air conditioning installations have become so heavy that many municipalities passed strict ordinances governing this special use of water and most of them require the recirculation of such water. For instance, a 10-horsepower compressor requires about 1,000 gallons per 8-hour day. Waterworks officials at Quincy, Ill., estimate peak loads have been raised 15 per cent, while at Phoenix, Ariz., the estimate is 100. For a brief discussion of air conditioning physics, see Henderson.[6] In 1950, a committee of the American Water Works Association found that water-cooled refrigeration "involves the use of water in quantities never before anticipated, thereby placing unexpected burdens on the public water supply system which are detrimental to other classes of water services," and calls for regulatory ordinances. On Long Island, by state law, all cooling water has to be returned to the ground through special diffusion wells sunk by the applicant. In New York City all air conditioning using water at a rate of 5 gallons per minute or greater, must be equipped with a water-conserving unit, such as a recirculating device, or a cooling tower. In Philadelphia, Pa., economizers are required where the rate exceeds 10 cubic feet per minute (75 gallons). Among other communities regulating the use of public water for air conditioning, are Champaign and Urbana, Ill., Rochester, N Y., Richmond. Va., Kenosha, Wis., Reno, Nev., and Washington, D.C.

The effect of pressure on consumption is direct; high pressures induce leakage, and freer domestic use. When the pressure at Oak Park, Illinois, was reduced from 45 to 25 pounds, the consumption rate fell from 65 to 45 gallons per capita per day.[7]

Undue use of water proves a serious consideration when it requires the municipality to seek additional sources, or install larger pumps and pipes. It can be curbed by public appeal and ordinances prohibiting the use of water for lawn-sprinkling and other purposes, in the emergency, by waste surveys, and by the installation of meters. When the New York City reservoirs dropped to an unprecedented low in December 1949, reform measures were instituted; prohibitions issued by the Department of Water Supply, Gas and Electricity, banned automobile washing, operating hoses, constant-flow showers, constant or periodic-flow flushometers, swimming pools, sprinklers, ice-skating rinks, etc. "Dry Thursdays" were observed (no bath, no shave) and the shortage kept daily in the public eye by newspaper, radio, and television, whose response was so effective that consumption was cut from 1,232 million gallons per day in December 1949 to 966 million gallons per day. On Sept. 14, 1950, when fortuitous rainfall had replenished the reservoirs, the bans were lifted. Surveys for waste abatement are routine procedure in large cities; a separate division was set up in the Bureau of Water in New York City. Water may escape in the street or on the owner's premises from defective joints, broken or cracked pipes; water may be wasted by defective plumbing fixtures; and by individuals who open faucets in cold weather to prevent freezing of pipes. Waste surveys in Detroit reported by Hardenbergh [8] indicated a loss of 3,000 gallons per day per mile, or 5 per cent of the pumped supply; in Chicago, 13½ per cent loss was reported, and in Philadelphia, before remedial measures were undertaken, it was 13 per cent. Hardenbergh estimates it impracticable to reduce leakage much below 1,500 gallons per day per mile, and it may reasonably be 3,000 on large pipes; he recommends that design of systems contain an allowance of 3 to 10 gallons per day per capita for uncontrollable waste.

The installation of house meters on an extensive scale confronts owners with their personal responsibility for the quantity of water used and soon produces a marked reduction in the consumption. But as the novelty of responsibility wears off, the rate of consumption starts to rise, although less rapidly than prior to installation. When the owners begin to check up on leaky fixtures, and unnecessary use of water, the rate drops for a year or two. Many large cities, such as New York, require meters only of industries, commercial establishments, and large apartment houses; the opponents of meters—and there are not a few—emphasize both the cost, and the nuisance, to the householder of meter reading and replacement, and the expense of installation. There is, too, considerable loss of pressure through the meter. On the other hand, a universally-metered system such as that in Boston provides for costs allocated according to benefits, the smaller user paying directly proportionally less, beyond the minimum termed the flat-rate, which is based on the size of the service; for instance, the Hackensack Water Company charges $2.25 per quarter for a ¾-inch meter.

Sources and Collection.—Hydrological conditions as to rainfall, run-off and percolation must be understood in developing and collecting a water supply Rainfall infiltrates into the soil, runs off over the surface, or is transpired by vegetation; evaporation follows; then condensation into cloud formation, and return to earth as rain or snow; this is known as the *hydrologic*

cycle. Although precipitation (see article on RAINFALL) is the source of all water supply, only a small part is divertible by man to his uses, since less than half of it appears promptly as stream flow, the remainder undergoing either percolation into the porous substrata, transpiration from vegetation, or evaporation from land and water surfaces. Sky water which undergoes evaporation and transpiration is not available in the immediate phase of the hydrologic cycle for man's use. On Long Island, where there are no surface streams of fresh water of any appreciable size, all water supplies are derived from the ground-water, rain-water which has percolated into the porous substrata. It has been found by the water works officials on the island that the safe yield of the aquifers is about one half the rainfall, the rest running off to sea over or through the ground, or lost through evaporation and transpiration.

Underground waters are found more feasible in small communities, while large cities, with a few exceptions, either go great distances for upland surface supplies, or utilize the large lakes or rivers on whose shores they were founded. Langbein, hydraulic engineer of the United States Geological Survey, deduces from the 1945 inventory of *Water Facilities in the United States,* by United States Public Health Service, that 70 per cent of the population were served by 15,400 public or private water supply systems. Ground waters were the source of 76 per cent of the systems, while 24 per cent used surface waters.[9]

But the ground water systems accounted for only 26 per cent of the water used, while the surface-water sources took 74 per cent. This is explainable by the fact that ground water resources lie near at hand and are cheap to install, while surface supplies can only be afforded by the largest cities, as they entail expensive reservoirs and aqueducts, or large offshore intakes, and expensive tunnels to the pumping station.

The method of development of sources to produce a dependable yield varies with the type of source: (a) in the case of liquid streams, it involves a large impounding reservoir to develop the safe yield of the stream, intake works (commonly termed "headworks"), and a transmission conduit between the reservoir and the community; (b) for surface supplies taken from lakes and rivers, of such large size that storage for dry periods is not required, it involves intake works, a subaqueous conduit, a pumping station, and a force main to the distribution system, and perhaps distribution reservoirs and booster pumps on the distribution system; (c) in the case of ground water, it involves wells, infiltration galleries of springs, distribution reservoirs to prevent overpumping the source, and pumps either in the wells, or on the surface.

Surface waters and ground waters can only be made available by constructing waterworks. If the sources of supply are large rivers, as in the case of St. Louis, Philadelphia, and Kansas City, or from the Great Lakes, as at Buffalo, Cleveland, and Chicago, intake structures are designed only to obtain water of the best quality, and no thought need be taken of lack of water in dry years. But where the supply is dependent on large reservoirs on upland streams of variable flow, as at Boston, New York and San Francisco, consideration must be given to the amount of runoff which can be caught in the reservoirs and held for use during a series of dry years. Impounding reservoirs must be built on streams in the highlands to store water during freshet flows, for use when the natural flow of the streams is insufficient to meet the demand. Impounding reservoirs are formed by throwing a dam across a narrow valley and just downstream from a region where the valley has a wide floor, to afford large storage for minimum cost of dam.

The capacity to be developed in a proposed impounding reservoir will require statistical, economic, hydraulic and hydrological studies. Statistics will reveal the past records on which future rates of demand must be predicated. Economic studies will entail the correlative costs of dams of various heights as compared to the storage capacity secured and the real estate to be acquired to safeguard property just outside the flow-line from pollution, and the clearing and possible grubbing of the site. Hydraulic studies will fix the flow-line of the depleted reservoir high enough so that the distribution system can be largely fed by gravity, and the transmission conduit between source and municipality will be the smallest possible. Hydrological investigations, on this and comparable watersheds, will provide bases for estimating the stream flows in dry seasons, and the consequent drafts from the reservoir; also for estimating flood flows, for which the spillway must be proportioned; this class of investigations is most susceptible to errors in judgment, since reservoirs are generally projected on small unimportant streams where real estate is cheap, and on such streams, no direct records are available. Hazen's[10] method of utilizing data from comparable streams affords the quickest approximate method of fitting the reservoir capacity to the expected flow. The function of the hydrological studies is primarily to arrive at an estimate of the safe yield of a project. Safe yield is defined as "the maximum dependable draft which can be made continuously upon a source of water (surface or underground) during a period of years during which the probable driest period or period of greatest deficiency in water supply is likely to occur."

Not all storage behind an immense dam is available for use; the lowest outlet port in the headworks leading to the transmission conduit is located several feet above the bottom of the reservoir, to avoid discharging silt into the conduit. Allowances must be made, particularly in the West, for the gradual siltation of the reservoir, which may, over a term of years, reduce its available capacity; for instance the designers of Elephant Butte reservoir in 1916 estimated that it will silt up in about 233 years. Evaporation must be considered in reckoning on the available storage, since the evaporation from water surfaces in a year in the vicinity of New York, is about equal to the rainfall; if there were no rainfall, the water surface would drop 4 feet in a year due to evaporation alone. The City of New York operates its series of Croton and Catskill reservoirs on the basis of always leaving 25 per cent in storage for emergency use in a year drier than any yet experienced; in the unprecedented crisis of 1949–1950, the city managed never to draw the reservoirs down to the 25 per cent margin; 37 per cent was the lowest point reached Dec. 1, 1949.

Intakes on impounding reservoirs may be located in the dam as at Ashokan reservoir, in which case they are termed "headworks," or at another point on the reservoirs, as at Schoharie

reservoir, both on the Catskill system, New York City. Since the quality of water at various depths in such large bodies of water varies from month to month, and the water level may vary with the dryness and demand, effluent ports must be provided at several levels. Valves must also be provided to let compensation water pass downstream to satisfy the dry weather flow of lower riparian owners, and for emptying the reservoir to a desired minimum. Generally, it is inexpedient to locate valves at the extreme bottom of the reservoir, as they would soon be buried in the silt. Screens and stop logs are necessary (see section *Intake Works* below).

The development of supplies from large bodies of water requires investigation as to the least polluted areas for locating the intake, and studies of offshore winds which would carry pollution to the intake; in the case of rivers, hydrological investigations are necessary to assure that the dry-weather flow will satisfy in future years, both the proposed water-taker, and riparian owners downstream.

The development of ground waters requires a series of test wells, and test pumping, to reveal the best site, how closely wells may be spaced, and the levels of the aquifers. The Jamaica Water Supply Company on Long Island has wells spaced as closely as 50 feet but drawing from three different aquifers, at depths of 100, 250 and 600 feet.

Intake Works.—Intake works are essential on reservoirs, lakes or large rivers to divert the required quantity of water into the transmission conduits or suction wells of the waterworks system. They are generally equipped with inlet and outlet gates, or stop-logs as an alternate; coarse screens to exclude cumbersome floating objects which would damage the conduit and pumps; and in cold climates heating devices for the screens to prevent ice from plugging the waterways. It is important to install the intake in deep water, with valved inlet ports at varying levels, so that valves can be operated to select the level at which the water is of best quality. Intakes of the tower type are used at Chicago, where there are five, and at Cincinnati. (See *Engineering News Record,* May 22, 1930, p. 834.) The latter extends to sufficient height to allow for a 70-foot variation in the stage of the Ohio River. Tower intakes require night lighting to warn marine and aerial navigation.

Submerged intake cribs of the type used at Gary, Indiana, contain no valves or screens, such operating devices being placed at the shore end of the intake conduit. Intakes of this kind should not project above the bed of the lake far enough to endanger navigation. Cleveland has a new submerged steel intake with its top 41 feet below low-water level (*Engineering News Record,* Aug. 5, 1948, p. 76).

In both types of intakes, it is advisable to build the entrance ports large enough so that the entering velocity is less than 1 foot per second, to minimize the quantity of sediment, fish and anchor ice carried into the intake.

The intake conduit from the deep-water intake to the shore may be a tunnel as at Chicago and Cleveland, a 10-foot diameter reinforced-concrete pipe as in the new Cleveland intake, steel pipe as at Rochester, or cast-iron pipe as at Cedar Rapids.

Works for the collection of underground waters may be springs, infiltration galleries or wells of several types: large open, driven, drilled, and gravel-packed. For years, Roanoke, Va., got most of its water from a spring in rock formations; Havana, Cuba, gets most of its supply from the Vento Spring in limestone formation; New York City operates the infiltration gallery at Wantagh, Long Island, over 5 miles long and yielding 30 mgd. Wells in consolidated formations constitute the most common method of utilizing shallow or deep supplies. Wells are used also in rock formations, as at Madison, Wis. At comparatively small cost, a well can be put down to utilize water resources at any reasonable depth. In calculating the spacing of wells, consideration must be given to the drawdown curve of each well, caused by the rapid withdrawal of water by the pump, which will cause wells too closely spaced to yield less than the anticipated quantities; this circle of influence may extend for several thousand feet in porous formations, and less in tighter soils.

Water supplies for single farms or homes can generally be obtained from a shallow dug or driven well, at little expense, but the purity must be properly safeguarded, by sealing the top of the well against pollution from the surface. Ordinarily, drilled wells in unconsolidated formations comprise a hole cased with a pipe to prevent caving, and having at its lower end a screen to keep out sand. Since it is impracticable to make the screen openings small enough to keep out the finest sand, and yet large enough to admit the desired quantity of water, it is common practice to remove the fine sand within movable distance of the screen, by pumping the well to waste for several days at an excessive rate, so that the fine sand will be washed out of the interstices of the gravel next to the screen, where the converging waters have velocities sufficient to move sand, so that when the well is pumped at normal rates, little if any fine sand will enter the screen. This process is termed "development of the well." Where water is to be obtained from a fine-sand layer, as on Long Island, the gravel-packed or gravel-wall well has been found most advantageous in assuring uninterrupted flow, since an ordinary well in this material would clog readily. This type of well is double cased, the ground opposite the screen is underreamed, and the space filled with pea gravel poured down between the casings, which space is afterwards sealed off with mortar. This type brings less sand into the well during years of operation.

Rock wells are the chief source of underground water in the north central states, Ohio to North Dakota. Madison, Wisconsin (*Water Works Engineering,* June 1951) is an outstanding example of a population of 100,000 supplied entirely from rock wells. The first wells were put down in 1881; 22 wells have been drilled to depths varying from 500 to 2,000 feet, to tap the same water-bearing rock known as Potsdam sandstone. The overburden varies from 10 to 250 feet. Ten wells have been abandoned for various reasons: hydrogen sulphide gas, capacity too small, poor location relative to growth of city, high in iron from upper rock layers (these layers were cased off in later wells and corrected this trouble). The present 12 wells yield an average of 25 million gallons per day (mgd.). They are widely spaced around a 25 mile circuit.

Ground water supplies, in comparison with surface waters, require continual vigilance for their conservation as to quantity, pumping level,

quality, and condition of the screens and casings. Close spacing may reduce the quantity per well, over-pumping may cause the static level to drop, as at Houston where it dropped 120 feet over a term of years. Encroachment of homes and industries may bring pollution problems. In Nassau County, Long Island, a dump for garbage and rubbish, including old auto bodies, raised the iron content of a shallow well several hundred feet away to such an extent that the well had to be deepened to a water-bearing formation where the surface pollution had not penetrated, perhaps due to the tight clay lenses which separate various water horizons on Long Island. Wearings of screens and pumps by sand often shorten the lives and reduce the yield of wells.

CONDUITS

The conveyance of water supply from an impounding reservoir to the distribution system entails the construction of conduits of some form: canals or open channels, large masonry aqueducts or pressure tunnels (see article on AQUEDUCTS), or metal or reinforced concrete pipes. The ancients had no materials available to withstand high pressures, so they had to content themselves with masonry aqueducts following the topography, with aqueduct bridges across valleys. But, in modern waterworks, with a wide choice of materials, equipment and skills, the engineer places less dependence on topographical considerations, and is free to adapt the procedure to the physical conditions, and can utilize canals, pipe lines of wood, metal, reinforced concrete and asbestos-cement, cut-and-cover concrete masonry, grade and pressure tunnels, siphons, and even, as in the case of the Colorado River aqueduct, incorporate in the project booster stations and force mains. The economical combination of these various types is represented in the Catskill aqueduct of New York City, which contains cut-and-cover aqueducts, grade tunnels, pressure tunnels, steel-pipe siphons, some reinforced concrete monolithic aqueducts, and a dual cast-iron pipeline under the Narrows in New York Harbor.

Reinforced concrete conduits may be monolithic or precast. Precast pipe is not obtainable in sizes above 120 inches. Steel cylinder pipe is recommended where the head exceeds 100 feet; it is manufactured under patents by Lock Joint Pipe Co. The hydraulic carrying capacity of concrete, asbestos-cement, or cement-lined metal pipes does not deteriorate as rapidly as with tar-coated metal pipe. However, slimes will build up in such pipes and reduce the carrying capacity.

In the last quarter of the 19th century, a great deal of wood-stave pipe was used, as it was cheaper than iron or steel and maintained a high carrying capacity, but it was found, as at Atlantic City and Norfolk, to have a relatively short life.

For high heads, and where water hammer is a dominant factor, plate steel with modern welded shop joints, and Dresser couplings for field joints, produces a satisfactory conduit. Conduits should be safeguarded against tuberculation by cement-mortar lining, bituminous coating, or cathodic protection. As compared to cast-iron pipe in sizes above 48 inches, steel pipe is cheaper, and is damaged to a lesser extent by blowouts. But it must be protected against collapse by air-and-vacuum valves.

Cast-iron pipes are used for conduits in sizes up to about 48 inches. The modern tendency is to use centrifugally-cast pipe which is lighter in weight than pit-cast, and comes in 20-foot lengths. Where waters are active, the pipe should be cement-lined to guard against loss of capacity by tuberculation.

Appurtenances essential to the successful operation of transmission conduits include, high-level overflows on flow-line aqueducts; sectionalizing valves or stop planks at convenient intervals, so that sections may be taken out of service without too much loss of water or damage by water to adjacent property; blowoffs at convenient stream crossings for emptying sections for repairs and inspection; air valves on summits of all pressure lines; drainage shafts and blowoffs on pressure tunnels; air and vacuum valves on all steel pipelines.

The size of conduits from distant reservoirs can be reduced, and continuity of service can be better insured, if distribution reservoirs (see below) are installed on the distribution system, to provide for hourly and daily peak rates of demand, or several days' storage in case of a break in the transmission conduit.

The waterworks system of Kingston, N. Y. is typical of the utilization of service storage in assuring continuity of supply at adequate pressures without expending more money for transmission conduits. Cooper Lake, the impounding reservoir in the Catskill Mountains, is 14 miles northwest of Kingston and at a satisfactory elevation for gravity flow through a pressure filter plant located 6 miles from the city. For a score of years, an attempt was made to meet all demands of the municipality by momentary changes in the rates of pressure filtration. This proved unreliable so a storage reservoir, which could be filled by gravity flow, was built at an economical high point midway between the filters and the city. During the next 10 years, Kingston continued to expand to the hillsides at the west. It was found that at times of peak demand (lawn sprinkling and shower baths on hot days) the existing transmission conduits from the equalizing reservoir (an 18-inch pipe laid in 1883, a 20-inch pipe laid in 1895, and a 20-inch pipe laid partly in 1914 and partly in 1926) could not supply water to the high points at satisfactory pressure. Therefore, in 1938, the "West Side" standpipe was built, with its flow line at the same elevation as the equalizing reservoir. It is situated on the opposite side of the distribution system from the point of connection of the three transmission conduits, and is connected to the distribution system by a 16-inch cement-lined cast-iron pipe. Obviously, this 1,000,000 gallon standpipe which is 40 feet high to full level, cannot be completely filled by gravity flow from the equalizing reservoir; it was necessary, therefore, to install an automatically controlled pump, which would pump water in the early morning hours (the time of least demand) from the distribution system to fill the standpipe. (This installation is described in *Public Works,* February 1928).

PUMPING SYSTEMS

For the various kinds of water works pumps, and particularly triple-expansion reciprocating pumps and motor-driven centrifugal pumps, see article on PUMPS AND PUMPING MACHINERY. Deep wells are generally equipped with motor-driven turbine pumps; closely spaced groups of shallow wells, if the pumping depth is less than 20 feet, can sometimes be connected to a common

suction header, and served by a pumping station at ground level. The Jamaica Water Supply Company, Jamaica, Long Island had two stations, comprising about a dozen wells each, which operated successfully for years, but they had to be abandoned due to various causes, not the least important the gradual recession of the pumping level. Wells can be pumped directly into the system, but this leads to over-pumping of the stratum during periods of high demand; a more conservative practice is to pump at a low constant rate from the well to a tank at ground level, whence water is boosted by other pumps to meet the fluctuating rates of demand.

The choice between steam and electricity for power depends on many factors. Electricity is essential for automatic or semi-automatic operation. Power failures must be guarded against with electricity by providing gasoline or Diesel engine stand-bys.

Three types of pumping systems are in use in this country: direct, indirect, and direct-indirect. In direct pumping, there is no open reservoir on the distribution system, and the pressure at the pumps depends on the number of taps open; water hammer is a constant menace, and fire demands can be met only by speeding up the pumps to raise the pressure. In indirect pumping, an open storage reservoir is provided between the pumping station and the distribution system, into which all water is pumped, before it flows by gravity to the distribution system; this allows the use of constant speed pumps, and eliminates water hammer on the pumps, but water hammer might still menace plumbing fixtures. In direct-indirect pumping, an open storage reservoir is located on the far side of the distribution system, allowing the pumps to operate against fairly constant pressure; there is no water hammer on pumps or plumbing fixtures. Fire demands can best be met by this system, whereby double the quantity is available, and at higher pressures. Smaller pumps, and reduced power charges, are possible with this system.

STORAGE IN DISTRIBUTION RESERVOIRS

Impounding reservoirs, discussed above, are situated only at the source of surface supplies, whereas distribution reservoirs (also termed "equalizing" or "service" reservoirs) are utilized in connection with both surface supplies (lakes or reservoirs) and ground water supplies, to insure adequate service to consumers in all foreseeable emergencies. They are located close to, in the midst of, or on that side of the distribution system, opposite to the conduit from the source of supply. They serve numerous useful purposes: (1) on indirect, or direct-indirect pumping systems, distribution reservoirs provide a cushion against which the pumps react, and in turn are operated more evenly, thereby eliminating water hammer hazards; (2) where wells are the sole source of supply, distribution reservoirs provide storage to meet hourly and daily peak demands, and conserve the ground water supply by allowing the well pumps to be operated at a slower rate, so that water is withdrawn from the aquifer in quantities unlikely to cause recession of the water table, or inflow of undesirable water; (3) by providing an emergency reserve, they lessen the damages and discomfort consequent on a break in a supply conduit, failure of wells, pumps or power, or flooding of pumps or wells; (4) they insure the supply of water at better pressures than that supplied by long transmission conduits, or by direct pumping systems, thereby postponing the need of larger conduits or additional pumps; (5) in hilly terrain, the distribution system can be zoned by elevations, each zone being serviced by a distribution system reservoir, and perhaps a booster pump; (6) the reserve storage in distribution reservoirs makes it possible to design transmission conduits, wells, pumps, etc. for the average rather than the peak demand rate, at marked economy; (7) on small systems the distribution reservoirs can be filled during the 8-hour day, or during periods of low-priced power, thereby saving 2 labor shifts, and considerable power; (8) where the supply is filtered, the storage in distribution reservoirs allows the operation of the filters at normal rather than peak demand rates, thereby saving wash-water, power and wear-and-tear; (9) distribution storage provides for peak rates of fire flow required by the National Board of Fire Underwriters more economically than extra pumps or supplementary distribution pipes.

In large cities, fire demands do not predominate and the required storage is a matter of judgment respecting the hazards involved in event of interruption of supply through failure of the transmission conduit, pumps, or wells. According to Babbitt and Doland [11] reserve storage for fires should in general be sufficient to meet fire demands plus average domestic demands for 2 hours; in the case of cities, it should be 10 to 12 hours. Fire reserves should be kept ready for immediate use, and not withdrawn during the daily fluctuations of water level in the reservoir.

The volumes of available storage to be provided vary slightly on gravity, and pumping systems. Gravity systems involve a long transmission conduit from the upland impounding reservoir, and the size of this conduit can be reduced if storage for a week or two can be provided in a distribution reservoir. On a direct-indirect pumping system, where the storage ordinarily floats on the line, storage of a few days should suffice. "Equalizing storage capacity is operated through a cycle of withdrawal and replenishment. The theoretical capacity depends on the pumping . . . rates and the rate of consumption. The greatest capacity is rarely more than that required for the demand on the maximum day. A decision as to the actual capacity to be installed rests upon economic studies which determine the combination of storage capacity and pumping requirements that will result in the lowest annual expense." [11] On a direct pumping system (no storage), the capacity of the pumping plant and pipeline must be adequate for the maximum rate of demand: domestic plus fire.

Distribution reservoirs should be located centrally, and as close as possible to the district to be served, and if practicable should be on the side of the distribution system opposite to the source of supply, be it wells, pumping station, or a transmission conduit. They should be placed at sufficient elevation to afford adequate pressures even when emptied to the ¼ stage. If the homes to be served are nearby, the bottom of an elevated storage tank should be at least 30 feet, and preferably more, above the eaves of the nearest house. In locating storage, it must be borne in mind, in general, that ¾ of the pressure can be conserved by feeding a hydrant from two opposite directions.

Distribution reservoirs may be constructed by excavating to form earth embankments on ele-

vated ground, as at Hillview and Silver Lake reservoirs for New York City, or may assume the shape of reinforced concrete-covered, groined, arch structures, like the Provin Mountain reservoir at Springfield, Massachusetts, or the form of reinforced concrete or steel standpipes, or steel tanks on towers. The Jamaica Water Supply Company which supplies 35 mgd. from 52 wells scattered over 40 square miles on Long Island, utilizes for distribution storage 6 steel standpipes, 6 tanks near ground level (5 steel and 1 prestressed concrete) and 10 steel tanks on towers.

The reinforced concrete standpipes built in New England in the beginning of this century, proved leaky and unsightly (Waltham and Attleboro), and present-day labor costs have reduced their economy. Prestressed concrete has lately come into use; while it costs more than a steel standpipe, it can be made more sightly, will be less subject to ice troubles in cold weather, and will eliminate the problem of interior painting, or annual renewal of electrodes for cathodic protection.

Elevated steel tanks on towers appear to be less objectionable aesthetically then steel standpipes, particularly in the recent designs employing elliptical bottoms and tops, and steel tubes in place of H-beams for legs. However, the requirements for spectacular painting imposed by the Civil Aeronautics Commission to safeguard and guide air traffic, has imposed another unattractive feature. Repainting the interior of steel tanks is a major operation, and puts them out of service for weeks. The use of cathodic protection in the last decade has obviated the necessity for painting the interiors and insures uninterrupted use of the tank, but the electrodes have to be renewed annually in freezing climates. The objections of adjacent property owners at Scarsdale to a bare steel standpipe of 1,000,000 gallons capacity necessitated its enclosure in an attractive but costly Martello tower of ashlar masonry, with walls set far enough outside the standpipe to leave space for a spiral steel stairway to the roof.

DISTRIBUTION SYSTEMS

The network of interconnecting pipes extending from the pumping station, wells, or the end of the transmission conduit, to the consumers' premises, or to hydrants is termed the distribution system. The function of a distribution system is to deliver water in required quantities and at satisfactory pressures, under all conditions of demand and operation, and despite a break in any pipe in the system.

While various materials were formerly used for pipes—wood, wrought-iron, cement-lined stovepipe, wrought steel, galvanized steel and cast-iron, the present trend is to cast-iron pipe (cement-lined in regions where the water is aggressive) or asbestos-cement pipe. Some of the larger private companies, notably American Water Works Company, which controls a great many properties, are now installing extensive footages of asbestos-cement pipe. The sizes of pipe, where hydrants are to be served, except in small, limited systems, should never be less than 8 inches. Street mains larger than 48 inches are uneconomical, as they are difficult to procure in cast-iron, property damages due to a break increase as the square of the diameter, and they take up so much room in the street that many existing utilities have to be modified or circumvented by expensive special construction. Seventy-two inch pipes are sometimes used, as in Jersey City and Brooklyn. Only unusual circumstances warrant the use of more than one large pipe in a street, since a break in one will endanger another. Very large cast-iron pipes are subject to shrinkage and other stresses which make them less reliable than steel or reinforced concrete under heavy pressures.

The primary function of hydrants is to afford hose connections for a fire, and they should be spaced close enough together so that no more than 300 feet of hose will be required to play a vigorous stream on a fire. Generally there should be at least one at a 4-way street intersection. Gate valves are essential for segregating a section of pipe in event of a break, and limiting the damaging escape of water. They should be placed on all pipes involved in an intersection, and not more than 1,000 feet apart between intersections. Check valves are required to prevent backflow at pumps. Pressure-regulating valves are required in low parts of the system, to keep the pressure within the limits tolerated by the consumer; excess pressures provoke complaints of air bubbles in the water, and breakage of dishes insecurely held under the open faucet in the kitchen sink. Altitude-controlling valves are spring-operated to close at a prescribed pressure, and prevent overflow of distribution reservoirs and tanks. Cone valves—a recent development—may be operated manually, automatically or electrically, to maintain a constant level in a distribution reservoir, to check backflow when pumps are stopped, to prevent water hammer, or to reduce pressures.

TREATMENT AND CONDITIONING

A large part of this section is taken from *Water Quality and Treatment,* a manual of American Water Works Association, 2d edition, 1950.

Quality of Water.—Waters subject to treatment have qualities broadly characteristic of their sources, as modified by pollutional, chemical and physical agencies to which the waters have been exposed between the point where the skywater hits the earth, and the treatment plant. Natural pollution results from material picked up by the fresh skywater in its travels over or through forest covers of leaves, fertilized crop lands, and pasture lands strewn with manure and other organic debris. Pollution by humans is more injurious, comprising industrial wastes and untreated sewage discharged into water courses; the impairment of quality has been termed roughly proportional to the ratio of population to stream flow. Chemical agencies comprise primarily the soluble minerals with which the water has been in contact, air dust picked up by skywater, and chemical wastes discharged into streams, which agencies increase the hardness and alkalinity of the water, and add carbonic acid, color and odor. In addition streams in flood pick up floating debris and silt (physical impairments), and water in storage is subject to algae, microorganisms, worms and fish (biological agencies). The net effect of these various influences is to add algae, alkalinity, bacteria, color, floating debris, hardness, microorganisms, odors, tastes, toxicity and turbidity in varying intensities to the water delivered for treatment.

There are also counteragents in streams which offset the baneful agencies: sedimentation in still-waters remove some silt and other suspended matter; waterfalls and rifles remove some car-

bon dioxide, tastes and odors; oxidation modifies organic constituents; sunlight bleaches color; and biological agents destroy pathogenic bacteria. These counteragents contribute to self-purification of streams; but time, temperature, and character of the pollution are important factors. Streams of the United States have widely divergent outstanding characteristics; those of the West are likely to be hard, turbid, and low in color; those of New England, soft, clear and colored.

Ground waters, as compared to surface waters, are generally clear, cold, colorless, and harder than the surface waters of the same region. Bacterially, ground waters are generally better than surface waters. Water from limestone formations is apt to be hard and may be polluted through fissures from the surface; it forms deposits on water pipes, and is relatively non-corrosive. In granite formation, ground waters are soft, low in dissolved minerals, relatively high in carbon dioxide, and are actively corrosive. "The temperature of ground water 10 to 50 feet below the surface is usually the mean atmospheric temperature of the locality. Below 50 feet, the temperature increases roughly 1 degree F. for each 60 feet of depth. Ground water temperatures remain fairly constant throughout the year."

Function of Treatment.—It is the function of the treatment to correct impairment of quality so that the water will be fit for human and industrial use, and will not cause formation of tubercles or slime in the pipes. While the primary function of treatment, as advanced by Koch in 1892, is to destroy or eliminate impurities that may cause disease, its function nowadays is considered unfulfilled unless it produces a clear, pleasing potable water, disinfected, and acceptable to both domestic and industrial consumers.

Types of Treatment Available.—Since raw waters differ so markedly in characteristics and the quality desired by the consumer varies with the uses to which it is to be put, the habits of the consumer (Easterners, for instance, suffer from the laxicity of the high sulphate waters which are tolerated by natives of Kansas), and the types of pipes and appurtenances in the waterworks system, different types of treatment have been developed to suit circumstances. The types available include: longtime storage in reservoirs, screening, plain sedimentation, sedimentation following coagulation with chemicals, filtration through slow or rapid filters, disinfection, softening and aeration; also, the occasional use of copper sulphate as an algicide, chemicals for corrosion control, and removal of tastes and odors.

Long-time Storage.—Investigations by Stearns and Drown in Massachusetts in 1890, and Houston in England, later, concluded that long-time storage will reduce color, and nitrates, increase albuminoid ammonia, reduce the number of bacteria of all sorts, including pathogenic, and remove some suspended matter. Many large American cities—New York, Boston, Los Angeles, San Francisco and Vancouver—utilize these benefits of long-time storage as the chief water treatment, supplemented by chlorination. New York applies chlorine after the water leaves the distribution reservoirs at Kensico, Hillview and Silver Lake, where it is exposed to pollution by trespassers and sea-gulls. New York also promotes sedimentation in Kensico reservoir by applying alum to both the Catskill aqueduct and the Delaware aqueduct before their water enters the reservoir.

Screening.—Coarse screens are generally placed in intakes or headworks to divert large floating objects including ice from the conduits. Fine screens which carry mesh of about ¼ inch opening are placed inside the coarse screens to intercept leaves, larva (such as the troublesome bloodworm), aquatic vegetation, and fish. They require frequent removal for cleaning; in many large systems, mechanical cleaning devices are installed.

Plain Sedimentation.—Plain sedimentation (not induced by the application of coagulants) takes place whenever the velocity of flowing water is reduced suddenly; matter carried in suspension is subsided and deposited. It is one of the self-purification processes of streams, and results in the siltation of reservoirs mentioned above. In a water treatment plant, water is held in a quiescent stage in sedimentation basins, for a sufficient interval of time to permit the gravitational deposit of the larger suspended particles. These settle at a rate dependent on their size, weight and shape, and the viscosity of the water. For theory of subsidence, see Hazen, *Transactions of the American Society of Civil Engineers,* vol. 53, p. 45, 1904; also, for later developments, see vol. 102, p. 389, 1937. Modern practice favors upward flow rather than horizontal flow basins, with skimming troughs closely spaced along and across the top to pick up the cleanest water, and with sludge-removal mechanisms installed to remove sludge continually before it has opportunity to mingle with the incoming water. This practice not only insures greater average settling depth (silt builds up to 6 feet on the bottoms of hand-cleaned basins) but insures removal of the sediment without periodically taking the basin out of service, to hose out the mud. At the Little Falls basin of the Passaic Valley Water Commission, silt to a depth of 6 feet has to be removed by hosing, taking the basin out of service at 6 to 8 week intervals. Plain sedimentation at Cincinnati, with 72 hours detention at a 100 mgd. rate, yields 1 foot depth of mud per year on 45 acres; basins are cleaned every 5 years (Ref. 12).

Coagulation.—The process of coagulation consists in adding a coagulant chemical to the water, to bring about an agglomeration of colloidal or finely divided suspended matter into larger masses which will settle more readily in sedimentation basins than the separate particles; this insures removal of greater quantities from the water. The process involves not only the addition of the chemicals to the water but their uniform dispersion through the water by violent mechanical stirring, termed flocculation, resulting in collision of particles and agitation of the water, which builds up a readily settleable floc. Plain sedimentation can be utilized as a sole process, but coagulation requires both sedimentation and filtration, to remove the agglomerated chemicals and impurities. The floc resulting from coagulation enmeshes some organic matter, bacteria, and substances causing color. Coagulation is recommended when the turbidity of the raw water exceeds 30 to 50 parts per million. Some coagulants and water require rapid violent mixing, while others produce better results with slower mixing over longer periods. Flocculators are made by Dorr, Link Belt, Walker and other specialists, and involve some form of rotating

paddle. Sulphate of alumina, commonly called alum, is the most widely used coagulant; it is clean, easy to handle, and effective in its action. Ferric salts have also been extensively used as coagulants; they are nearly as effective as alum, but less convenient to apply. Coagulation periods vary at different American plants, from 3 to 90 minutes, the majority being 10 to 30 minutes; the current trend is to longer periods—30 to 60 minutes, including the time of preliminary flash or rapid mixing. Velocities of 1.0 to 1.3 feet per second are now extensively used for coagulation basin design, and appear to produce about the desired turbulence in baffled basins. It is important that the application of chemicals be uniform, and in proper proportion to the flow of water. Dry-feed machines for chemicals are preferable to wet-feed, effecting closer control of chemicals, economy of space, and elimination of solution tanks and piping.

Filters.—Two types of filters are in successful use in water treatment plants, the rapid-sand (or mechanical) which is widely used, and the slow-sand (or "sand," or "English"), the predecessor to the rapid, and now used chiefly where there are large areas of land available, and where turbidity and color removal are not prime considerations. Slow filters differ from rapid, in many respects: (a) they are available only for gravity flow; (b) they are operated at the slow rates of 3 to 8 million gallons per day per acre; (c) water does not require pretreatment by coagulation and sedimentation; (d) filters must be taken out of service several hours, for cleaning by scraping off the dirty layer of sand, and, upon return to service, filtered water must be wasted for several hours, until the schmutzdecke is reformed on the sand surface; (e) they require 10 times the land, more concrete, but less control equipment. On the other hand, rapid filters (a) can be built for either gravity or pressure flow; (b) can be operated at rates of 125 to 200 million gallons per day per acre; (c) ordinarily require pre-treatment of water by coagulation and sedimentation; (d) can be cleaned quickly by backwashing which requires taking the filter out of service for 10 to 15 minutes. Filters of either type if well designed and effectively operated can be relied on to produce an agreeable water under practically all circumstances. Nowadays filters are not depended on to kill bacteria, which is more certainly done by disinfection with chlorine and other agents, as explained below.

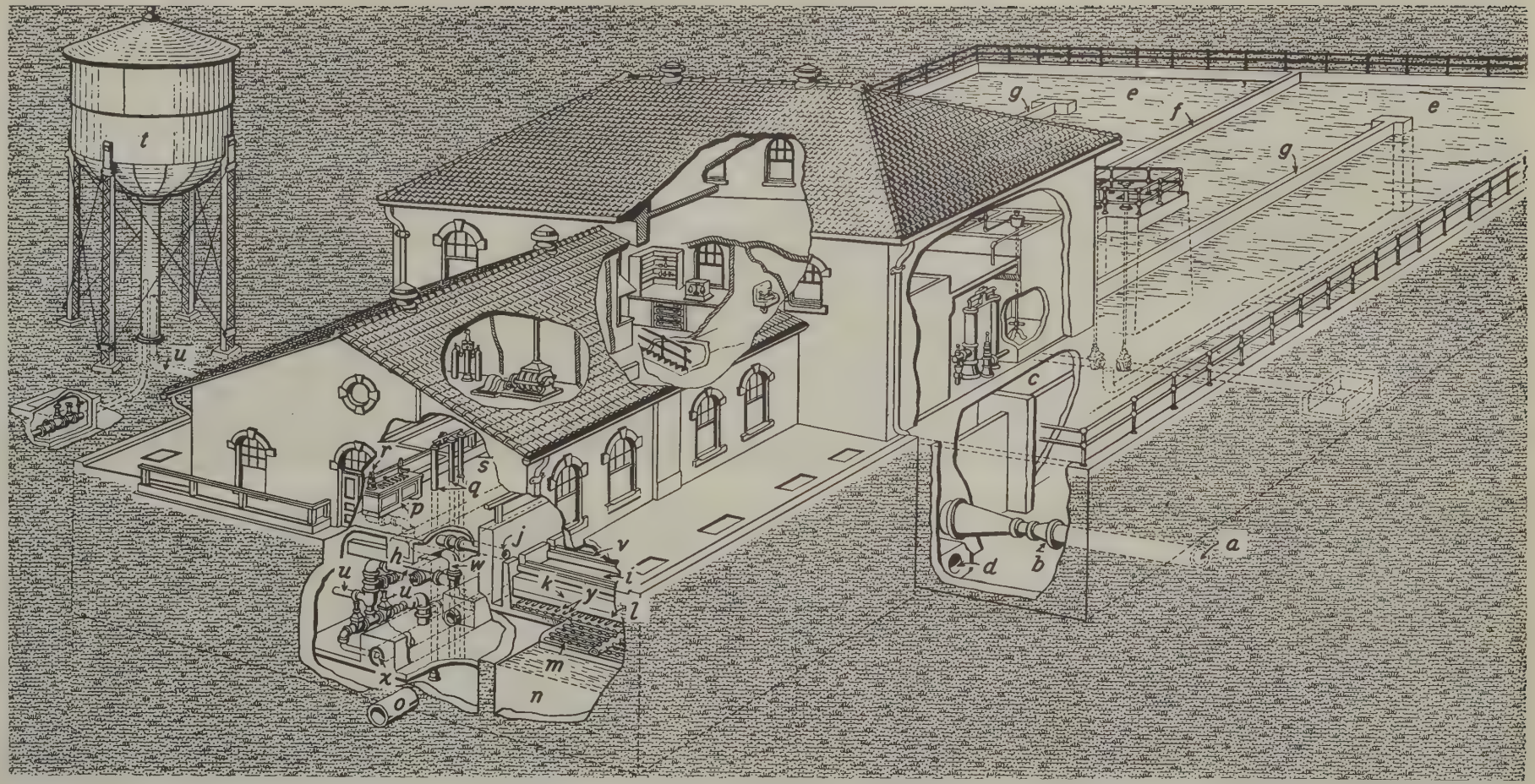
Where turbidity or bacterial loadings are high, or pollution is heavy, rapid filtration has decided advantageous over slow sand; where color and taste removal are important, rapid filters must be supplemented by pretreatment with free residual chlorine, activated carbon, or similar processes. "With adequate pretreatment facilities . . . rapid sand filters are adequate to the treatment of practically all surface water supplies, including those subject to nearly all forms of bacterial and other pollution, high or variable turbidity loadings and excessive algae growths." With modifications, rapid filters are used in connection with water-softening plants.

A filter consists of a bed of sand or prepared crushed anthracite (about 24 to 30 inches thick in rapid filters, and up to 40 inches in slow), supported on a bed of gravel or some other coarse porous material such as carborundum, and contained in a basin, with various operating accessories, for controlling flow, and for washing the basin. The American Water Works Association (1948) issued specifications for filtering material, which are accepted as standard.

Steel explains the clarifying effect of sand filters (more effective than strainers) as follows;[12] The minute void spaces between the sand particles act as small sedimentation chambers and thus permit the suspended particles to come in contact with the surfaces of the sand particles, which surfaces soon become sticky, from residues of coagulants carried onto the filter, and from slimes. The suspended particles in their tortuous downward path through the filtering medium touch these sticky surfaces and adhere. This soon results in an accumulation of removed suspended matter in the top few inches of the sand which forms a dense blanket of mud, floc, and living or dead organisms; this accumulation is termed the schmutzdecke. It was formerly held that the schmutzdecke was highly important in filtration, but it is now known that relatively clean sand, with only a thin film upon the sand grains, is as effective as a bed with a dense blanket at the surface. There is also the possibility that the sand particles have an electrical charge opposite to the ions in the colloids. The sand particles will therefore attract colloidal matter until the electrical charges are neutralized. As the bed is washed, the accumulated material will be removed, and the electrical charge of the sand restored.

Layouts of rapid sand filter plants vary with local conditions, the experience of the designer, and the size of the plant, but in general, follow the scheme shown in Fig. 1. The water enters through pipe *a* (lower right hand corner) and through the Venturi meter *b* into mixing chamber *c* where the coagulant is applied. (The flocculator is not shown.) The coagulated water then passes to sedimentation basins *e* through conduit *d;* here the floc settles out. The two basins are separated by wall *f* so that they may be operated separately. (In some plants, sludge removing equipment would be installed here.) Wall *g* provides a baffle to guide the water in even flow, and prevent cross currents and short-circuiting. (Valves, in the bottom of the basins, for clean-out of sediment, are not shown.) The flume *h* leads the water from the sedimentation basin to the various filter boxes *i*, through the influent pipe *j*. The water percolates down through the sand *k*, which is supported on gravel *l*, which in turn is supported on the filter bottom *m*. It flows into the clear-water reservoir *n* beneath the filters. The filtering and washing operations are controlled from the operating table *p*, the rate-regulator *q*, and the loss-of-head gage *r*, which are located on the operating floors over the operating gallery. Filtered water for back-washing the filters is stored in the elevated wash-water tank, *t*, from which it is fed through pipes *u* into the filter bottom *m*, and flows upward at high velocity through the gravel and the sand, causing the sand to float to a limited extent, so that it is more easily freed of dirt. The wash water and dirt are carried into the gutters *v*, and thence into the drains *w* and *x*.

The filter boxes range in capacity from 0.3 to 2.0 million gallons per day, and are generally arranged symmetrically about either side of the operating gallery which is the enclosure under the operating floor, provided for the pipes and valves. In northern climates, the entire filter is enclosed, but in the deep south, only the operat-

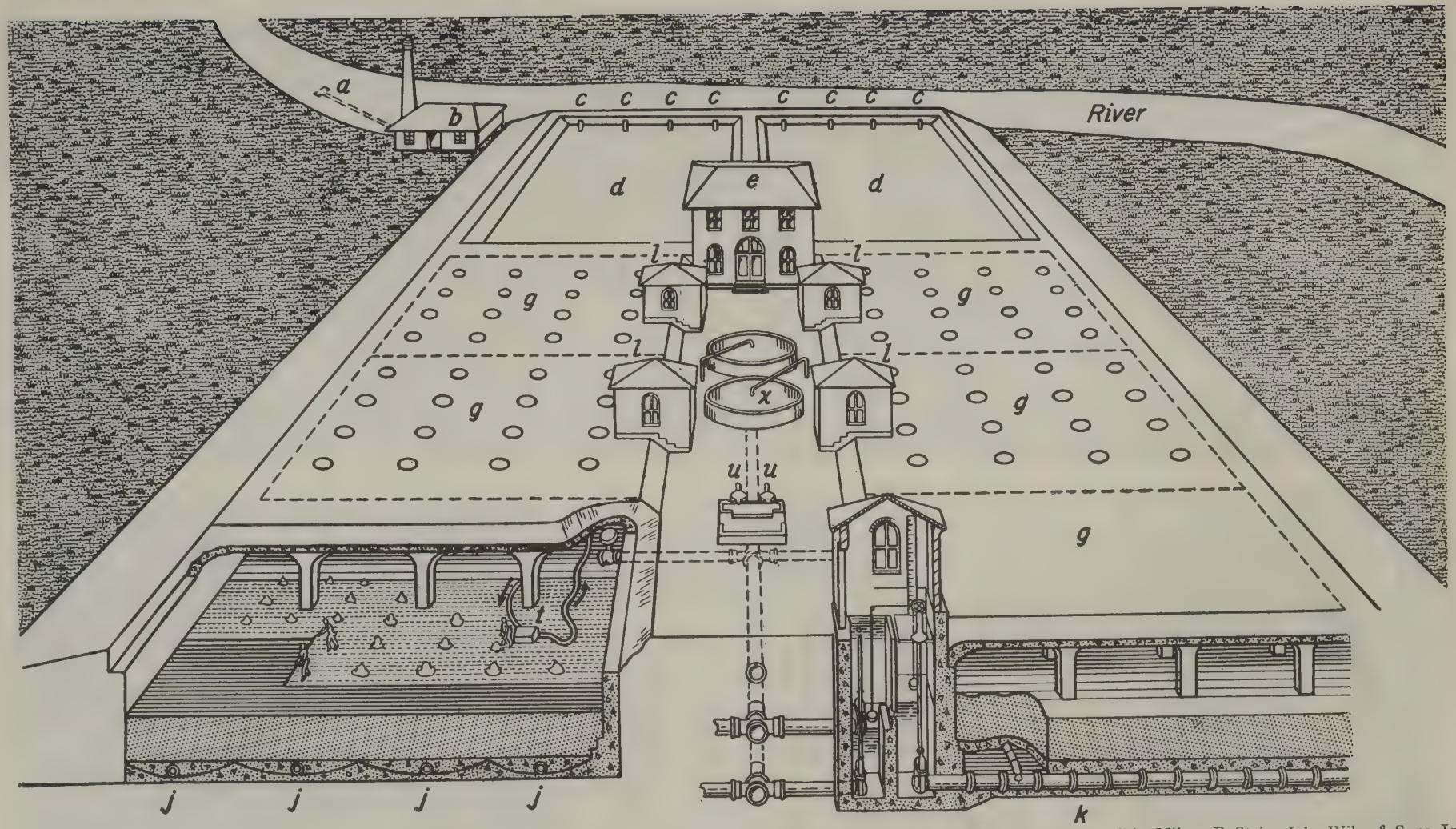


Redrawn by permission from *Water Supply and Purification* by William A. Hardenbergh; International Textbook Company, 1945.

FIG. 1. Typical arrangement of rapid, or mechanical, filter plant.

The raw water passes from the main *a* through the Venturi meter *b* into the chemical chambers *c*, where the coagulant is mixed with it. From the mixing chambers the coagulated water flows through the flume *d* to one of the sedimentation basins *e* (at the far end in the illustration), in which the precipitate is allowed to settle. There are two similar basins, one being in use while the other is being cleaned or is held in reserve. The two basins are separated by the wall *f*, and each basin has a baffle wall *g* to guide the water and prevent cross-currents. After passing through one of the sedimentation basins, the water enters the flume *h* (shown at the near end *in* the illustration) and is distributed to the various filter units *i* by pipes *j*. The water percolates down through the sand *k* and the gravel *l*, is collected by the strainer bottom *m*, and is carried to the filtered-water reservoir *n* under the filters. From the filtered-water reservoir, the water passes out through the pipe *o* to the elevated tank or reservoir from which the water supply is to be taken.

The filter is operated and regulated by means of the valve controls *p*, the rate-regulating apparatus *q*, and the loss-of-head gauge *r*, that are located in the gallery or operating floor *s*. Filtered water to be used for washing the filters is stored in the tank *t*, from which it is led through the piping *u* to the filter bottom *m*, and is forced upwards through the gravel and sand. The wash water, carrying the dirt and sediment in the sand, is discharged through the troughs *v* and the sewer *w* into the waste *x*. Air for agitating the sand during cleaning is supplied through the piping *y*.



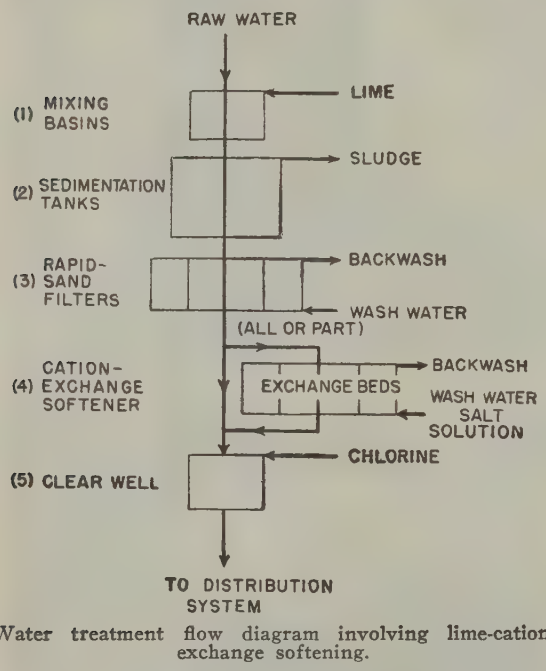
Based on "Water Purification Plants and Their Operation," by Milton F. Stein; John Wiley & Sons, Inc.

FIG. 2. General view of slow filter plant.

This consists of duplicate sedimentation basins, *d*, the filter units, *g*, the laboratory, *e*, etc. Low-lift pumps, *b*, take water from intake, *a*, and deliver through aerating risers, *c*, to sedimentation basins, *d*. Water is uniformly distributed to filters, *g*, by a float valve. Collector pipes, *j*, collect the filtered water and lead to the main collector, *k*, which leads to the regulator house, *l*, whence it flows through regulating orifices to the clear water well. A portable sand ejector, *t*, is employed when the sand requires washing. Sand washers, *u*, discharge the clean sand to sand storage bins, *x*.

ing floor is roofed over. The filtered water basin is generally situated beneath the filter boxes, and provides support for them, and short piping from the filter boxes.

Disinfection and Chlorination.—Disinfection is the process of killing a large proportion of microorganisms, by means of chemicals, heat, ozone, ultraviolet rays, etc. Liquid chlorine was first employed in 1909, and was commonly added to raw or coagulated water just prior to filtration. Currently, the value of chlorination for disinfection, and hastening other chemical or biological results and in producing a satisfactory effluent, is recognized. It is applied both before and after filtration. Chlorination materially improves the coagulation of some waters. Prechlorination may also control the growths of algae, reduce biological accumulations in filters, and contribute to improved filter efficiency, and lengthened filter runs. Postchlorination appreciably reduces the number of bacteria of all types entering the distribution system. When ammonia is combined with chlorine, a slower acting disinfectant results, which has been found beneficial in retarding growths in long pipelines leading to the distribution system, and for suppressing the development of iron-fixing or slime-forming types of bacterial growths. "The wider adoption of treatment utilizing greater chlorine additions may be expected in the future, inasmuch as high-rate chlorination provides a means of achieving a high standard of bacterial quality and of improving plant practice, including the elimination of certain types of tastes and odors." [13]



Water treatment flow diagram involving lime-cation-exchange softening.

Chlorination, however, is not a substitute for more general treatment. Preliminary coagulation and sedimentation plus filtration are generally required for removing color, turbidity, and obnoxious industrial wastes, but chlorination may lead to a more satisfactory effluent when combined with these processes.

Chlorine is a greenish-yellow gas which under pressure is converted to a liquid. Commercially, it is available in steel cylinders, of various capacities, ranging from 100 to 2,000 pounds. At 70°F., the pressure required to maintain the liquid form is about 85 pounds per square inch, but the pressure increases as the temperature rises. When the liquid is drawn from the cylinder, the release of pressure causes it to change back to a gas. Chlorine, to be effective, must be applied continuously, and in definite proportions to the water flow. Liquid chlorine is fed from the pressure cylinders, to the water through a machine termed a chlorinator, which automatically proportions the gas to the rate of flow.

The mechanism of the action of chlorine in destroying bacteria and microorganisms has been the subject of much conjecture. Formerly, it was held that chlorine reacted directly with water to generate nascent oxygen, which had a definite bactericidal action on the cell. This theory was disproved; the general belief nowadays being that there is a physicochemical reaction between chlorine and the proteins and amino groups in the cell wall and contents, causing disintegration of the cell and destroying its life. Green and Stumpf [14] have suggested another explanation based on inhibition of a key enzymatic process, which oxidizes the glucose of the cell. Chlorine destroys this power of oxidation, so that the bacterial cells die.

The most recent development in the use of chlorine has been the breakpoint method, whereby more effective bactericidal action can be obtained, and tastes and odors removed, with a minimum quantity of chlorine.

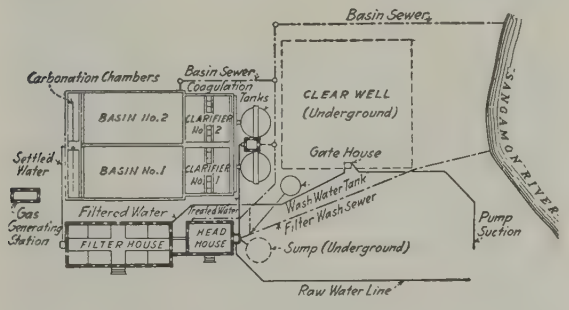
Chlorine dioxide—a compound of chlorine and sodium chlorite—possesses greater chemical activity than chlorine alone, and produces a more rapid oxidation of some organic compounds. It was first introduced in water treatment about 1940, for destruction of taste-producing substances which frequently result from chlorination. It destroys chlorophenols, and similar taste-producing compounds; in some instances, it has reportedly proved effective in precipitating iron and manganese.

Ozonization is employed at the Belmont filters at Philadelphia for taste and odor control. Ozone is a faintly blue gas of pungent odor; it is oxygen in molecular form, three atoms of oxygen comprising a molecule; it is an unstable allotrope, and readily breaks down to normal oxygen and nascent oxygen, which is a powerful oxidizing agent. Ozone is produced by the discharge of high voltage electricity through dry air in a closed apparatus known as an ozonator, and is applied to water by discharging into a scrubber or into an injector, or by spraying the water into ozonized air. At Ashton, England, ozonization is reported to disinfect, and reduce color, tastes, and odors.

Ultraviolet rays are employed for swimming pools, but have been found too expensive for any but small municipal installations. The water to be disinfected is made to flow in a thin film past a series of quartz mercury-vapor arc lights emitting ultraviolet light. Turbid waters must be filtered, and color reduced to 15 parts per million (ppm.) before the rays are effective.

Softening.—The hardness which is added to skywater due to minerals dissolved by running over the surface, or percolating underground, is a real expense to the consumer unless reduced by softening. Steel [12] claims "Water softening has so many advantages that there is little excuse for the fact that it is not more widely used. . . . Hard water is a continual though unrecognized expense to water users. For a family of five, Applebaum estimated in 1932 that moderately hard water will

cause a 'hard-water tax' of $44 per year, divided among the following items: soap destroyed, plumbing bills due to scale in pipes, extra fuel caused by scale in hot-water and steam heaters, decreased life of fabrics washed in hard water, and increased wear on cooking utensils." In 1936 it was estimated by Charles P. Hoover that the cost of soap due to hard water amounted to approximately $1.00 per capita per year for each 100 parts per million hardness. Data cited by Turneaure and Russell[7] for 1,034 groundwater supplies in the midwestern states show only 63 with hardness below 100 ppm., 835 above 200, and 537 above 300. According to Howson[15] softened water is now served to approximately 15,000,000 people in the United States. At present prices, large softening plants (about 80 mgd. capacity) can be built for about $55,000 per mgd. capacity; in capacities from 15 to 18 mgd., for about $90,000 per mgd., and a 2 mgd. plant for about $125,000 per mgd. The annual cost of removing 200 ppm. hardness from average water, by the lime-soda process, would be 6.2 cents per 1,000 gallons for a 6 mgd. plant, and 4.1 cents for an 80 mgd. plant, including fixed charges, chemicals and labor. He estimates that 50 per cent of the consumers, who use 3,000 gallons of water per month, at a minimum charge of $1.50, would be assessed an additional 25 cents per month for softened water, which would be offset by the saving on soap, fuel and plumbing. He concludes: "Softening can be accomplished more economically and satisfactorily in public works than by individual household softeners."



Typical municipal softening plant—(Springfield, Illinois).

Water softening processes for municipal plants are either the cold lime-soda process, the cation-exchange process (formerly called the zeolite process), or a combination of the two. In the cold lime-soda process, the steps are usually: addition of chemicals (generally lime and soda ash), mixing, sedimentation in basins for the reaction to take place, rapid sand filtration, and recarbonation to prevent the formation of incrustants and scale. If the water were not recarbonated (by diffusing carbon dioxide gas through it, to restore the carbon dioxide removed by the reaction with lime) the water would be unstable as to the solubility of carbonates and the corrosion of metals. The lime-soda process involves the handling of dusty lime, the disposal of great quantities of sludge, and expert supervision of recarbonation; if the recarbonation is not properly done, the sand, gravel and equipment in the filters, and the pipes in the distribution system, will accumulate coatings of carbonates of calcium and magnesium.

The cation-exchange softener is the most widely used type in municipalities, industries, and homes. In industries and homes, a water of zero hardness is produced, while in municipalities, completely-softened water is mixed with hard water, to produce a water of tolerable hardness. The softener occupies comparatively little space, and is simple to operate. A cation-exchange water softener consists essentially of a container (gravity or pressure type) for the bed of exchange material, and piping and appurtenances for passing water through that material in one direction for softening the water, and in the reverse direction for the regeneration of the bed. In the reverse flow, the water carries brine. There is also required a storage bin for the salt, and a tank for saturated salt brine. The principle of this process lies in the ability of certain sodium compounds, which are insoluble, to exchange cations with other substances in the water; when a hard water is passed through a sodium cation exchanger, the calcium and magnesium in the hard water are replaced by sodium from the exchanger. Since the action is reversible, the "exhausted" cation exchanger can be "regenerated," with a solution of common salt, once all the readily replaceable sodium has been exchanged for calcium and magnesium from the hard water. In the regeneration, the calcium and magnesium of the exhausted cation exchangers are replaced with a fresh supply of sodium from the regenerating brine unit. Then, after washing with water to free it of brine, the exchange material in the filter is in condition to soften a fresh supply of hard water.

Corrosion may be an incidental result of cation-exchange softening, unless provision is made to guard against it. Water softened by this process is not in itself corrosive, but the absence of magnesium and calcium compounds prevents the formation of a coating based on alkaline hard water which protects the metal from attack by oxygen, the real corrosive agent. To protect pipelines in distribution systems, it is therefore advisable to mix the softened water with the raw, or make such adjustments to the pH and alkalinity, as will produce substantial saturation with calcium carbonate.

Aeration.—Aeration is the process of bringing about the intimate contact of air and water by any of the following methods: spraying the water in the air, bubbling air through the water, or by agitation of the water by cascades, etc., to promote surface absorption of air. Aeration removes hydrogen sulphide, simple chlorine odors, and odors caused by decomposing organic matter; it can greatly reduce odors caused by microorganisms, and can remove some iron and manganese. Odors caused by chlorine combinations are only slightly affected. The aeration methods employed depend on the efficiency desired, and on the hydraulic head available. Jet aerators, such as are used at Ashokan and Kensico reservoirs on the Catskill water system of New York City, are most efficient, but require loss of 10 to 20 pounds pressure. At 10 pounds a properly designed nozzle with a 1-inch orifice, will discharge 72 gallons per minute, to a height of 7 feet. Cascades, which are much used in industries, comprise 3 or 4 open metal steps, or concrete steps, down which the water tumbles, impinging on each step. A series of slag-filled trays built vertically over each other, with screened or slatted bottoms, providing a fall of 18 inches from tray to tray, using about 5-foot head for 4 trays are termed tray aerators or trickling beds. They are more efficient than cas-

cades, particularly for removing musty tastes and odors imparted by algae, but are less effective than jet aerators. Compressed air can also be blown into the water mechanically through porous plates so set as to induce spiral flow. The patented Aeromix operates in a draft tube through which air at atmospheric pressure is sucked.

Tastes and Odors.—Tastes in water and the odors that are closely associated with them are caused by (a) dissolved gases, such as hydrogen sulphide, (b) organic matter originating in algae and other microorganisms, either living or in process of decay, (c) decomposing organic matter in general, (d) industrial wastes of which phenol is the most troublesome, (e) chlorine, either as a residual, or in combination with phenol or decomposing organic matter. Most tastes, except those caused by chlorine alone, can be removed by an oxidizing agent. One such agent—widely used—in over 1,200 American treatment plants—is activated carbon, which had its first application in 1930 at the New Milford treatment plant of the Hackensack Water Company. Its wide-scale adoption in 20 years amply testifies to its efficacy and economy, based on ease and flexibility of application and low cost. Activated carbon is produced by charring wood or a similar inexpensive material, and then subjecting the char to an activation process. The resultant carbon surface has a property, termed "adsorption," to attract and hold odorous substances present in the water.

As mentioned above, chlorine is most valuable for taste and odor control. It is a strong oxidizing agent which when present in water as free available chlorine, will convert many of the odorous compounds to oxidized, less objectionable forms.

Corrosion Control.—By the addition of lime or soda, to water containing free CO_2, in such quantities that unprotected metal pipes will be corroded and tuberculated, water can be maintained in such chemical balance that the pipe coating is not dissolved, and the metal is protected from corrosion. "Carbon dioxide tends to dissolve carbonates, and water containing enough free carbon dioxide to dissolve a coating of carbonates that has been previously deposited is said to be aggressively corrosive." [8] Of recent years, sodium hexametaphosphate (sold under the trade name of Calgon and Nalco-18) has come into increasing use, to combat corrosion and tuberculation in metal pipes. "Conflicting results have been reported. Recent disclosures cast doubt whether corrosion of mains is prevented by this treatment. It seems to be well established, however, that these metaphosphates secure the following results: (1) precipitation of iron already in the water or that due to corrosive action is prevented; (2) large tubercles are not formed in the mains, so that the pipe surface remains smoother than would otherwise be the case; and (3) the products of the corrosion of the small water piping in buildings do not collect and clog the piping." [13]

CONSERVATION

In *The Saturday Evening Post,* May 13, 1950, Hugh H. Bennett of the United States Conservation Service warns that cities and areas plagued by water shortages grow in number each year. In February 1950, the United States Geological Survey reported "some 50 areas where the supply of suitable water for household, industrial or agricultural use could become serious or already is critical . . . with adequate hydrological investigations . . . shortages in most communities can be met intelligently, or avoided, by making an approximate analysis of the quantity and quality of the water needed, and by designing the systems on the basis of reliable information on the sources of water to be developed. . . . The Geological Survey methods and technique for determining the dependable yield of present or prospective sources of water are available, and where carefully carried out, can afford confidence to a community and its industry that it has an adequate source of water on which to base its future." (*Engineering News Record,* Feb. 16, 1950.)

There is ample water, if properly conserved and developed. Carhart [16] declares that the runoff from annual rainfall, evenly spread over the United States, would yield 8.7 inches, whereas national demand for domestic, industrial and agricultural purposes, and irrigation, could be met by 1 to 1.5 inches of this available average supply. Although water supplies are not inexhaustible, the average citizen feels little compunction not to waste water; his interest in water resources ends at the bathroom tap. Recent restrictions imposed in New York City, and elsewhere, confronted the ordinary citizen with the exhaustible phase of his water supply, and the necessity to conserve dwindling supplies.

The conservation of ground water resources is particularly important, since heavy pumping near the seacoast lowers the water table to such an extent that sea water will flow landward, requiring the well to be abandoned. This has happened to the New York City wells on Long Island, to the deep wells at Atlantic City, and to wells in the Los Angeles district (Long Beach and along the coast from Santa Monica to Santa Ana, and the southwest Basin), in the Panhandle region of Texas, Savannah, and Brunswick, Ga.

Supplementing deficient supplies of fresh water by using desalted sea water has been considered by large seaside municipalities such as New York and Los Angeles, in view of the successful use of desalting equipment to supply thousands of persons on South Pacific Islands during World War II. Studies by the Metropolitan Water District of Southern California are presented by W. W. Aultman, Water Purification Engineer of the District, in the *Journal* of the American Water Works Association, 1950, p. 791, wherein he shows that treatment alone, by the cheapest method—vapor-compression distillation—will cost $1.25 per 1,000 gallons, excluding distribution costs, as compared to usual rates, including distribution charges, of 10 to 15 cents. Aside from the essential problem of costs, "from an engineering standpoint, there is no question that fresh water can be and is being produced from sea water. But within the foreseeable future, and in the light of current technological knowledge, there appears to be no possibility that it will be economically feasible to turn to the ocean as a source of domestic, industrial or agricultural water along either coast of the United States."

Powell and Bacon [17] recommended in 1950 to the American Water Works Association a local and regional survey of actual and potential surface and ground water resources, and an inventory of water requirement on a national basis; discouragement of overindustrialization on the critical watersheds; decentralization of large industries using great quantities of water; control of flood waters to avoid runoff of water needed

for supply; encouragement of use of desalted or salt water, to conserve water; expansion of the activities of the state and federal agencies controlling critical underground resources; coordination of activities of authorities controlling waste regulation and those concerned with the allocation and utilization of water resources.

A temporary Water Resources Commission was appointed by President Truman, January 1950, when the domestic water supply shortage became critical in several widespread areas of the country. It was directed "to make a prompt survey of the water-supply situation in this country, and report its recommendations to Congress for legislative action." The commission brought out 70 items in its "Outline of Policy," three dealing directly with those phases of water supply with which the present article is concerned. Briefly, the committee recommended that: (1) municipal works and metropolitan water districts should continue to be administered locally rather than federally, but coordinated into comprehensive basin (the drainage area of a major stream) programs; (2) utilization by water works of the storage facilities incidental to a multiple service reservoir system, should carry a financial charge; (3) basin program should consider the water supply needs of industries, particularly those utilizing the oil shales. Recharging of ground water reservoirs should be considered in basin programs, together with the economic possibilities of so storing excess flood waters (see discussion by Morris [18] of the Water Resources Commission).

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Consulting Engineer; Coauthor of "Waterworks Handbook."

FOOTNOTES.—

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WATER TABLE, *in architecture,* a projecting stone sloped on the roof to throw off water. It occurs in buttresses and other parts of Gothic architecture. In *hydraulic engineering,* the upper limit of the portion of the ground which is wholly saturated with water. In agricultural districts a lowering of the water table by reducing the supply of well water creates serious economic problems for the residents.

WATER THRUSH. Any of several species of North American warblers, genus *Sierus,* usually found near streams. The species include the ovenbird (*S. aurocapillus*) which breeds from northern Ontario to northern Georgia; the northern water thrush or water wagtail (*S. noveboracensis noveboracensis*); Grinnell's water thrush (*S. noveboracensis notabilis*); and the Louisiana or southern water thrush (*S. motacilla*). The plumage is olivaceous above and streaked below. See also OUZEL.

WATER TURBINE. See TURBINE; WATER WHEEL.

WATER VALLEY, city, Miss., and one of Yalobusha County seats; altitude 294 feet; 119 miles northeast of Jackson, the state capital; and 13 miles north of Coffeeville, the other county seat; on the Illinois Central Railroad. It was settled in 1855 by William Carr; incorporated in 1858, and chartered as a city in 1890. It was occupied by Federal troops during the Civil War. In 1873 it was made a county seat and that same year suffered from an epidemic of yellow fever. Its industrial prosperity long centered about the Illinois Central railroad shops. These were moved to Paducah, Ky. in 1929. It is an agricultural region, in which cotton is one of the principal products. A major activity is the growing and shipping of watermelons. The chief manufacturing establishments are a garment factory, axe handle factories, and a stave mill. The city owns and operates the local waterworks and obtains electric current from T.V.A. The government is vested in a mayor and board of aldermen. Pop. (1940) 3,340; (1950) 3,217.

WATER WHEEL, a machine by which the energy in falling water is utilized to perform mechanical work. Water, through its tendency to seek the lowest level—the point nearest to the center of the earth—acts as a motive power by its weight. When the water is confined, as in a vertical pipe, this weight becomes pressure. When the water has acquired a velocity in flow its motive power is called impulse. Water wheels adapted to these various conditions may be divided into two general classes—the "vertical," consisting of the "overshot," "breast" and "undershot" wheels; and the "horizontal," which includes a great variety of turbine or reaction wheels. The impact or impulse wheels are represented in both classes. The term water wheel is correctly applicable to all forms of water motors that rotate, but in this article it will be restricted to those of the vertical class. For those belonging to the horizontal class, see TURBINE.

The overshot wheel is so called because the actuating water is fed to it from the top. It is provided with a number of buckets fixed to its periphery in such a way that as the wheel revolves the buckets on the descending side have their tops upward, and being filled with water at or near the top of the wheel, the weight of the water exerts a downward pull and the axle of the wheel being free to turn in its bearings, a rotary motion is imparted to the axle from

which it is transmitted by belts or gearing to the mechanism to be operated. The water is admitted to the wheel by various methods, such as the overfall sluice, the penstock and the guide bucket, in all of which the water is guided in a course tangential to the perimeter of the wheel. If the water is in motion, that is, has a certain velocity, when it enters the wheel buckets, it acts partly by impact, but in usual conditions the motive power of the wheel is simply the weight of water in its descending buckets, which may be roughly estimated as the cubic content in feet of two-thirds of the number of buckets, multiplied by 62½ pounds. To obtain the greatest efficiency, the number of buckets, ought to be as large as possible and so arranged as to hold the water as long as practicable. The buckets vary in form, but the greatest effect is obtained from curved buckets, the «radial» giving only about 75 per cent of the power obtainable by the use of «elbow» buckets. Overshot wheels may be constructed of wood or iron in any size. The earlier forms were massive structures built of wood; the modern wheels are generally built of iron and are practically limited by construction problems to falls less than 60 feet in height. The average sizes range from 8 to 40 feet in diameter.

In the breast wheel the water is received by the buckets on a level with or but slightly above the axle of the wheel. It is most effectively employed in connection with falls ranging from 5 to 20 feet, and where the flow ranges from 5 to 90 cubic feet per second. The buckets are generally held in a curb, and, not being required to hold water, are set radially. Their number is made as large as possible, and they are set at such an angle that they leave the water vertically so as not to carry up water from the tailrace. The breast wheel is more effective than the overshot where the fall is low, since it can be made of nearly double the diameter and affords an increased facility for the reception and discharge of the water by the buckets, besides gaining some power from impulse.

The undershot wheel receives the water below its horizontal centre line. Instead of buckets it is equipped with a series of paddles or vanes fixed to the periphery in such a way that the flowing water passing under the wheel pushes against the paddles, causing rotation. It is usually set in a curb with a minimum amount of clearance for the escape of the water. The most effective curbs are concentric to the wheel, those set straight or tangential allowing too much waste. The paddles are set radially and inclined upward in order to be readily emptied of water upon the return side.

For falls not exceeding six feet, the most effective wheel is the Poncelet. In it the water acts in a manner very similar to its action in a turbine, and although not quite as efficient as turbines working under normal conditions, it is superior when working under a reduced water supply. The buckets are curved, and the water flowing along their concave sides presses upon them without impact and with greater effect than that of water impinging at right angles against buckets with plane surfaces. The effect of the wheels increases with the depth of the water, and the velocity of rotation is equal to about one-half the velocity of the flowing water. The simplest form of the «impact» wheel consists of a series of rectangular buckets fixed upon a wheel at an angle varying from 50 to 70 degrees to the horizontal. The water is conducted to it through a pyramidal flume set at an angle varying from 20 to 40 degrees, so that it strikes the blades nearly at right angles. The normal effect is about 5 per cent of the total mechanical power of the flow, but this may be increased somewhat by increasing the length of the paddles, so that the water exerts a combined impinging and pressing force.

In another form, known as the «impulse» wheel, a series of cup-shaped buckets attached to the periphery of the wheel are acted upon by a jet of water conducted by a pipe and delivered through a nozzle tangentially against the cups. More power is obtained by increasing the number of nozzles to two, or even four. Of this form the most notable are those of the Pelton type, which are extensively employed to work air compressors in mining operations. At first limited in usefulness to the locality of the power, the development of electric power transmission brought them into a greatly enlarged field of service. Such wheels are now operating under heads up to nearly 2,000 feet. A Pelton wheel in the service of the Southern California Edison Company, working under 1,900 feet head at 430 revolutions per minute, develops 1,600 horse power. This wheel has been running continuously since 17 March 1903. At a plant recently erected in Europe, a jet of water one and one-half inches in diameter under a head of 5,250 feet develops 3,000 horse power. The Rio Janeiro Traction, Light and Power Company operates a Pelton wheel with four nozzles under 900 feet of head. The power developed is equivalent to 20 000 horse power.

The efficiency of the turbine being so much greater than that of any type of vertical water wheel they are universally preferred except in the smallest water power developments. This statement, however, does not apply to the Pelton wheel whose efficiency is equal to the turbine, and is available where the head is too great for economical use in turbines. The largest vertical water wheel ever built in America was the Burden wheel, located on the bank of Wynant's Kill, which enters the Hudson River near Troy, N. Y. This wheel was of tension construction, the 264 spokes being one and one-half inch rods bolted to rosettes on the 12 inch shaft. Its diameter was 60 feet, and its face width was 20 feet. The water was brought to the wheel through a steel penstock which crossed the wheel transversely at its summit. Four gates at intervals in this penstock were in the constant charge of the wheelman who opened or closed them so as to keep the supply such that it would turn the wheel at a constant speed of two and one-half revolutions per minute. On the outer sides of the rim were circular cogged racks which engaged with pinions seven feet in diameter and nine inches face keyed to the shaft, which projected 31 feet into the mill. This wheel was in constant operation 45 years, much of the time running night and day for long periods. It was abandoned in 1898 as of insufficient power for the needs of the business, but remained intact for 15 years thereafter before it began to fall into decay. The largest water wheel in the world is that which supplies the ancient city of Hama with water for drinking and irrigation from the river Orontes —

about 120 miles north of Damascus. This wheel is of the undershot type, 70 feet in diameter and of comparatively narrow face. It is built of wood upon an iron axle.

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WATER WILLOW, common name of a number of species of herbs, as the American herb *Dianthera americana;* the purple loosestrife; the great willow herb; the swamp loosestrife; and the Eurasian willow, *Salix aquatica.* The water willow has long narrow leaves, it bears purplish flowers, small, in spikes. The willow herb, *Chamaenerion angustifolium,* grows in most parts of the north temperate zone; it is known also as fireweed and French willow.

WATER WORSHIP, a feature of nature worship, and one of the primitive superstitions of mankind. Water was not worshipped as an element, but in its various forms of well and spring, river and ocean. Every spring and river was supposed to have an animating deity, who could be propitiated or offended, and the worship of these divinities was a prominent part of Greek and Roman cult, especially in the rural districts. An excellent example of water worship, with a slightly different aspect from that of the Greek and Roman world, is the Hindu faith in the virtuous powers of the Ganges River. Particularly at the point where the Jumna flows into it, the Ganges is supposed to have power to heal and cleanse. Native belief is that the stream flows from the feet of Brahma, and it is this divine origin that endows the waters with curative powers. (See GANGES.)

WATERAGE, transportation of goods by water; also, the charge for such carriage of goods. In commercial use the word is similar, in construction and in manner of application, to *freightage, haulage, truckage.*

WATERBAILAGE, a duty assessed against goods upon delivery after being conveyed by water; in England formerly a customs charge levied by the city of London on goods shipped by water into or out of the city.

WATERBERG, geological designation of a formation of rock in South Africa. It applies to the uppermost stratum of sedimentary rock of the Paleozoic period preceding the Devonian. Sandstone, shale, and conglomerates are its principal components; some lavas are associated with it. The name is from Waterberg, South Africa.

WATERBORO, town, Maine, in York County, 21 miles west of Saco, on the Sanford and Eastern Railroad. The town is situated at an altitude of 285 feet and includes several small villages. Nearby are Little Ossipee Lake and Ossipee Mountain, 1,050 feet high, affording facilities for camping in summer and skiing in winter. Waterboro was settled in 1760 and incorporated in 1787. Pop. (1950) 1,071.

WATERBUCK, an African antelope of the genus *Kobus.* There are two species to which the name is applied, *K. ellipsiprymnus* and *K. defassa.* Closely related is the sing-sing, *K. defassa unctuosis,* of western Africa; its hair is not so coarse as that of the true waterbuck, and its coloration is more dominantly brown. Coloring of the waterbuck may vary from reddish brown to gray-brown. The neck hair is heavy, the tail is tufted. The males have long horns spreading out to form a broad-based V. The waterbuck has a band of white over the rump which does not appear in the sing-sing. All these species frequent watercourses; they are good swimmers. Some kobs of the related genus *Adenota* are frequently called waterbuck. The reedbuck is related, but smaller. The name is also written *waterbok.* (See ANTELOPE.)

WATERBURY, city, Connecticut, in New Haven County, one of the county's two seats, New Haven being the other. It is situated at an altitude of 280 feet, 32 miles northeast of Bridgeport, on the New York, New Haven and Hartford Railroad.

Location and Transportation.—Waterbury, fourth city of the state in population, following Hartford, New Haven, and Bridgeport, is approximately the same distance from each of these three cities. Hartford lies to the northeast, New Haven to the southeast, and Bridgeport to the southwest. The Naugatuck River, into which the Mad River flows near the city's southern boundary, empties into the Housatonic River 20 miles south of Waterbury. The city is the trading center for the northwestern section of the state. It has rail and motor bus and truck connections with other cities of the state, and fast service to New York and Boston.

Industries.—The chief seat of the brass industry in America is the Naugatuck Valley, of which Waterbury is the center. Its brass foundries produce brass and bronze to be further fabricated into sheets, rods and tubing. The mills also work in aluminum, steel, and many alloys. It produces a great variety of articles made wholly or in part of brass: buckles, wire, tubing, kettles, pins, clips, fasteners, eyelets, and many others. While brass is Waterbury's chief industry, its mills and shops produce many other kinds of goods: cutlery, automatic machinery, chemicals, buttons, metal hose, recording instruments, chromium and nickel plating, paper boxes, and so on. There are important machine shops and foundries. The manufacture of cheap watches was carried on here so extensively and successfully that the name "Waterbury watch" was known everywhere. The "dollar" watch also originated here. It is not so generally known that from the opening years of the 19th century Waterbury has been a leader also in the making of clocks. In 1914 Waterbury turned to the manufacture of war materials, and when war broke out again in Europe in 1939, and later when the United States program of production for defense was launched, the city's industrial activity was again accelerated. The Waterbury speed gears used on warships are made here.

Topography.—Waterbury is in the valley of the Naugatuck River, with hills on either side. The slopes roundabout have been largely denuded of their original cover of timber to supply fuel for the earlier brass works; ridges of granite hold the soil. The river flows through the city in a general north-to-south course; the railroad roughly parallels the stream, and the mills and shops follow the same line. The first settlement was on the west bank of the river (see section

History of this article); on the opposite side of the river and several blocks to the east is the civic center of today's community. About the Green are clustered the Masonic Temple, the Y.M.C.A. building, the First Congregational Church, Immaculate Conception Church, St. Johns Church (Episcopal), Hotel Elton, and various business and professional buildings. The streets are not laid out in geometric pattern, but present many irregular curves and angles. The Mad River flows through the eastern part of the city, then swings to the west and joins the Naugatuck.

Education and the Humanities.—Schools were at first administered by the town government, and later by a "school society." Under this latter control the town was divided into 14 school districts. In 1849, chiefly with a view to establishing a high school to take the place of the earlier academy, five of the districts were consolidated as a central district, and this was placed under the management of a board of education, a finance committee, and a superintendent. In the outlying districts the former system of control by a board of visitors was retained. In 1899 the control of the central district was simplified; the powers and functions of the earlier and somewhat cumbrous organization were concentrated in the board of education. Even when the city was made coterminous with the town in 1901, the traditional status of the outlying districts was preserved, but later the distinction was dropped and a system of unified control was adopted. The public school system includes kindergarten, grammar, and high schools, with departments of domestic science and manual training. There are parochial schools, elementary and high; Notre Dame Academy was established in 1869. Well known Waterbury schools have been Saint Margaret's School for girls (Episcopal, diocesan), and McTernan School for boys. The Silas Bronson Public Library was opened in 1870. The Mattatuck Historical Society, organized in 1877, was incorporated in 1902; it maintains colonial collections, a children's museum, and a genealogical library. Dating from the 1880's are the Waterbury Club and the Women's Club; from the 1890's, the local Daughters of the American Revolution, and the Naturalists' Club. The Waterbury branch of the Young Men's Christian Association was established in 1858, only six years after the first society in this country was formed. In addition to the customary social, civic, and service organizations, the city has many philanthropic and charitable enterprises, homes and hospitals. With these complementing its qualities as an industrial center, Waterbury makes liberal provision for the humanities of community life.

Parks and Monuments.—At one end of the Green stands a Civil War memorial, the Soldiers Monument, with cannon mounted about it. The sculptor was George E. Bissell; this particular one of his many works was done in 1883–1884. Bissell married Mary E. Welton of Waterbury. At the other end of the Green is a memorial fountain presented to the city by Caroline J. Welton, a Waterbury woman who was one of the group that organized the state humane society. The city's largest parks are Hamilton in the southeastern and Fulton in the northern sections. In 1939 the city completed a municipal stadium and athletic field. Hamilton Park contains a city zoo, athletic fields, swimming pools, drives and trails; in it is an old water wheel used about 1845 in a brass mill. Fulton Park has lawns and gardens; the rock garden especially is noteworthy. There is a bird sanctuary in this park. The park provides excellent recreational facilities. Riverside Cemetery, west of the Naugatuck, was opened in 1853, and is notable for its park-like beauty. Also on the west bank of the river, near the site of the first settlement, is Chase Park. At the entrance to the park, opposite a concrete bridge spanning the Naugatuck, is the Pilgrim Memorial, and a boulder with tablet marking the site of the first settlement.

Buildings.—The city hall and the public library are just south of the Green, in a triangle formed by Meadow, Grand, and Field streets. The municipal building is one of several in the city designed by Cass Gilbert (1859–1934), architect of the Capitol in St. Paul; the Essex County courthouse in Newark, N. J.; the Woolworth Building in New York, and of public buildings in many other large cities. Here in Waterbury are several specimens of his skill: the Chase Infirmary, the Waterbury Bank, and the Waterbury Club's house. The city hall is a three-story structure of marble and brick, with a belfry. It is approached through a formal garden, with a fountain. The Silas Bronson Library building is of brownstone; in its grounds stands a statue of Benjamin Franklin by the Connecticut sculptor Paul Wayland Bartlett (1865–1925), of whose work specimens are to be seen in the Library of Congress, the Stock Exchange in New York, the New York Public Library, in Boston, and in other cities. Between these buildings and the Green are the office building of a brass company, another Gilbert design, and the home of the Mattatuck Historical Society. Opposite the library is the railroad station, having a clock tower copied from one in Italy.

History.—Salient facts in the history of Waterbury are that it was settled in the 1670's; was set off from Farmington and incorporated as a town in 1686; received its charter as a city in 1853, and was consolidated with the town by a charter amendment in 1901. Some apparent discrepancy in the assigning of a date of settlement is accounted for by the fact that in 1674 families from Farmington (itself settled in 1640 by migrants from Hartford, and incorporated some five years later) settled on the high land on the west side of the river; the site of this settlement has ever since been known as the Town Plot. This settlement was abandoned in King Philip's War, and in 1677 a new one was made, on the other side of the river, nearer to Farmington; this second site has been known as the Town Spot. The 31 householders who formed the settlement, upon order of the General Court and payment of some £2,500, built their houses about the Green; it is said they entered into an agreement fixing the minimum dimensions of the houses at 16 by 18 feet. Settlement of Connecticut antedated the foundation of Waterbury by only four decades; it was in the 1630's that colonists from Massachusetts began reaching out to the west for new lands and new homes. Their first settlements were planted in the Connecticut Valley; for Hartford, the year was 1635. New Haven was settled in 1638. By the time of Waterbury's permanent settlement the colony of Connecticut had received its royal charter, and was developing such powers of self-government as the colonial system per-

mitted, and (as is perceivable in retrospect) developing the American ambition for independence which in another century was to bring on the Revolution.

The site of the Waterbury settlement was called by the Indians "Matetacoke," meaning "land without trees." This name was contracted to Mattatuck, and that was the name under which the town received separate incorporation, upon being cut off from Farmington, of which it was originally a part. At the time of that incorporation, 1686, the locality was a part of Hartford County. For more than a century the town's growth was slow. In addition to the natural disadvantages of its situation for a community dependent upon agricultural pursuits it underwent such setbacks as the "great flood" of 1691 and the "great sickness" or epidemic of 1712. Long afterward, in 1902, the city's business section was destroyed by fire.

With the advent of the 19th century, Waterbury's history moved over into industrial territory. The very conditions that had surrounded the settlement of the town and limited its agricultural prosperity became now an important and favorable factor in its development. Under the discipline of poverty and hardship a group of men had grown up who possessed inventive genius, initiative, ideals of thrifty administration, endurance, and determination to achieve. The farmers' sons became manufacturers, makers of clocks and buttons. The streams furnished power for small mills and factories, whose products met the growing demands of the time. It was in response to these demands, emphasized by the War of 1812, that Waterbury began to establish itself as the center of the brass industry. Crude early methods of manufacture were superseded by new processes. Skilled artisans were brought in from England. These Connecticut Yankees were not mere imitators; they added skill to skill, and improved upon their models.

Population.—Waterbury's industrial history has a supplement in the steady inflow of workers of foreign birth or descent. When the first federal count was taken, in 1790, Waterbury's population was somewhat less than 3,000. In 1850 it was 5,137; and in 1900, 51,139; in 1940 it was 99,314, and in 1950, 104,477.

WATERBURY, town, Vermont, in Washington County, ten miles north-northwest of Montpelier, at an altitude of 425 feet, in the valley of the Winooski River; and on the Central Vermont Railroad. It contains the villages of Waterbury and Waterbury Center. Industrial enterprise centers upon woodworking and the processing of dairy products. There is a public library in Waterbury village; it has a museum. A state hospital for the insane is located here; it has farms, a laundry, and a cannery for its own maintenance. In 1927 the village suffered heavy loss of life and property, when floods swept through the streets and washed many buildings from their foundations. Two miles distant is Green Mountain Power Plant No. 1. It is in a gorge at a spot where an island of rock breaks the river into two swift channels, and the water boils over projecting ledges. On the edge of the gorge is a lookout. Pop. (1950) 4,276.

WATERCOURSES, *in law,* streams of water usually following a well-defined channel and emptying into some other body of water. A watercourse need not maintain a constant current, but it must be more than an occasional stream, the result of unusual rains or the melting of snow and following a channel customarily dry. See RIPARIAN RIGHTS.

WATEREE, a river of South Carolina, formed by the junction of the Catawba River and Fishing Creek, and is called the Catawba in the upper part of its course. It is about 315 miles long and runs nearly southward, forms the east boundary of Chester, Fairfield and Richland counties, and unites with the Congaree River at the southwest extremity of Sumter County to form the Santee River.

WATERFALL, a sudden descent in the water of a river or stream from a higher to a lower level. When the water falls over a precipice it is called a cataract, and when several cataracts occur in succession it is called a cascade. Where the incline is less steep and there is merely a stretch of very swift and tumbling water, the term rapid is commonly used. Some of the mountain waterfalls are remarkable for their height, while others are noted for the fall of immense quantities of water.

The most remarkable waterfall in the world is Niagara Falls on the Niagara River, between lakes Erie and Ontario, and thousands of visitors from all parts of the world have admired the sublimity of these falls. Waterfalls are now being utilized to furnish both electric and water power for commercial purposes. The falls discovered by Dr. Livingston in Africa and named by him Victoria Falls, the falls of the Ruikanfoss in Norway, the Cascade of Gavarnie in the Pyrenees and the falls of the Rhine are among the most beautiful in the world, and justly celebrated. Falls are characteristic of a youthful stage of river erosion, and are usually caused by unequal hardness of the rock, the softer being worn down the faster, and giving rise to inequalities in the river bed. After the softer beds are cut down as low as they can be eroded, the rivers more slowly cut away the harder layers, and the fall gradually disappears. For a fuller description see CATARACTS.

WATERFORD, town, Connecticut, in New London County, at an altitude of 44 feet, 3 miles southwest of New London, served by the New York, New Haven and Hartford Railroad. It has textile and paper mills. Incorporated in 1801, it is governed by a board of selectmen. Pop. (1950) 9,100.

WATERFORD, maritime county, Ireland, in the province of Munster, bounded on the north by Tipperary and Kilkenny, on the east by Wexford, on the south by the Atlantic Ocean and on the west by Cork and Tipperary. Its greatest length is 51 miles and greatest breadth, 23 miles. The name derives from the Danish Vadre-fiord. The Gaelic name is Port Láirge. The Knockmealdown Mountains run east and west between Waterford and Tipperary. The chief harbors are Waterford and Tramore. The Blackwater is the chief river. Main towns are Cappoquin, Dungarvan, Lismore and Waterford. Until recently there was a part of the eastern portion of the county called the Decies where the language of the people was entirely Gaelic. The occupation of the people in nonurban areas is farming. Area 454,278 acres. Pop. (1951 prelim.) 75,062.

WATERFORD, city, Ireland, capital of County Waterford. It is about 100 miles due south of Dublin and is situated on the southwest bank of the river Suir. It is connected with Ferrybank, on the opposite side of the river, by a ferroconcrete bridge, 832 feet long. Waterford is an important railway station on the line running from Mallow to Wexford and Rosslare, in connecting with the cross-channel service. The Gaelic name for the city is Port Láirge. The town was founded by the Danes in 873 A.D. but its authentic history may be considered as beginning with the arrival in 1170 of Strongbow and a large force of Anglo-Norman invaders. After slaughtering most of the inhabitants Strongbow married Eva, daughter of the King of Leinster. Hook Head and Crook Head are promontories near the city and it is said that the phrase, "by hook or by crook" arose from a statement made by one of the invaders that if he did not get in by Hook he would get in by Crook.

Waterford harbor is not especially good but vessels drawing 22 feet can discharge at the quays. The local industries include breweries, foundries, jute, margarine, bacon, flour mills, polish, and glass factories. It is here that the famous "Waterford Glass" originated. Pop. (1951 prelim.) 28,689.

WATERFORD, village, New York, in Saratoga County, on the Hudson River at the mouth of the Mohawk River, 10 miles north of Albany at an altitude of 38 feet and served by the Delaware and Hudson Railroad. Here is the junction of the Champlain and Erie divisions of the State Barge Canal which entails the handling of canal traffic, a considerable item in the local industrial schedule. Settled by the Dutch out of Albany about 1640, the village originally was named Half Moon after Henry Hudson's ship whose crew explored the Hudson River as far as Waterford in 1609. The village, incorporated in 1794, is the business center. Contiguous is an industrial and residential area known as Waterford Town.

Waterford has an important place in history. Originally a trading center it was for many years the center of fierce fighting between various Indian tribes. In 1691 Waterford was the site of Half Moon Fort, a defensive outpost against the Canadian Indians. Here was the crossing place of Abercrombie's 1758 army, later defeated at Ticonderoga; here Kosciusko, under General Schuyler, erected earthworks to stop the advance of General Burgoyne; and it was here that Thomas Moore, the Irish poet, wrote a poem after visiting the neighboring Cohoes Falls. On Haver Island is a bleachery connected with the manufacture of shirts and collars. Also here are important chemical plants and valve works. Pop. (1950) Waterford Village, 3,025; Waterford Town, 6,075.

WATERHOUSE, Alfred, English architect: b. Liverpool, July 19, 1830; d. London, Aug. 22, 1905. He studied architecture under Richard Lane in Manchester and afterward in France and Italy. He began practice in Manchester in 1853 and first made his name known by the Assize Courts of that city. For the same city he afterward designed the county jail, Owens College, the town hall, Saint Mary's Hospital and other buildings. In other parts of England he was responsible for the following among other buildings: in Liverpool, Seaman's Orphanage, Turner Memorial Home, Royal Infirmary and University College; in London, Natural History Museum, New St. Paul's School, City and Guilds Central Institution, King's Weigh House Chapel and University College Hospital; in Oxford, Balliol College (partly rebuilt); in Cambridge, Caius and Pembroke colleges (partly rebuilt); in Leeds, Yorkshire College; the mansions of Eaton Hall (Cheshire), Heythrop (Oxford), and Iwerne Minster (Dorset).

He was elected an Associate of the Royal Academy in 1878 and Royal Academician in 1885, and in 1898 became treasurer of the academy. He received a Grand Prix from the Paris exhibition of 1867 and was a member of various foreign academies. In 1878 he was awarded the gold medal of the Royal Institute of British Architects, of which he was president 1888–1890.

WATERHOUSE, John William, English painter: b. Rome, Italy, 1849; d. London, Feb. 10, 1917. He studied at the Royal Academy but was largely self-taught. His paintings are noted for the richness of their coloring. His paintings include *The Oracle* (1884); *Echo and Narcissus*; *The Magic Circle; The Lady of Shalott; La Belle Dame sans Merci; Hylas.*

WATERLAND, Daniel, English clergyman: b. Lincolnshire, Feb. 14, 1683; d. Dec. 23, 1740. He studied at Cambridge, became master of Magdalen College, chaplain to George I and canon of Windsor. Waterland was an able defender of the Orthodox faith against the Deists. His chief writings are *A Vindication of Christ's Divinity, being a Defense of some Queries relating to Dr. Clarke's Scheme of the Holy Trinity* (1719), followed by a second (1723) and third (1725) *Vindication;* a *Critical History of the Athanasian Creed* (1724), also directed against Clarke; *Christianity Vindicated Against Infidelity,* a reply to Tindal's *Christianity as old as the Creation;* and a *Review of the Doctrine of the Eucharist* (1737), directed against Hoadley's rationalistic theory of that ordinance.

WATERLOO, city, Illinois, seat of Monroe County, 26 miles south of St. Louis, Mo., on the Gulf, Mobile and Ohio Railroad. It is situated at an altitude of 717 feet in a fertile agricultural region, in which the chief products are wheat and corn. In the vicinity are quarries of fine building stone, known in the trade as Waterloo marble. The chief manufacturing establishments are flour mills, marble works, an ice factory and a hatchery. There are large stockyards and coal and lumber yards. The educational institutions are a high school, founded in 1891, public and parish elementary schools and a school library. Until the passage of strict marriage license laws in 1937 the city was known as the Gretna Green of the St. Louis area. Pop. (1950) 2,821.

WATERLOO, city, Iowa, Black Hawk County seat, 52 miles northwest of Cedar Rapids on the Cedar River, and on the Illinois Central, the Chicago, Rock Island and Pacific, the Chicago Great Western, and the (electric) Waterloo, Cedar Falls and Northern railroads, and three federal highways. At an altitude of 856 feet, it is in a farming, dairying and stock-raising region, and is headquarters of the National Dairy Cattle Congress and the Na-

tional Belgian Horse Show. There is abundant and cheap power from the Cedar River, here about 800 feet wide. The Illinois Central has big repair shops here. Factory products are: meat packing, tractors and other farm and dairy machinery, washing machines, soy bean processing, caskets and refrigerators. The city has 12 parks with a total area of 350 acres. The educational institutions include public elementary and high schools—the East High School, founded in 1872, and the West High School, in 1870, and four junior high schools. The Roman Catholic Church maintains four parochial elementary schools and one high school. There are two business colleges. The city has two public libraries and five hospitals. There is a symphony orchestra. The *Courier,* evening and Sunday newspaper, was established in 1858.

The settlement was first known as Prairie Rapids, the name given to it by the Hanna family, its first settlers. The name became Waterloo in 1851. The city was settled in 1845–1846 and was incorporated in 1868. The growth of the city was very rapid. The government is vested in a mayor and a council of six members elected every two years. Pop. (1950) 65,198.

WATERLOO, village, New York, one of the two Seneca County seats on the Seneca River, midway between the northern ends of Seneca and Cayuga lakes, 57 miles southeast of Rochester at an altitude of 450 feet and on the New York Central, and the Lehigh Valley railroads. Fine farm country surrounds the village. Waterloo's industries are the making of sauerkraut and pickles, canning, and production of automobile bodies. In the center of the village is Lafayette Park, beside which stand the county buildings and a modern high school. Pop. (1950) 4,438.

WATERLOO, a manufacturing city in Ontario, Canada, in the county of the same name, immediately adjacent to the city of Kitchener (q.v.) with which it is connected by electric railway. It is surrounded by an excellent mixed farming and dairying district traversed by highways which supplement the services of branches of the Canadian National and Canadian Pacific railways. Of its 54 industries, the most important is one of the largest liquor distilleries in Canada. There are also ten furniture factories, as well as large manufactories of bicycles, miscellaneous cotton goods, cooperage, paper boxes and bags, and agricultural instruments. The total value of industrial products is $29,096,975 representing the employment of 2,647 persons (1949). Waterloo is also noted as the headquarters of three life and two fire insurance companies, a health and accident insurance company, and a trust company. The city has ten churches, three public schools, a separate school, a collegiate institute, a technical school, a public library (16,957 vols.), a park and tourist camp, a weekly newspaper, an airport, four banks, and a Chamber of Commerce.

The county of Waterloo was to a considerable extent settled by Mennonites ("Pennsylvania Dutch" in local parlance) who came from the United States soon after 1800, and over 60 per cent of its present population derives from that origin. This conduced to the establishment in Waterloo city of a Lutheran Evangelical Seminary in 1911 which developed into the Waterloo College School in 1914 and into the Waterloo College of Arts in 1925. The latter is now an affiliated college in Arts and Theology of the University of Western Ontario (London). Pop. (1951) 11,079.

WATERLOO, county town, Quebec, Canada, in Shefford County, about 60 miles southwest of Montreal on the Canadian Pacific and Canadian National railways. Waterloo Lake on which the town is situated is an expansion of the Yamaska River. There are 18 local industries which employ 758 persons and manufacture to the value of $4,339,105 (1949), the two largest being a manufactory of plastic products. The town was incorporated in 1890, though the neighborhood (devoted to mixed farming) was settled early in the nineteenth century. There are three churches, a classical college, a high school, a convent, a business college, two weekly newspapers, two banks, and two public parks. Pop. (1951) 4,027.

WATERLOO, town, Sierra Leone colony, Africa, on the Sierra Leone Peninsula, 17 miles southeast of Freetown, with which it is connected by a narrow gauge railway. It is a center for trade in kola nuts, ginger and rice. It was the site of the colony's chief airfield until 1948 when it was removed to Lungi, 10 miles north of Freetown. Founded in 1819, it has a Roman Catholic mission. Pop. (1931) 2,312.

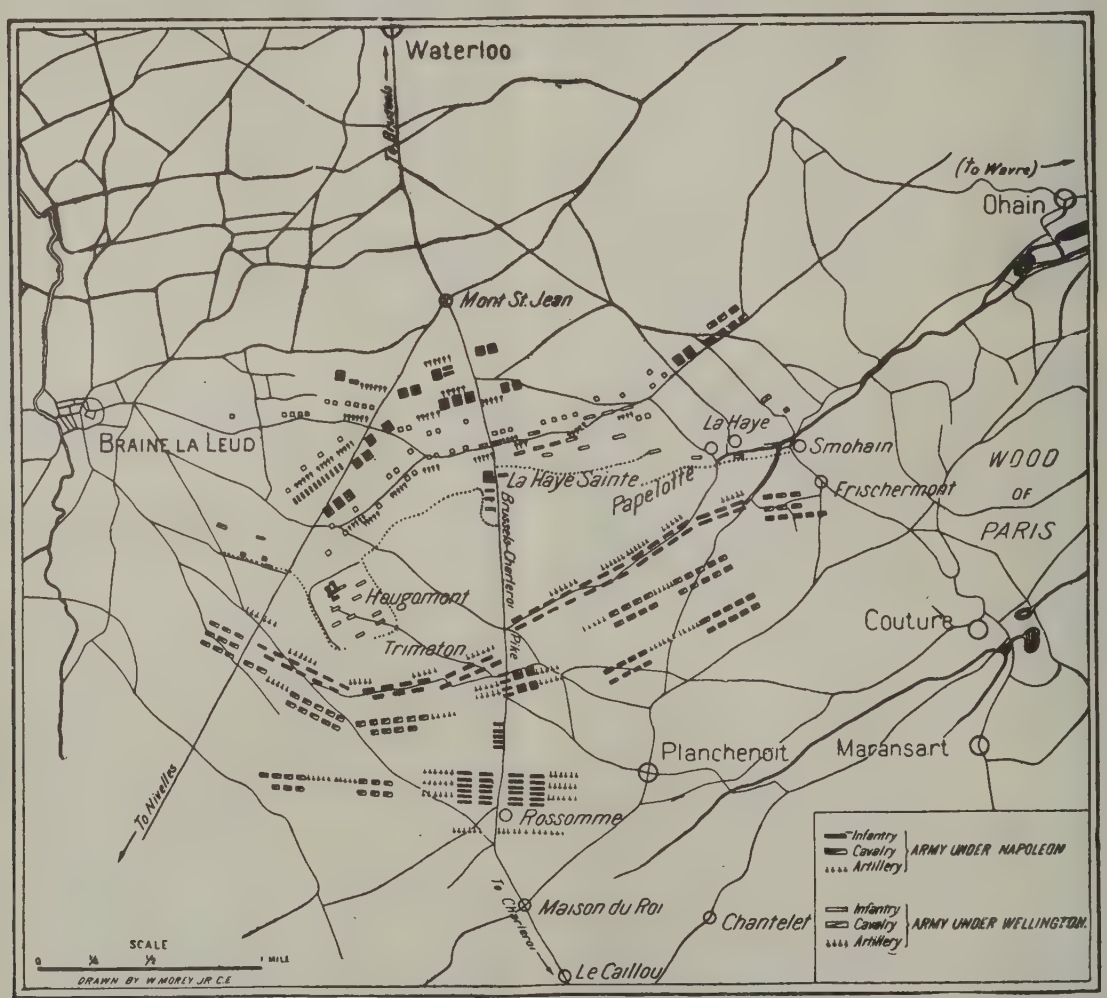
WATERLOO, village, Wisconsin, in Jefferson County, 21 miles northeast of Madison. Situated in a dairying region, its manufactures are chiefly dairy products. Pop. (1950) 1,667.

WATERLOO, Battle of, the culminating engagement of the shortest and most decisive of all of the Napoleonic campaigns, was fought June 18, 1815, near the village of Waterloo, in Belgium, situated about 12 miles south of Brussels. From April 11, 1814, when Napoleon signed the first abdication and retired in exile to Elba, until March 20, when he terminated the period of that retirement and returned to Paris, the political and domestic affairs of France had been bordering on revolution. Although the administration of affairs by the government established by the Comte du Provence, who, under the title of Louis XVIII, had taken unopposed possession of the country, restored political liberty, the changes inaugurated were so sudden, that they unsettled all domestic affairs, the title of estates, the position of public men, and the prospects of the army to an intolerable extent. A general sense of alarm and humiliation prevailed among all classes, and even a Napoleonic period seemed preferable to the existing conditions. To add to the general turmoil, about 300,000 troops who had been held as prisoners in the various German fortresses were released under treaty stipulations and returned to France. Their apparent availability for further operations soon formed the basis for innumerable military plots of which that designed by Fouché, with the ultimate object of placing either the duke of Orleans or the king of Rome upon the throne, was the most important.

Napoleon was fully conscious of the existing state of affairs. France was down, groveling at the feet of the Allies. Here was the

opportunity for a truly patriotic action. He would give popular liberty to imperial France, and henceforth devote all his energies to strengthen that liberty and increase that prosperity. He counted upon the enthusiastic support of the army which was fretting under the command of emigrés who had once fought against France, but were then being appointed to important commands, and felt sure of the effect of his tremendous military fame upon the general military feeling of the country. He thought of Marengo; how in three short months he had lifted France and himself from

army amounted to about 500,000 men, on paper, but only about 200,000 men were available for actual field service. In planning the campaign, Napoleon had the choice of confining himself to purely defensive operations and allowing the Allies to invade France, or of assuming the offensive, and relieve her of the consequences of a second invasion. He chose the latter, and laid the scene of the campaign in Belgium where the English under the Duke of Wellington had their headquarters at Brussels, and the Prussians under the command of Marshal Blücher, at Namur.



Field of Waterloo. (Showing positions of the two armies at 11 A. M., 18 June 1815).

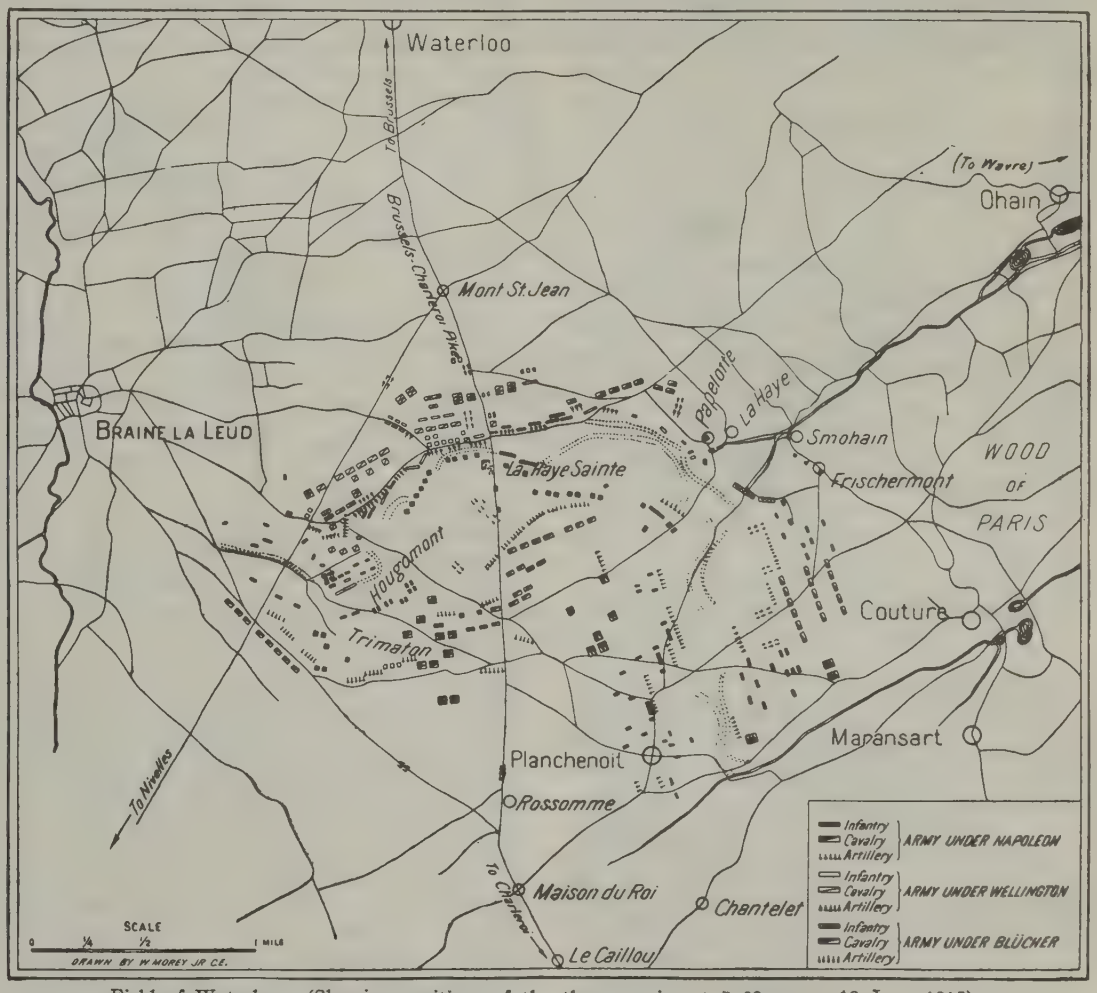
the lowest ebb of fortune up to the highest pinnacle of military glory and power. He judged correctly in all these things. He left Elba 20 February, and landed on the coast of France 1 March, and entered Paris triumphantly 20 days later.

While Napoleon was inaugurating the Hundred Days with professions of peace and liberty, the Allied Powers suspended negotiations at the Congress at Vienna, issued a declaration branding him as "an enemy and disturber of the peace of the world," and formed a new Coalition to renew the struggle against him. By the beginning of June they had more than 700,000 men in the field, and he was compelled to take active measures to defend his newly recovered empire. The French

The general plan of operations was based upon his favorite form of strategy — action on "interior lines" against the two armies opposed to him. He assumed that Wellington and Blücher would endeavor to form a junction at Charleroi, and determined to concentrate the bulk of his own army at that point and defeat them separately before they could effect that junction, and then turn his attention to the force of Austrians and Russians gathering on the eastern border under the command of Prince Schwarzenberg.

At the beginning of the campaign the French army numbered 124,588 men — 89,415 infantry, 23,595 cavalry, 11,578 artillery with 344 guns. Wellington commanded 93,717 men — 69,829 infantry, 11,879 cavalry, 9,406 artillery and

engineers, with 196 guns. The Prussian forces under Blücher amounted to 120,954 men—99,715 infantry, 11,897 cavalry and 9,360 artillery, with 312 guns. Wellington's forces, composed of Englishmen, Dutch, Belgians, Nassauers, Germans and Brunswickers, were stationed in numerous cantonments scattered over a large area around Brussels, and to the westward of the Brussels-Charleroi pike leading to the south, with the coast as their base. Of Blücher's force the First corps, under Ziethen, was at Charleroi, the Second, under Pirch, at Namur, the Third, under Thielmann, at Ciney tacked the Prussians at Ligny, and after three hours of severe fighting, defeated them and captured 21 guns. The battle was desperate and bloody; about 12,000 Prussians fell, and in the final charge of the Guard, Blücher himself was wounded. This was Napoleon's last victory. As the result of the battle, he assumed that the Prussians had been routed and were retreating to their base by way of Namur and Liège, when, as a matter of fact, under the direction of Gneisenau, Blücher's chief of staff, they were moving northward and converging on Wavre, with the intention of join-



Field of Waterloo. (Showing positions of the three armies at 7.30 P. M., 18 June 1815).

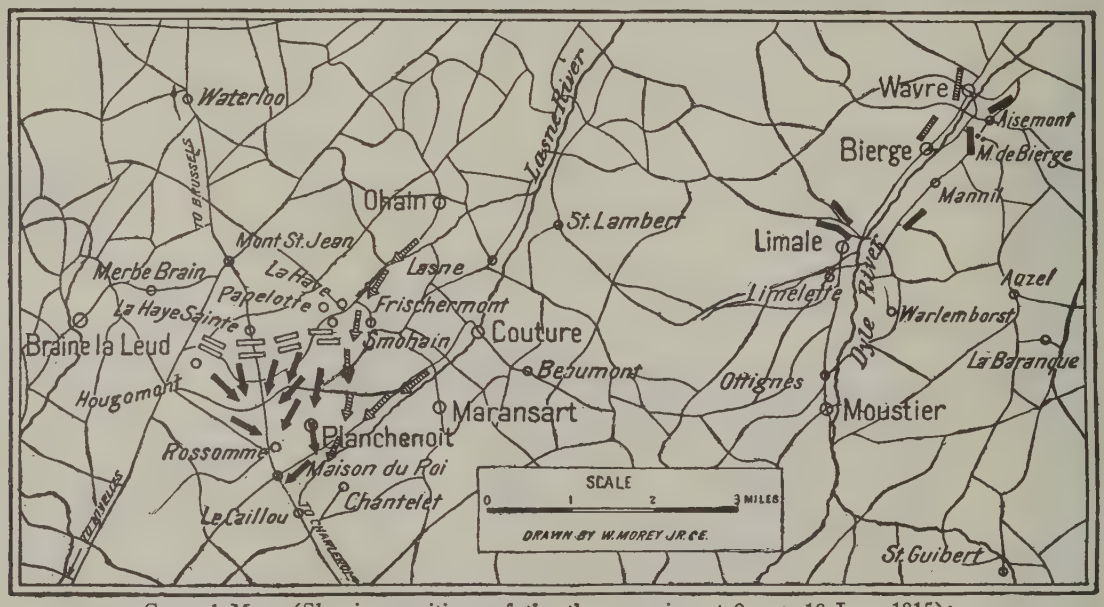
and the Fourth, under Bulow, at Liège, with the Rhine as their base.

The movement began on 13 June. The French army advanced rapidly northward, crossed the Sambre on the afternoon of the 15th, attacked Ziethen's position, drove him back upon Fleurus, and occupied Charleroi. A portion of the army then continued the advance through Gossilies to Quatre-Bras where they met a force of 25,000 men under Wellington, on the afternoon of the 16th, and after several hours of hard fighting were driven back upon Frasnes. In the meantime, with the intention of blocking the road between Quatre-Bras and Sombreffe so as to separate the forces under Wellington and Blücher, the troops commanded by Napoleon himself at-

ing Wellington, with whom they were in constant communication. About noon of the 17th, Napoleon detached Grouchy with 33,000 men to pursue and complete the defeat of the Prussians driven back at Ligny, while he himself with the main body of the army joined Ney and followed Wellington, who, although victorious at Quatre-Bras, had been forced to fall back northward toward Brussels on account of the defeat of the Prussians at Ligny. Wellington's retrograde movement was continued during the whole of the 17th, until he had reached the heights of Mont Saint Jean, about four miles south of the village of Waterloo, where the Prussians could join him by way of Ohain and Wavre. Here he selected his position, and confident of their assured

support, he awaited the advance of the emperor.

On the afternoon of the 17th, when Napoleon reached Marbain, he received the information that the Prussians defeated at Ligny had not retreated to Namur and Liège, and he sent a message to Grouchy informing him of that fact, and instructing him to find out if the Prussians were moving to a junction with Wellington. When Grouchy received this message he was actually farther from the Prussians than the Prussians were from Wellington, and about the time he reached Gembloux, about 10 o'clock on the night of the 17th, only



General Map. (Showing positions of the three armies at 8 P.M. 18 June 1815):

rear of Wellington's position, and thus cut off his retreat in the direction of Brussels and his base of supplies. The best authorities concede that the plan was admirably conceived.

About 8 o'clock on the morning of the 18th, Wellington drew up his forces in line of battle, but although the rain which had been falling all night ceased about that time, the attack by the French was postponed so that the ground might be in better condition for artillery movements. A little before 9 o'clock Napoleon reviewed his lines, and about 10 o'clock he sent instructions to Grouchy to advance upon the Prussians at Wavre. The battle commenced

to learn that the Prussians had really marched to Wavre, the main French army had reached the field of Waterloo and bivouacked opposite the forces of Wellington. It was past midnight when Napoleon inspected the position of both armies. The main line of Wellington's forces occupied an advantageous position along the highway that runs from Braine la Leud to Wavre by way of Ohain, with the centre resting on the Brussels-Charleroi pike, while strong outposts held the farm house of La Haye Sainte directly in advance of the centre, the hamlets of La Haye, Papellotte, and Smohain on the extreme left, and the chateau of Hougomont on the right. His force consisted of 67,661 men — 49,608 infantry, 12,-408 cavalry and 5,645 artillery with 156 guns. Of these the British troops numbered only about 24,000. Napoleon had 71,947 men — 48,-950 infantry, 15,765 cavalry and 7,232 artillery with 246 guns. He arranged his troops in two lines diagonally across the Brussels-Charleroi pike, the right resting on Frischermont, and the left across the road to Nivelles, with a strong force of infantry, cavalry and artillery stationed in the rear on both sides of the Charleroi pike near Rossomme.

Early on the morning of the 18th, he dictated his plan of battle, the direct object of which was to capture the village of Mont Saint Jean lying on the Charleroi pike directly in the at 11.30. As a diversion, a division of Reille's corps assaulted the British position at Hougomont, were repulsed, and were supported by division after division until the entire Second corps were in action against Wellington's left, and therefore did not take any part in the main attack on the British centre by D'Erlon about 1.30. In this attack, the advanced troops of the British right, composed of Bylandt's brigade, were easily routed, but the advancing French received a terrific fire from Picton's brigade, and being charged by the British cavalry, fell back in great disorder. Here General Picton who probably commanded the British right was killed. In the meantime, assault upon assault was made by the French on La Haye Sainte, which occupied the greater part of the afternoon, while for two hours, from 4 to 6 o'clock, under the personal direction of Ney, the splendid cavalry divisions of the French were hurled against the British right-centre, but failed to break the formation of a single British square. The cavalry attack being unsupported by infantry, Ney was compelled to withdraw for lack of troops, about 6.30, just as La Haye Sainte was taken, too late to be of any advantage. About the middle of the afternoon Napoleon discovered the advance guard of the re-enforcing Prussians on the hills of Saint Lambert about three miles away upon his right, and realized for the

first time that the entire Prussian force had succeeded in concentrating at Wavre, and were now on hand to aid Wellington. He immediately detached Lobau with the Sixth Corps, to intercept the new enemy, and sent a message to Grouchy, ordering him to return. Grouchy in the meantime, having moved off to Wavre in search of the Prussians, did not get this message until evening.

Lobau being unable to check the advance of the Prussians, the Young Guard was sent to re-enforce him, and then, believing that his right was secure, Napoleon massed the eight remaining battalions of the Imperial Guard for a final attack upon Wellington's center. Supported by a terrific artillery fire, and led by Friant, the Guard advanced, while D'Erlon hurled the First Corps against the British right. D'Erlon's assault was effective, but the Guard, decimated by a heavy fire from Maitland's brigade, supported by those of Halkett and Elphinstone, were repulsed with terrific loss and fell back in complete disorder before the impetuous charge of the 52d regiment. Just then, about 7:30, the main body of the Prussians arrived, and going right into action, attacked the French right and threw it into confusion. At that moment, Wellington, seeing that victory was assured, ordered a general advance of his lines and decided the contest. His troops, however, were too far gone to engage in the pursuit, which was taken up by the Prussians with vigor, and the retreat soon became a rout. Napoleon left the field in the center of a square of the Imperial Guard. He left this at Genappe, and arrived at Charleroi at daybreak with a small escort of horsemen. He reached Paris 21 June, and signed the second abdication on the 22d. The entire campaign had lasted but three days, and the battle itself, one of the most remarkable and terrible of modern times, was decided in eight and a half hours. The French lost in killed, wounded and missing, about 31,000 men, and the Allies, about 23,000.

Bibliography.—The literature upon the subject is very extensive, but for the most reliable and exhaustive information consult Ropes, J. C., *The Campaign of Waterloo* (New York 1892); Chesney, *Waterloo Lectures* (London 1874), and Gardner, *Quatre-Bras, Ligny and Waterloo* (London 1882).

WATERMAN, Nixon, American author: b. Newark, Ill., 12 Nov. 1859. He was connected with the Omaha *World-Herald* and *Bee* 1887–90; the Chicago *Herald* and *Post* 1890–93; after 1895 becoming engaged in literary work he gave readings from his works and lectures on humorous topics. His works include *A Book of Verses* (1900); *In Merry Mood* (1902); *Io from Iowa* (1911); *Boy Wanted* (1912). He died at Canton, Mass., 1 Sept. 1944.

WATERMELON. See Melons.

WATERPROOFING, the art of rendering various substances impervious to the penetrating action of water. The purposes to which waterproofing is now applied are very numerous and the methods range from the early use of lead for sheathing building foundations, of tar for tarpaulin, oil for oilskin, rubber for clothing, to various painting processes which claim for bases, substances capable of resisting the natural action of the elements, and which, invisible, impenetrable, insoluble and imperishable, effectually render brick, stone, marble, terracotta, stucco, concrete, etc., impermeable to water. These processes are used to waterproof and insulate exterior and interior walls of buildings, for cold storage plants, for the lining of reservoirs, for monuments, etc.

Among the numerous methods of waterproofing, many of which are protected by patents, the greater number in general relate to a surface application of some composition, usually somewhat thicker than an ordinary liquid solution. The more widely known methods of waterproofing are those used in connection with paper and paperboard, textile fabrics, cloth, with cordage, leather, etc.

Paper.—The commonest process for waterproofing paper and manufactures of paper is their saturation with wax or paraffine; either by the use of heat, or in solution, as with benzol. Flexible papers (and woven fabrics also) of an absorbent nature may be made waterproof by a half-and-half mixture of a vegetable oil—such as China wood oil, linseed oil, poppy seed oil or soya bean oil—with polymerized cumarone. The mixture is heated for a time, and after being allowed to cool, is dissolved in a volatile solvent, which is applied with a brush, or by dipping the material into the solution and draining off the surplus. This treatment does not affect the folding qualities of papers, practically doubles the tensile strength, and renders the sheet transparent. One of the newest methods, recently patented, consists in saturating the paper with an ammonia soap of stearic acid emulsified with paraffin and diluted with water. The paper is passed through a tank containing tne emulsion, and thence is taken over a series of drying rolls to evaporate the water. A French process recently introduced consists in coating the paper with a vegetable mucilage, and, after this is dry, applying a coat of agar-agar. The paper thus prepared is then subjected to the steam arising from a bath made by adding four pounds of formol and five pounds of potassium bichromate to six quarts of water. This process renders the paper somewhat brittle, and to restore flexibility it is sponged with a weak dilution of glycerine. The so-called Japanese waterproof paper is made by pasting two sheets of paper together, the fibers crossing, with a secret waterproof cement.

Textiles.—Water-repellent textiles may be grouped into two classes according to their nature, first, the coarser tissues used for awnings, tents, oilskins, tarpaulins or canvas coverings for exposed merchandise, etc.; secondly, the finer tissues employed for the manufacture of waterproof clothing. The processes employed are of two classes, mechanical and chemical. In the first, a solid layer of some impermeable substance is laid upon the material The substances, usually applied are india rubber, varnish, resin, pitch, tar, paints, etc. These are also impervious to air. The agents in use for chemical waterproofing are aluminum sulphate, common alum, lead acetate, copper sulphate, zinc sulphate, iron sulphate, ammonium cuprate, potassium chromate, paraffin, ceresine, wax, soap, etc. In waterproofing loosely woven fabrics it becomes necessary to fill up the interstices between the threads with imperviable

material as well as to waterproof the threads themselves. It follows that a textile which is to be waterproofed should be very tightly woven so that when the individual threads are made impervious to water the cohesion of water falling upon it will prevent its separation into particles so small as to be able to pass between the threads. The earliest process consisted in covering the tissue with tar, a method still employed for marine supplies, ropes, cordage and coverings, and which has the advantage of giving solidity to the fibre, and at the same time preserving it. Drying oils, and particularly boiled linseed oil, are still largely used to waterproof coarse tissues, and particularly for the oilskin overalls worn in rough weather by sailors and fishermen. Oiled tissues, however, are heavy and lack comfortable suppleness, while their color and appearance militate against their extended use. One of the more widely employed processes for waterproofing the coarser tissues consists in impregnating the material with an insoluble soap such as those formed with copper, iron, zinc and alumina. Copper soap is most universally used. The material to be waterproofed is first scoured by boiling with soda lye and then washed, after which it is passed through a 20 per cent ammonia soap bath, then immersed in an 8 per cent solution of sulphate of copper. According to its nature, the fibre absorbs a certain quantity, large or small, of copper soap. In the ashes produced by the burning of a square yard of canvas or linen tissue so treated, as much as 57½ grammes of copper is found, and nearly 29 grammes of copper is to be found in the cinders of the same quantity of cotton tissue. Copper-soap waterproofed materials present a characteristic greenish tint.

The manufacture of waterproofed materials for clothing has attained considerable importance. The fact, however, must be recognized that the results generally obtained are not altogether satisfactory, especially from a hygienic point of view. Absolute waterproofing cannot be obtained without wholly closing the pores of the tissue; thus prepared it is an efficacious protection from rain and from contact with water, in certain cases is of real service, but inconveniently prevents ventilation. While the garments are made watertight they are at the same time made airtight. The perspiration and natural moisture of the body are not allowed to escape, but are held in saturation in the clothing, rendering it impure, damp and uncomfortable. The body is kept damp, and upon removing the outer garments the wearer is liable to chills and colds, hence, such waterproofing is unsuitable for prolonged personal wear.

The most diverse substances can be used for waterproofing textiles, if they are soluble in a liquid other than water, and can be spread over the surface of the material,—if they possess a certain suppleness, and neither alter the fibre nor the color of the tissue. Wax, balsamic gums, isinglass, spermaceti, metallic soaps dissolved in essential oils, a solution of shellac with borax are employed in waterproofing tissues. The cloth, whether of silk, cotton, flax or wool, is usually rendered waterproof by the application of some solution of any of these substances to one or both surfaces. In many of the earlier processes, the cloth was immersed in a liquid, so as to become saturated with the waterproofing agent. An early patent was obtained for a method of rendering cloth waterproof without concealing its textile surface; the cloth in the first place is saturated with a waterproof composition; it is then dried on one side to form a hard film, while the other side is kept moist, and is afterward deprived of its composition by means of spirits of turpentine.

Frequently silk tissues are waterproofed by the use of gelatine rendered insoluble by an alumina soap. The material is impregnated by passing it through cylinders covered with swanskin, afterward being steam dried. Woolen tissues are passed through a solution of acetate of alumina obtained by treating ordinary alum with acetate of lead. The process most extensively in use at the present day is the acetate of alumina treatment. The fabric is steeped in the acetate solution for 12 hours, the temperature being kept at about 95 degrees, special care being taken that it shall not reach 100 degrees. Much difficulty in securing an even distribution of the acetate throughout the fabric is avoided by the use of the "jigger," a machine which takes the cloth on a reel and passes it continuously through a vat containing the chemical, winding it upon another reel. When it has all passed the machine reverses and rewinds the cloth on the first reel; repeating this alternation again and again. By this process the time of saturation is reduced to five hours. A still more effective method of saturation is by the vacuum process. The reel of cloth is placed in an airtight drum and the air is exhausted. The acetate liquor is then allowed to flow in, filling the cylinder. Air pressure to the extent of two and one-half to three atmospheres is applied, and allowed to remain for 45 minutes, when the operation is complete. The cloth then goes to the drying room where the temperature is kept well above 100 degrees, in order that the acetate may be changed by the heat to the insoluble basic acetate of alumina. In this condition the fabric is sufficiently waterproof for most purposes of wearing apparel. If it is required that it be absolutely waterproof, it may be made so by immersion in a 5 per cent solution of soap. An insoluble aluminum soap is formed on the fibre of the textile and adheres firmly. The fabric will now have a slippery feel, and this is quite objectionable. It is readily removed, however, by passing the goods through a solution of common alum of the strength of 1 degree or one and one-half degrees Beaumé. With some manufacturers it is a practice to add india rubber or paraffin to fortify the protection given by the insoluble aluminum soap. This is readily accomplished, as the soap solution easily forms an emulsion with melted paraffine or with a solution of rubber in a mixture of linseed and palm oils. A highly recommended formula directs that chopped-up india rubber be dissolved in twice its weight of a hot mixture of petroleum and linseed oil; and that to this be added three times its weight of Japan wax. When well mixed, a small quantity of liver of sulphur is to be worked in. This mass is then to be stirred into a boiling mixture of olein, linseed oil and resin. Finally the whole is to be saponified to a neutral soap with caustic

potash lye. The completed mixture should show a 10 per cent content of rubber and from 5 to 10 per cent of palm oil. After immersion, the fabric is calendered by polished steel rolls under heavy pressure. Linen, hemp and cotton require heavier pressure than wool or silk. In this calendering operation care is needed to avoid such extreme pressure that the textile fibres are crushed. Casein is sometimes used in waterproofing certain textiles and collodion also, but rarely.

Absolute waterproofing of textile materials is obtained by applying to their surface a thin layer of rubber. The first experiments were made in France by Besson in 1793; they were improved upon and perfected successively by Mackintosh and Hancock of Glasgow, Scotland, by Buttire and Guibal in France and by Goodyear in the United States. As in the case of Macadam with road surfaces, the successful efforts of Mackintosh perpetuated his name in connection with india rubber waterproof garments. The material is prepared by spreading on the surface a semi-liquid layer of rubber dissolved in benzol then submitting it to the action of heat to evaporate the solvent. Carbon disulphide first employed to dissolve the rubber, was replaced by a mixture of benzol or coal naphtha and essence of turpentine and later by benzol which alone is now used. In the treatment of cotton and linen cloth a small proportion of sulphur is generally added. A thin layer of this rubber solution is spread on the fabric by special machinery, after which the cloth is doubled, pressed and finished in calendars, the waterproof layer being thus in the centre of the finished material. (See RUBBER MANUFACTURES.) The offensive odor of waterproofed rubber garments may be remedied by treating them with aromatized vapors or by dipping them in concentrated infusions of vervain root, of orris root, of lavender, of camomile, etc. Ammoniacal vapor and sulphurous acid can also be successfully utilized to relieve rubbered materials of their penetrating odor. The application of rubber is made on dyed material in thread or in piece. The use of paraffine as an impervious agent allows the tissue to be dyed after being waterproofed. Paraffined tissues do not absorb water, which assumes a spheroidal shape and slides off the surface. The chief objection to paraffine lies in the fact that it is exceedingly brittle at low temperatures and melts readily with ordinary summer heat. Woolen tissues well cleaned by passing through a light and tepid bath of carbonate of soda and soap, are dried, then steeped in a solution of paraffine in petroleum ether, 60 or 100 grammes to the quart. They are afterward passed through roller pressers, dried in the open air, and sent to the dyeing vats.

As already pointed out waterproof rubbered textiles are not only impervious to water, but also to air and numerous other methods and processes have been introduced to produce fabrics which, while resisting rain, do not altogether obstruct ventilation. The consecutive dipping of cloths, as already explained, in soap and alum solutions or in gelatine and gall solutions or in a solution of acetate of lead and then in a solution of alumina, are resorted to with more or less success. Algin, obtained from seaweed, has been strongly recommended for the same purpose. One of the most modern processes consists in treating the fibres in the solution before they are manufactured into textiles and the fabric thus produced, while rain-resisting, offers the same ventilation as ordinary materials. «Fibre-mail,» as it is called commercially, is described as a clear, colorless substance held in solution for the purpose of treating silks, woolens, cottons, feathers, paper and other materials, so as to render them water-repellent and proof against dampness, mildew and moths. The value of the process is further stated to be by no means limited to the water-repellent qualities given to the goods treated. The application of the solution leaves a coating upon each separate fibre which, by the action of heat, is cured or vulcanized upon and into the fibre, strengthening it and leaving it impervious and elastic. Among other advantages cited are the properties of giving weight and body to the finer textile fabrics, and by this means, where desirable, economizing material, the quality of the goods being greatly improved and never deteriorated; the process also gives lustre and finish to fabrics, being especially valuable for silks, alpacas, etc.; gives elasticity and toughness to the fibres, preventing cracking and breaking qualities valuable for felt hats, silks, etc.; deepens and fastens the colors in dyed goods; resists stains and spots in the lighter and more delicate goods; prevents woods from swelling and warping; preserves painted surfaces; and prevents polished or metal surfaces from rusting.

Leather.—«Fibre-mail» is also successfully applied to leather and leather goods. Many compositions, some of them patented, have been long employed, for rendering leather waterproof by filling up the minute pores. Four or five may be briefly described as examples of the whole. Boiled linseed oil, mutton-suet, yellow-beeswax, and common resin are melted together over a slow fire and applied while hot to the leather, which is itself to be made warm. Linseed oil, resin, white vitriol spirit of turpentine and white oak sawdust are the materials of another composition. Yellow beeswax, Burgundy pitch, turpentine and linseed oil constitute a third. A fourth plan consists in applying to the leather a hot mixture of two parts tallow with one part resin. Another is to first apply a coating of tallow to the leather with a second coating of one part copaiba balsam with two of naphtha. Caoutchouc, boiled for two hours in linseed or neat's-foot oil is also said to be effective.

Structures.— Paint and silica compounds, oils, varnishes and gums have long been experimented with for the preservation of buildings by waterproofing. The Sylvester process has long been in vogue for stone, brick and cement surfaces. It consists of alternately applying hot washes of soap and alum. Coating buildings with linseed oil has been a favorite method as affording some degree of protection against the deteriorating action of the elements. But linseed oil alone or mixed with colors, varnishes and gums has never proved wholly efficient to prevent the disintegration of stone, the weather staining of brickwork, the crumbling of mortar joints and the efflorescence of soluble salts, contained to a greater or less

degree in all bricks, cement and some varieties of stone; this is owing to the protective materials in themselves being subject both to chemical changes when exposed for a comparatively short time to the weather. When linseed oil alone is used, should there be any lime or alkaline salts in the wall, these immediately saponify the oil and render it useless as waterproofing. The oil soon dries out and leaves a spotted or mottled surface. Paint is often seen peeling off from the mortar joints of a building and from the brick work as well, owing to the same cause, the caustic alkaline properties of the salts of lime saponifying the linseed oil in the paint. Among scores of proprietary secret formulas there are some that are indisputably good and are thoroughly guaranteed by their makers. It is the custom of some architects to call for these applications in specifications.

Dry foundations are necessary in order to prevent moisture from rising by capillary attraction from the damp earth into the bases of walls or stoops. One or more perfectly waterproof courses near the foundations and reaching above the level of the ground, should be introduced as a «sine qua non» to a good building. Otherwise, a constant state of dampness, affecting that part of the structure, is apt to produce staining and disintegration beyond redemption. Cement or slate will not effectually answer this purpose owing to their absorbent qualities. Asphalt, sheet lead, copper or some other non-absorbent material should be used. The modern practice of builders of valuable structures is to construct a waterproof «membrane» completely enclosing the foundation. This is commonly a succession of layers of burlaps cemented together with asphalt and united to the foundation material by the same impervious substance. An elastic felt recently introduced is claimed to be superior to the burlaps. Sheet lead as foundation waterproofing is found in the ruins of Roman buildings 2,000 years old. One of the best processes hitherto employed for waterproofing the exterior and interior surfaces of the walls, is the paraffine compound process. The base of this compound is paraffine wax of special manufacture with refined creosote oil and other substances not disclosed. The method of application is to warm the wall to be treated, to the depth of about one-quarter of an inch, thereby evaporating all moisture and rendering it absorbent of the waxy material. The melted waterproofing is then applied to the warm surface until absorbed into the pores. It there remains for a brief time in a liquid state, penetrating as deeply as the surface is heated and dry and gradually hardens as the surface cools. The pores are thus permanently filled and rendered solid without altering the appearance of the stone, etc., treated. This waterproofing compound thus forced in by heat and becoming solid when cold, is far more durable and effective than superficial applications of cold solutions, oils or paints, applied in the usual manner, which do not penetrate into the material, which soon perish, if they are not previously chipped or rubbed off.

As a preservative of stone and marble, of monuments and statuary, vaults, etc., from the destructive effects of the weather so often observed in cemeteries, the process has proved of great value.

A material successfully used in Europe is a fluo-silicate of magnesia, commercially known as «fluate.» Its application both hardens and rainproofs stone, but it takes a year to demonstrate the effect. Consult Ross, J., 'Waterproofing Engineering for Engineers, Architects, Builders, Roofers and Waterproofers' (1919).

WATERS, wâ'tẽrz, **Clara Erskine Clement,** American writer: b. Saint Louis, Mo., 28 Aug. 1834; d. 20 Feb. 1916. She was well known as a writer and lecturer upon art. Her writings include 'Legendary and Mythological Art' (1870); 'Eleanor Maitland' (1881); 'Life of Charlotte Cushman' (1882); 'Stories of Art and Artists' (1887); 'Women Artists in Europe and America' (1903); 'Women in the Fine Arts' (1906), etc.

WATERS, Territorial. See INTERNATIONAL LAW.

WATERS, Underground. A certain amount of the water that falls on the earth's surface passes underground, the percentage varying with the porosity of the surface materials. This absorption of water is due to the fact that all rocks are somewhat porous and considerably fissured. Sand and gravel deposits are very porous and can store from 15 to 35 per cent of their bulk of water. Sandstones have space between their sand grains, but their porosity varies greatly with size of grain and especially with the amount of cementing material filling the interspaces which, in the case of quartzite and some highly calcareous sandstone, fill these spaces entirely. Most sandstones, however, are porous and many hold from 5 to 10 per cent of their bulk of water. Limestones are only slightly porous, but they are always traversed by joint planes and usually, toward the surface, by channels and caverns. Clays, shales and slates have but little capacity for water and the crystalline rocks, such as granite, have very slight porosity. Crystalline rocks, however, are usually traversed by many joint planes and often by zones of decomposition along which surface waters descend for a greater or less distance. In many districts, also, the crystalline rocks are deeply decomposed by the solution of some of their components, and the resulting «rotten rock» is usually as porous as many sandstones. Many lavas are porous and they usually are extensively fissured. Water passes underground in various ways, of which the following are the most prominent: direct inhibition of rainfall; the sinking of surface flows in passing over zones of porous rock; the spreading of streams laterally into the porous deposits of their valleys; and the percolation of water laterally from the ocean or lakes into the materials of the shore. In all regions it is found that the surface run-off and evaporation do not equal the rainfall, which is evidence of the general inhibition of water. Many streams are observed to diminish in volume and even to disappear entirely in running over areas of porous sandstones, cavernous limestones or especially permeable portions of their beds. In many arid regions waters flow out of the mountains in rocky beds and at once sink in the sands of the valleys. In nearly all river valleys there are

alluvial deposits in which the water extends laterally from the main stream and some watercourses have water only in the sands and gravels of their beds for the greater part of the year.

travel of underground water is slow, averaging about one mile a year in moderately porous sandstone.

In the accompanying figures are shown some conditions of underground waters, which have

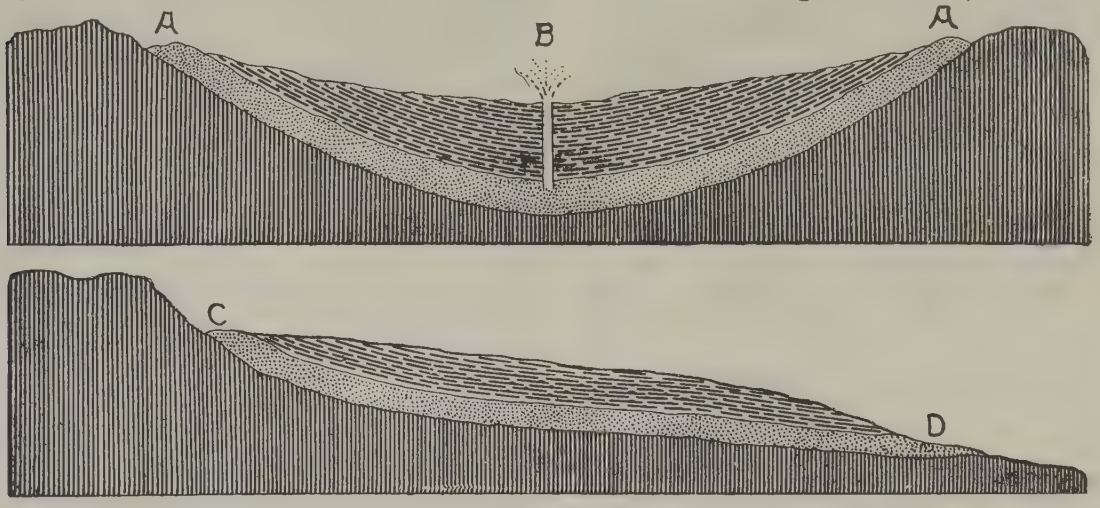


Fig. 1.

Waters present various conditions underground, in some cases flowing to lower levels, through permeable rocks, caverns in limestone or crevices in the harder rocks, to emerge as springs in hillsides, valley bottoms or even out under the ocean, as off the east coast of Florida. Usually the water supply fills an underground reservoir of sand, gravel, porous sandstone, decomposed crystalline rock or fissures. Water under this condition is usually designated "ground water" and its surface level is known as the "water plane." In some cases ground water may occupy strata or follow down crevices for a depth of several hundred feet. Waters which extend far underground are mainly contained in sandstones, and some of these water-bearers are of vast extent and often descend to great depths. Two conditions frequently existing are shown in accompanying cuts. Fig. 1. Cross-sections showing conditions of underground water in permeable rocks. In the first of these sections a bed of sandstones reaches the surface at *A A* where it receives water from rainfall or sinking of streams. This water passes underground below relatively impermeable clay or shale, and an artesian basin is formed which would yield a flowing well at *B* and at other points where the land is less elevated than at *A* and *A*. In the second section the conditions are somewhat similar, the water entering at *C* but escaping in springs at *D*, so there is a constant flow from *C* toward *D*. On account of this flow to a lower level there is gradual diminution of "head" of the water from *C* to *D*, known as the "hydraulic grade." This condition is found in the Central Great Plains of the United States, where there is a bed of porous sandstone with an average thickness of 200 feet, underlying more than 500,000 square miles and in places lying 5,000 feet deep, and apparently filled with water throughout. Many wells draw artesian supplies from this sandstone and in some areas the flows have a surface pressure of over 200 pounds to the square inch. Hundreds of billions of gallons are contained in this stratum. The rate of

been referred to above. Fig. 2. Sections of a river valley, showing the relations of underground waters. This valley is cut in rock but partly filled with sand and gravel, as shown by

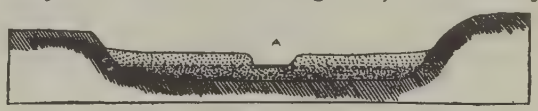


Fig. 2.

the stipple. The river flows on the surface at *A* but the waters also flow slowly underground in an "underflow" and pass laterally into the sands, filling them to the "water plane" *B B* at the level of the river. Fig. 3. Fissured and de-

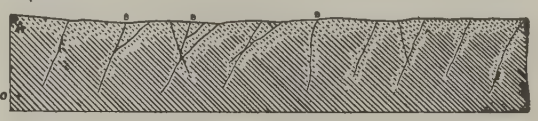


Fig. 3.

composed crystalline rock. Surface waters often sink deeply and occur in considerable volume under the conditions shown in this figure. *A* is the zone of decomposition and disintegration of the rock. *B B* are fissures down which the decomposition has progressed still deeper. This condition is found over wide areas in the Piedmont region of the eastern United States.

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WATERSHED. See Rivers.

WATERSPOUT, a meteorological phenomenon frequently observed at sea, and analogous to the whirlwinds experienced on land. It occurs when opposite winds of different temperatures meet in the upper atmosphere, whereby a great amount of vapor is condensed into a thick black cloud, to which a vortical motion is given. This vortical motion causes it to take the form of a vast funnel, which appears to descend near the surface of the sea, creates

a partial vacuum at the center and draws up the water in its vortex, which joins in its whirling motion. The dark cloud above does not in fact descend, as is usually stated by observers, the column being formed by the visible condensation of the moisture in the rapidly ascending air currents. The whole column, which after the junction extends from the sea to the clouds, makes a magnificent appearance. It is light in color near its axis, but dark along the sides. When acted on by the wind the column assumes a position oblique to the horizon, but in calm weather it maintains its vertical position and is carried along the surface of the sea. Waterspouts seldom last more than a few minutes and are not as a rule dangerous to passing vessels. Firing a projectile into one to dissipate it has not been observed to give any appreciable results.

WATERTON, wô'tĕr-t'n, **Charles,** English naturalist: b. Walton Hall, Wakefield, June 3, 1782; d. there, May 27, 1865. He was educated at the Roman Catholic College at Stonyhurst, where he showed a great taste for natural history. He spent many years in travel, and in 1825 published *Wanderings in South America, the Northwest of the United States, and the Antilles in the years 1812, 1816, 1820, and 1824,* a book which attained great popularity. An illustrated and slightly altered edition was published under the direction of J. G. Wood in 1879. His only other publication is *Essays in Natural History, with an Autobiography.* These appeared originally in three series (1838, 1844, 1857). In 1870 Norman Moore produced a new edition of them, together with some of his letters and a life. He lived a secluded life for many years at Walton Hall, where he formed a curious collection of animals.

WATERTON-GLACIER INTERNATIONAL PEACE PARK, established in 1932 by acts of the Canadian Parliament and the United States Congress, comprises Waterton Lakes National Park in southwestern Alberta and Glacier National Park in northwestern Montana. The largest of the Waterton Lakes, 11 miles long, straddles the international line at an elevation of 4,193 feet.

WATERTOWN, wô'tĕr-town, town, Connecticut, Litchfield County, altitude 600 feet, is located on the Naugatuck River, 6 miles northwest of Waterbury, on the New York, New Haven and Hartford Railroad. Its industrial products are silk and rayon goods, plastics, wire products, pins, and tacks. The Taft School for boys is here. The town was set off from Waterbury in 1780. Pop. (1950) 10,699.

WATERTOWN, town, Massachusetts, Middlesex County, altitude 20 feet, is located on the Charles River, 6 miles west of Boston, on the Boston and Maine Railroad. It contains the villages of Bemis, Watertown, and Mount Auburn, and was first incorporated in 1630. It has a number of industries, chief of which are manufactures of rubber footwear, tires, rubberized and waterproofed cloth, elevating trucks, shoe findings, food products, textile machinery, paint, varnish, stoves, and heating apparatus. A large amount of modern ordnance is produced at the United States arsenal here. Perkins Institute for the blind is here; also the famous Mount Auburn cemetery. Pop. (1950) 37,329.

WATERTOWN, city, New York, Jefferson County seat, altitude 478 feet, is located on the Black River, about 10 miles from its entrance to Black River Bay, an arm of Lake Ontario, about 70 miles north of Syracuse, on the New York Central Railroad. The area inside the city limits is 8.7 square miles.

Industries.—The city lies on both sides of the river, which has a fall of 112 feet inside the city limits. It takes its name from the fine water power, which has been used for manufacturing since 1802. From Carthage, a village 16 miles above the city, to Dexter, eight miles below the city, the river is lined with busy manufacturing villages, which contribute to a considerable extent to the prosperity of Watertown. Along this 24 miles of river valley is a string of paper mills, and there is a considerable output of paper-making machinery. Next in importance to the paper industry is the manufacture of railway airbrakes. The other major factory products are metal working, clothing (women's dresses and knit goods), clinical thermometers and optical goods, flour and other grist mill products (including dietetic foods), plumbers supplies, mattresses, and electrical machinery.

Trade and Finance.—Watertown is the financial and commercial center of the largest dairy farming section of New York State, as well as one of the greatest resort sections, the Thousand Islands region. To the east are the Adirondack Mountains. It is also an important wholesale and distributing center for the northern section of the state with its rich farms and dairies—but scattered population.

It was in Watertown stores that Frank W. Woolworth, brought up in Great Bend, a few miles to the east, clerked in stores in the 1870's before he set up his first five-and-ten-cent store in Utica. There is a large Woolworth Building in the city. Watertown is an important insurance center with the home offices of two companies.

Buildings and Municipal Improvements.—The retail business of the city is located in Public Square, an imposing plaza situated in the geographical center of the community, and on thoroughfares that radiate from the common center. The public buildings include the post office and federal court building, a state armory, county buildings, the city hall, the Jefferson County Historical Museum, and the Roswell P. Flower Memorial Library, a classic marble structure, the gift to the city by Mrs. Emma Flower Taylor as a memorial to her father, Democratic governor of the State of New York in 1892–1895 and a leading citizen of Watertown. The city also has two orphanages and four hospitals. The Henry Keep Home, established and endowed by Mrs. Emma Keep Schley, is a refuge for the aged. There are two schools for graduate nurses. Of Watertown's numerous churches, the largest and most attractive are Trinity Episcopal, erected by the late Roswell P. Flower and his brother, the late Anson R. Flower; the Sacred Heart and Holy Family (Catholic); the First Presbyterian; Emmanuel Congregational; and the Asbury Methodist. The Young Men's Christian Association, a six-story building, and the Young Women's Christian Association, occupying its own building, are both located in Public Square. The Black River Valley Club,

with a modern clubhouse in lower Washington Street; the Elks' Club; the Masonic Club, housed in a beautiful marble temple; the Knights of Columbus, with a spacious club home in Stone Street, close to the business center; and the Lincoln League, with about 2,000 members, are the principal social organizations of the city. Watertown is overlooked on the east and south by Thompson Park, purchased, developed and presented to the city by the late John C. Thompson. A number of playgrounds (tennis courts and baseball diamonds) are maintained by the city. Watertown has one daily newspaper. The city owns a municipal airport, a hydroelectric power plant (1927) and its street-lighting system.

History and Government.—Watertown was settled about 1800 by five New Englanders who had pushed their way up from the Mohawk Valley, finally stopping at Black River Falls, and naming the site appropriately, Watertown. Their sawmills and gristmills, which they built along the Black River, attracted the settlers of nearby hamlets, who came to find work in the carpenter and machine shops. Papermaking began with the introduction of a rag mill in 1809. For a time the settlement was less important than Sackett's Harbor, 10 miles to the west, a fine port on Lake Ontario and a strategic point in the War of 1812. But the water power of the Black River helped Watertown's industrial growth. On Jan. 1, 1920 the city adopted the commission-manager plan of government with a city manager and a nonpartisan commission of five members. Pop. (1890) 14,725; (1900) 21,696; (1910) 26,730; (1920) 31,285; (1930) 32,205; (1940) 33,385; (1950) 34,350.

WATERTOWN, city, South Dakota, and Codington County seat, altitude 1,733 feet, is located on the Big Sioux River, 90 miles northwest of Sioux Falls, on the Chicago and North Western; Chicago, Rock Island and Pacific; Great Northern; and Minneapolis and St. Louis railroads; has an airport, with airline service. Situated in an agricultural and stock-raising region, it is a railroad and shipping center, and has varied industrial interests. The processing and packing of foods constitute a prominent item in the industrial schedule; meat and poultry are shipped. There are creameries, flour mills, machine works, and bottling works; and cement and concrete, sashes and doors, are made. There is an extensive wholesale trade in farm machinery and tools, feeds and seeds. Several large chick hatcheries are located in the immediate vicinity. In the near-by district are extensive, developed deposits of sand and gravel. Watertown has a Carnegie library, a standard public school system, parochial schools, and excellent recreational facilities in the city parks and at Lake Kampeska, to the west. The lake, covering approximately 12 square miles, is a summer resort, with casino, clubhouses, and a municipal golf course. Public buildings are the courthouse, the city hall, the post office, and an auditorium. The city owns an electric plant and the water works. It was platted in 1878 and incorporated in 1885. In 1913 it adopted commission government, but in 1916 it returned to the aldermanic form. Pop. (1950) 12,699.

WATERTOWN, city, Wisconsin, in Jefferson and Dodge counties, altitude 824 feet, on the Rock River, and on the Chicago, Milwaukee, Saint Paul and Pacific and the Chicago and North Western railroads, 44 miles northwest of Milwaukee and 38 miles northeast of Madison, the capital of the state. It is on both sides of the river, and has considerable water power which is utilized by various manufacturing plants, chief of which are large shoe factories, flour mills, foundry and machine shops, creameries, and factories producing dairy products and equipment, furniture, wood table slides, automatic cashiers and sorters, carbonated beverages, dresses, rubber products, snow plows, paper boxes, store fixtures, apiary equipment, Venetian blinds, airplane propellers, cutlery and garden tools, ice cream, condensed milk, canned vegetables, stuffed geese, heating equipment, rope halter, interior finish, and concrete vaults. The city is a shipping point for butter and cheese and is noted as a goose market. Northwestern College (Lutheran, 1865), and Sacred Heart College (Roman Catholic, 1872) are here. Bethesda Lutheran Home (for the feeble-minded) is here.

The place was first settled in 1836 by Timothy Johnson and other settlers from Watertown, N. Y. It was incorporated as a village in 1849 and chartered as a city in 1853. Many Germans settled here about 1848, and in 1856 Carl Schurz (q.v.) came to Watertown, where he soon became a leader in the Republican party. His wife, who had been a pupil of Friedrich Froebel (q.v.) established in Watertown one of the first kindergartens in America. The municipal government is by city manager and five aldermen elected at large. Pop. (1950) 12,417.

WATERVILLE, city, Maine, Kennebec County, altitude 100 feet, is located on the west bank of the Kennebec River (opposite Winslow), 19 miles north of Augusta, on the Maine Central Railroad. It has a municipal airport. The Ticonic Falls furnish water power for industries here and in Winslow, and the Maine Central Railroad has repair shops here. The chief manufactured products are paper and pulp, cotton and woolen goods, men's shirts, lumber, wood products, fiber dishes, ice cream, shoddy, signs, and tractors.

Waterville is the site of Colby College (Baptist, coeducational) founded in 1818 and called Waterville College until 1867; and of Coburn Classical Institute. Samuel F. Smith (q.v.), who wrote the verses of the national anthem, *America,* lived here 1833–1842. The region was called Teconnet by the Indians. It was settled about 1760 by emigrants from Cape Cod, and was part of Winslow until 1802 when it was set off as a town and incorporated under the name of Waterville. In 1873 it was separated from West Waterville, and was incorporated as a city in 1883, receiving its charter in 1888. Government is by mayor and council. Pop. (1950) 18,287.

WATERVILLE, village, New York, Oneida County, altitude 1,231 feet, is located 21 miles southwest of Utica, on the Delaware, Lackawanna and Western Railroad, in an agricultural region in which hops and vegetables are the chief products. Picking peas and beans for the canneries is a seasonal occupation in the locality. The first settlers came from Waterville, Me.,

shortly before 1880. George Eastman (q.v.), inventor and philanthropist was born here. Pop. (1950) 1,634.

WATERVILLE, village, Ohio, Lucas County, altitude 654 feet, is located on the Maumee River, 14 miles southwest of Toledo, on the New York, Chicago and St. Louis Railroad. It is the trading center for an area of extensive plant nurseries, and each year in May holds a blossom festival. There are limestone quarries, oil and gas wells in the area. Glass, metal, rubber, and food products are manufactures. Here along the old Miami and Erie Canal is Waterville State Park, and along the river are numerous other public parks. In this region, in 1794, the forces of Mad Anthony Wayne (q.v.) battled with the Indian tribes. Pop. (1950) 1,110.

WATERVLIET, wô'tĕr-vlēt, city, New York, Albany County, altitude 27 feet, is located on the Hudson River, opposite Troy, 6 miles north of Albany, on the Delaware and Hudson Railroad. It is an industrial city producing coated abrasive and sharpening stones; hair brushes and other toilet brushes; steel castings and ingots; gray iron castings and bronze, and aluminum castings; harness; hardware; wooden ladders and scaffolding; silk, wool, rayon, and nylon yarns.

The United States Arsenal established here in 1813 has been a major factor in the industrial history of the city. It made guns for the War of 1812. Until 1887 it manufactured army equipment and shells. Since then it has supplied guns for every war in which the United States has participated. It has 30 buildings, including residences for officers, and is equipped to build heavy ordnance and rapid-fire antiaircraft guns. Its peak employment in World War II was 7,334 persons.

Watervliet was settled about the time the first settlements were made at Albany (1623). Overlooking the Hudson River is the Schuyler Homestead, only slightly altered since its erection in 1666. In 1774 Mother Ann Lee, founder of the Shakers (q.v.), arrived in America from England with a small group of converts and settled in Watervliet in 1776. Later, in 1785, they established a colony at Mount Lebanon, near the New York-Massachusetts boundary. Watervliet was incorporated as the village of West Troy in 1836. In 1897 it was chartered as a city under its present name. Government is administered by a city manager. Pop. (1950) 15,197.

WATERWAYS OF THE UNITED STATES. This article discusses American waterways primarily from the viewpoint of waterborne commerce and navigation in their descriptive and economic aspects. Technical engineering discussions are avoided, being covered in other articles to which reference is made. By "waterways" are understood all channels carrying, or capable of carrying, commerce. The subject therefore is divided into three main parts: (1) inland waterways, including rivers, canals and intracoastal waterways; (2) the Great Lakes system; (3) seaports and harbors.

INLAND WATERWAYS

Agencies and Means of Improvement.—Practically all waterways of the United States actually or potentially navigable are, by the Interstate Commerce clause of the Constitution, under jurisdiction of the federal government as regards navigation. This does not mean that the government owns in fee simple the waterways or the land under or adjacent to them, but that in so far as concerns matters affecting navigation it exercises a dominant control over any structures or activities on the waterways. Accordingly, improvements of natural channels for the benefit of navigation, other than such purely local matters as the dredging of slips or of approaches to terminals, have throughout our history been carried on mainly by federal agencies. This statement does not however apply to purely artificial waterways, that is, canals; the government has constructed a few, of which the most important is, of course, the Panama Canal, but most canals have been built by states or other public or private interests. See also article on CANALS.

The agency of the federal government for the creation and maintenance of navigable channels is the secretary of war, and under him the chief of engineers and corps of engineers of the army. This river and harbor activity of the army engineers is in addition to their purely military duties, and officers alternate between the two forms of work. Field work is handled in ten division offices by 47 territorial districts, which cover the entire United States, with offices at principal cities, and by special agencies such as the Mississippi River Commission and the California Debris Commission.

Every individual project for the improvement of a navigable channel must be authorized as a law by Congress. The usual procedure to obtain an improvement, or the extension of an existing improvement, is first for Congress, at the intercession of local interests, to direct the examination and survey of the channel. This is done by the army engineers who then recommend for or against the improvement. If Congress adopts their favorable recommendation the project becomes a law. It is then executed with the funds annually granted for river and harbor work, which, for the fiscal year 1952–1953, including funds for flood control, amounted to $584,000,000.

Congress has of course entire authority to order any improvement contrary to, or in the absence of, recommendation by the chief of engineers. Formerly this was often done, and resulted on occasion in the adoption of small and purely local improvements which gave rise to the term "Pork-Barrel." This practice has however practically disappeared. In recent years, and apart from emergency construction projects, practically no commercial waterway projects adopted have been ordered by Congress in the absence of a specific favorable recommendation by the chief of engineers.

The methods of improving inland waterways, and the details of plant and structures employed, are considered under articles DREDGE, CANALS, RIVER ENGINEERING, and HYDRAULIC ENGINEERING. Briefly, they fall into the two classes of canalization and open-channel work. Canalization consists of providing a navigable channel in a river by a series of dams creating long deep pools, each dam having one or more locks through which vessels pass from one pool to the next. In a river such as the Ohio, subject to very great rises of water in

floods, the dams are often arranged so that at high water they can be lowered or otherwise manipulated when lowered, commerce then passes down the main river over the lowered dams instead of using the locks.

Open channel improvement includes all methods other than canalization. Most rivers, even when canalized, also require at certain points some open channel work. The principal methods are *dredging, snagging* and *regulation. Dredging* of course consists of the removal of material from the bottom to form a sufficiently deep channel. See DREDGE. This may of course involve rock excavation by blasting or other means. *Snagging* is the pulling out and safe disposal of trees or logs which lodge in the river with one end at or near the surface, and are a menace to passing boats. It is required continually on some large rivers, such as the Mississippi, and on many small rivers is the only form of improvement done. *Regulation* consists of so manipulating the flow of the river as to hold the river at the point desired and force it to dig a deep channel for itself. The usual means is the construction of dikes or wing dams projecting into the river from the sides, or sometimes built parallel to the channel, thus constricting the flow and producing scour of the bottom and a deeper channel. A form of river regulation is the construction of levees and the paving and revetment of banks designed to hold the river, even during floods, in its main channel and to prevent it overflowing and eroding the banks. This is extensively practiced on the Mississippi. See MISSISSIPPI RIVER.

B. Channel Depths.—The most important element of a navigable channel is its depth. American improved internal waterways have a variety of depths, dictated partly by the type of traffic for which they are designed and partly by the amount of money which it is appropriate to spend on them. Broadly speaking, we may say that modern internal navigation practice in this country tends to one of four standard depths: (1) 12 feet, appropriate to large barges and river steamers. This is the depth of the New York State Barge Canal now being deepened to 14 feet and the upper Hudson, and is about the depth of small waterways on or connected with the Hudson which have commercial relations with it. It has also been the depth of the canal connecting Chesapeake and Delaware bays now being deepened to 27 feet and of the intracoastal waterway from Norfolk to the Cape Fear River, N. C. (2) 9 feet, appropriate for large river steamers of the type used on the Western rivers, and for good sized barges, up to 2,000 tons capacity, handled by river tow-boats. This is the project depth of the Mississippi to St. Paul, of the Ohio and Illinois and of the intracoastal waterway from New Orleans to Corpus Christi. It may be called the maximum depth of the Mississippi system. (3) 6 to 9 feet, appropriate to medium barge traffic and large motor-boat or small steamboat traffic. These are the project depths of some of the South Atlantic intracoastal waterways, and of the Missouri River to Sioux City. (4) 4 feet or less. Appropriate to small motor boats, small barge traffic and the floating of logs. Such depths obtain in small Southern and Southeastern rivers. The Lakes traffic is of course of a different sort, but excluding the Lakes, channels over 12 feet in depth are in practically all cases port or harbor channels serving ocean-going vessels.

Throughout this article, depths for tidal waterways along the Atlantic and Gulf coasts refer to mean low water; tidal waterways along the Pacific coast to mean lower low water; and non-tidal rivers generally to low water, or ordinary summer low water.

C. Principal Inland Waterways—Location and Description of Channels.—Full details of the project dimensions of all channels under improvement by the United States, of their condition, cost and the present activity on them may be found in the annual reports of the Chief of Engineers. Of some 300 internal waterways now under active improvement only the most important will be referred to below.

From the viewpoint of commerce, the waterways fall into ten clearly defined geographical groups.

1. The New England Rivers.—These are usually small, the Connecticut and several Maine rivers being exceptions, and in nearly all cases the fall line is near the sea. Their commercial importance is therefore generally limited to short stretches near the mouth which have been in many cases improved to a depth suitable for ocean going vessels. Such channels are properly approaches to *ports* and will be considered under that head. The Connecticut, though a large and long river, presents considerable difficulties to improvement above Hartford, and has never been fully developed. The Susquehanna in Pennslyvania belongs to the same class, as does the Delaware above Trenton.

2. Hudson System.—The Hudson River is the finest natural waterway in the country. For 117 miles, up to Hudson, it is really a natural tidal estuary capable of carrying ocean vessels. General improvements near the mouth are part of New York Harbor. A project now substantially completed provides a 27-foot channel to the city of Albany, making the latter an ocean port. Above Albany there is a completed 12-foot project to Troy with a lock and dam at that point. Thence the river connects with the New York State Barge Canal, completed in 1918 by the state of New York at a cost of over $150,000,000, a portion of which is now being deepened to 14 feet. This, the most ambitious waterway project ever undertaken by an individual State, is a successor of the old Erie Canal, which was so important a factor in the early and middle 19th century in opening up the Middle West and in placing New York City in the position which it has never lost, of the leading city and seaport of the country. The present Barge Canal (q.v.) has a governing depth of 12 feet, and in the canal sections, as distinguished from river sections, a bottom width of 75 feet. The main line extends from Troy to Tonawanda, on Niagara River, thus giving connection with Lake Erie. A branch extends to Oswego and connects with Lake Ontario and there are minor branches in the Mohawk Valley. Connected with this system is the Champlain Canal, also built by the State of New York, from Troy to the southern end of Lake Champlain. A 12-foot channel through the narrows of that lake, furnished by the Federal Government, gives navigation facilities into the deep part of the lake and there are Federally improved harbors including Burlington and Port Henry. This system tics the Atlantic coast, by

a good barge channel, to the entire Great Lakes territory and to northern and central New York.

3. The Southeastern Rivers.—This is a group in the territory from Virginia to Mississippi, which have many common characteristics. They rise in the Appalachians and flow first through the Piedmont district, which is generally a rich agricultural territory with rapidly developing industries. Near their fall line they enter the coastal belt, a flat and often swampy area with formerly a heavy growth of timber, and flow thence to the sea. In this lower stretch they are, or can at very little expense be made, navigable to depths up to from 4 to 6 feet or more. This coastal belt is not however densely populated, and with the cutting out of the timber, the potential resources for water transport have greatly decreased. A large potential commerce for the rivers exists in the Piedmont, but to reach it the rivers must in general be canalized, often at large expense. They are subject to floods which may cause a rise of 30 or 40 feet.

The following are the improvements of the principal rivers of this section (not all of which conform exactly to the above general description).[1] The Potomac is really a port approach up to Washington. The Rappahannock has a 12-foot project up to Fredericksburg, with a present controlling depth of about 10 feet. The York has good natural channels in the lower sections, and improvement has not thus far been found necessary. The James is a port approach to Richmond (See «PORTS» below). The Appomattox, a tributary of the James, has a channel to Petersburg about 10 feet deep, completed and maintained. The Roanoke has natural depths of at least 10 feet up to Hamilton, over which stretch snagging operations are carried on, and from Hamilton to Weldon there is a project for a 5-foot channel which is partly completed, the governing low water depth being 3 feet. The Pamlico and Tar Rivers in North Carolina have project depths of 12 feet to Washington, thence 6 feet to Greenville, thence 20 inches to Tarboro, with a provision for snagging and clearing up to Little Falls. A channel 11.5 feet deep exists to Washington, but depths less than 6 feet are at present found below Greenville. The Neuse has a project channel 12 feet deep at low water, to Newbern, thence 4 feet to Kinston and a lesser improvement to Smithfield, with project depths existing to Newbern and somewhat less above. The Cape Fear River to Wilmington, N. C., is a port approach. Above Wilmington there is a project for an 8-foot depth at low water to Fayetteville involving the construction of three locks and dams. These structures have been completed. The Savannah River is a port approach up to Savannah. Thence there is a project channel 6 feet deep at low water to Augusta, to be obtained by the construction of one lock and dam and by open channel work, work on the project now under way. A minor project exists above Augusta. The Altamaha River in Georgia has a project for a 3 to 4 foot channel at low water over the entire stretch of the river to its head at the junction of the Oconee and Ocmulgee Rivers, to be obtained as far as is possible by minor works. Such work is carried on as is of assistance and benefit to existing navigation. Turning to the Gulf rivers, the Apalachicola has a project channel 6 feet deep at low water, with a supplementary connecting 5-foot channel, which depths have been attained. A tidal canal 9 feet deep at mean low water connects this river from a point a little above the mouth with deep water at St. Andrews Bay to the west. The Chattahoochee has a 4-foot project up to Columbus, Ga., maintenance of which involves dredging, snagging and regulating; the full depth is available from January to August.

The most important, ambitious and successful purely river improvement in this stretch is that of the Mobile River system, including especially the Black Warrior. The latter stream passes through the great coal deposits of west central Alabama and close to the important steel centre of Birmingham. Commercially, therefore, it is at the present moment in a much more favorable position than the other rivers of this section. The approach of the Warrior is via the Mobile and lower Tombigbee Rivers, both of which below the mouth of the Warrior have natural or improved channels 9 feet deep. The Warrior River system has been improved for 476½ miles by a chain of 17 dams and 18 locks up to about the latitude of Birmingham, which takes it through a large part of the coal section.

4. The Florida Rivers.—These are of a different class from the other southeastern rivers, due to local topography. The St. Johns River somewhat resembles the Hudson, in that for a long distance it is a tidal estuary with excellent natural depths, capable of improvement at relatively small cost. Up to Jacksonville it is a port approach channel. Thence for 55 miles, to Palatka, it has an improved 13-foot channel; for 92 more miles, to Sanford, an improved 8-foot channel, and above Sanford a 5-foot channel to Lake Harney. The other principal system of the Florida peninsula centres on Lake Okeechobee, which, with the connecting rivers and the drainage canals recently dug by the State of Florida, form a system of light and medium draft channels centering on Okeechobee. In connection with the construction, now nearing completion, of levees about Lake Okeechobee to prevent overflow in times of hurricane storms, a channel of not less than 6 feet in depth is being made available entirely across southern Florida via St. Lucie River and canal, Lake Okeechobee and Caloosahatchee Rivers. Construction has also been inaugurated under the Emergency Relief program of a cross Florida ship canal via St. Johns, Oklawaha and Withlacoochee Rivers.

5. The Mississippi System.—This falls into three sub-systems:

(a) The Mississippi proper and its minor tributaries.

(b) The Ohio and its tributaries.

(c) The Missouri.

5-a. The Mississippi up to Baton Rouge is a port approach channel with depth of 35 feet. For much of the distance between Baton Rouge and Cairo there is a natural 9-foot channel. The river flows however in a very sinuous course through a broad flood plain composed of soft alluvial soil, and being subject to tremendous floods, tends continuously to erode its banks and shift its channel, with a corresponding

[1] Special descriptions are given only to rivers currently carrying in excess of 100,000 tons of commerce per annum.

temporary deterioration of that channel. The improvement for navigation therefore consists not only in dredging shoals, but also and largely in holding the river in place. This can be best attained by levees which contain the flood water of the river, coupled with revetments and other bank protection work which prevent the flood waters from attacking the banks at critical periods and undercutting the levees. Such work, by preventing the overflow of the river, is, of course, flood control as well as navigation work, and indeed the former aspect is at least as important as the latter.

The methods and achievements of the Army engineers in the past half century, in the tremendous task of controlling the Mississippi, are described under MISSISSIPPI RIVER, q.v. Briefly it may be said that they resulted in reclamation from periodic overflow of an area, extending along 1,571 miles of river, totalling around 27,000 square miles, larger than the State of West Virginia, the great majority of which is rich and valuable agricultural land. In 1922 the Mississippi was subject to one of the greatest floods in history. This flood passed without a break in the main-line levee system from Cairo to Poydras below New Orleans, a distance of nearly 1,000 miles, and the break at Poydras was because, due to limitations of funds, the levee had not been completed to the dimensions planned by the engineers of the Mississippi River Commission. The methods adopted proved entirely satisfactory up to the great flood of 1927 when the Mississippi levees gave way in numerous places with the result that 18,000 square miles were inundated, while 750,000 people were directly affected, about 600,000 being rendered homeless and destitute. The damage caused by this flood was estimated at $300,000,000. This disaster, the greatest in the history of the country, emphasized the fact that some better method of flood control be adopted before it can be said that all danger from Mississippi River floods is a thing of the past.

From Cairo up to St. Louis, the river changes its character, with a lesser flow and generally firm, high banks. Flood control ceases to be an important problem, but strictly navigation improvement becomes more difficult. The river at low water tends to be too wide and therefore too shallow. The project channel is 9 feet deep, to be attained by a combination of regulating works, which narrow the channel, and by dredging at critical points. A 9-foot channel exists up to St. Louis, but on occasions of low water it may be shoaled to less than this and have to be dredged out. Some periodic dredging will probably always be necessary, due to the large deposits of sediment following floods.

Above the mouth of the Missouri the river is much smaller. There is a project channel calling for a 9-foot depth to St. Paul-Minneapolis, involving 26 locks and dams with lock chambers in general 110 feet wide and 600 feet in length, one of which is located at a dam, privately constructed primarily for power purposes, at Keokuk. Work on this project is being actively prosecuted and is scheduled for completion during 1938. Above St. Paul-Minneapolis there are minor shallow-draft channel improvements. The Government has also constructed six reservoirs near the headwaters of the river to impound flood waters and regulate the flow below. These have had a very beneficial effect on navigation depts both above and below St. Paul, and computations indicate that these reservoirs can and do increase the low water stage at St. Paul.

The commercially important tributaries of the Mississippi, other than the Ohio and Missouri, are, first, the Illinois, which has a 9-foot channel to Lake Michigan, second, a group including the Yazoo, the Red, the Arkansas and others, principally in the southern part of the valley, which resemble on a smaller scale the Missouri, described below.

5-b. The Ohio is formed at Pittsburgh by the junction of the Allegheny and Monongahela, and is nearly 1,000 miles long. It is subject to tremendous floods which may raise the water surface 60 feet more at certain points. At low water in a natural condition it tends to be broad and shallow, with numerous bad bars. The same description applies in general to its principal tributaries, namely the Allegheny, the Monongahela, the Kanawha, the Big Sandy, the Kentucky, the Cumberland and the Tennessee.

The improvement of the Ohio forms with the Upper Mississippi, the most ambitious river project for navigation only, undertaken by the Federal Government. The Ohio has an immense potential commerce, as it flows through the steel, coal and general manufacturing centres of the Pittsburgh district, Ohio and West Virginia, and through important manufacturing, mining and agricultural areas below. The adopted project provides for a 9-foot channel from the mouth to Pittsburgh, by the construction of some 50 locks and dams, whereby the entire river has been canalized. The project started many years ago, has been completed resulting in a 9-foot navigation channel throughout the entire river.

The Monongahela and Allegheny are both canalized, with governing depths of 8 feet on the lower and important stretch of the former and 9 feet on the latter. The Kanawha River is being canalized for 9 feet for 90 miles above the mouth; the Little Kanawha, for a 4-foot depth for 48 miles; the Muskingum for a 5½-foot depth for 91 miles; the Kentucky for a 6-foot depth for 280 miles; the Green and Barren rivers, in Kentucky, to about 6 feet for nearly 200 miles. All these canalized projects, except the Kanawha and Allegheny, are completed and the locks and dams are being operated and maintained.

The Tennessee River, the largest tributary of the Ohio, has presented great difficulties to improvement on account of the fall line crossing the river in the neighborhood of Muscle Shoals in northern Alabama, producing a series of rock shallows and rapids. Work on the river has been carried on at various points and under various projects, with material commercial advantage, but until recently the great cost of a thoroughgoing improvement prevented its adoption. However, the steep slope and rapids at certain points which so interfere with navigation, possess at the same time great potentialities for electric power, particularly in view of the large low-water flow of the river and the possibility of increasing this through regulating reservoirs in the mountains. It is notably a river in which economic improvement for navigation must go hand in hand with the

development of electric power. Large scale improvement along this line began with the adoption during the World War of the great power development at Muscle Shoals, intended primarily in connection with a Government nitrate plant. The nationally known Wilson Dam was completed in 1927, and construction of a series of large dams, equipped with locks 110 feet wide and 600 feet in length, to secure a 9-foot channel 650 miles to Knoxville, Tenn., is now actively in progress. A large amount of potential water power will be available at the dams. This construction is being carried forward by the Tennessee Valley Authority.

At present 6-foot navigation exists from the mouth of the Tennessee to Wilson Dam and thence by its locks for a further distance of about 15 miles. Above that point work on the project for extending the channel to Chattanooga is in various stages of completion.

Wholesale development of the power of the Tennessee above Wilson Dam seems likely in the next generation. Under instructions from Congress the Army Engineers have completed an elaborate survey of the electrical resources and the possibility of their development in conjunction with navigation. It is likely that several million horsepower will ultimately be developed.

The most important remaining tributary of the Ohio system is the Cumberland. This has a project for a 6-foot channel by canalization up to Nashville, a distance of 192 miles, and for a 6-foot channel thence for over 300 miles by 18 additional locks and dams.

5-c. The Missouri was naturally navigable in a sense from its mouth to Fort Benton in Montana, a distance of 2,285 miles. It is characteristically a broad, rather shallow river, subject to very large floods and with a tendency to erode its banks and shift its channel like the lower Mississippi. It did not however possess in a natural state as good a low water channel. From the mouth to Kansas City, about 400 miles, there is a substantially completed 6-foot channel. From Kansas City to Sioux City the project provides for a 6-foot channel also, work on which is actively in progress. A large retention reservoir is being constructed at Ft. Peck, Mont., which will aid in flood control and also supplement the flow in the lower river during low water periods, it being expected that the regulated river flow will afford a channel 8 to 9 feet in depth from Sioux City to the mouth. Between Sioux City and Fort Benton there are Federal projects for snagging and clearing the river and for bank protection at critical points with a view to holding the channel in its present position.

6. The Intracoastal Waterways of the Atlantic. — By «intracoastal waterway» is meant a protected channel, usually of a depth for small vessels, running close to and generally parallel to the coast. Reference is often made to «an intracoastal waterway» from Boston to Miami or to Key West. The statement requires some interpretation. There does not exist a continuous intracoastal channel over this section, and should one be provided in accordance with one of several proposed plans, its character and commercial significance, and the amount of protection provided, would vary greatly in different sections.

Starting from Boston, private capital had provided a ship canal across the base of the Cape Cod peninsula with a depth of 25 feet. The canal was purchased by the United States in 1928 and is now being deepened to 32 feet. By using this, the waters north of Marthas Vineyard, Long Island Sound, and the improved channel through Hell Gate, vessels can proceed from Boston to New York Harbor by a safer and more protected route than that around Cape Cod in the open Atlantic. An important commerce moves over this stretch. The waters are however often quite rough, and the vessels utilizing them are mostly either ocean-going steamers or sailing ships, or large seagoing barges. This stretch can therefore hardly be classed among inland waterways. The next step is from New York Harbor across New Jersey to the Delaware River. A canal was constructed by private capital many years ago on this section, but its dimensions and therefore its commercial possibilities are limited, and this canal known as the Delaware and Raritan Canal is no longer in use. The Government has under consideration a proposal for a ship canal across New Jersey, an ambitious and expensive project. From Trenton on the Delaware there is a 25-foot channel to Philadelphia, and thence an ocean channel to the sea; and about 40 miles below Philadelphia the Delaware is connected with Chesapeake Bay by a formerly privately owned canal. This was taken over in 1919 by the United States and is being deepened to give a 27-foot sea level canal. Chesapeake Bay through its entire length is navigable for large vessels, and carries an important commerce; the numerous small communities on its shores are to a large extent dependent on it, and there are also heavy movements affecting Baltimore, Washington and Norfolk. This extends the intracoastal system to Norfolk. South of that point the coast is characteristically fringed with sandy islands locally called «sea islands» or «keys,» behind which is a stretch of marsh with winding tidal creeks. By straightening these and linking them together with short canals, an excellent sheltered waterway can be furnished at comparatively small cost. In this manner the United States has completed a protected inland passage to Miami, Fla., with depths ranging from 7 to 12 feet. An extension of the waterway south to Florida Bay, a distance of 63 miles, was recently authorized by Congress.

7. Intracoastal Waterways of the Gulf.— On isolated sections of the west Florida coast from Mobile Bay to Lake Pontchartrain, and along the Louisiana and Texas coast, there are natural systems of intracoastal waterways of much the same character as those described as existing on the South Atlantic coasts. In southern Louisiana this system is very intricate and extends far north into the State, on account of the existence of streams which are now or formerly were supplementary mouths of the Mississippi. The most important is the Atchafalaya, which flows from the Mississippi, near the mouth of the Red, south into the Gulf. These streams are locally known as bayous. Many of them have naturally excellent depths. Federal improvement in the past has been concerned chiefly with linking up natural waterways by limited and inexpensive work. The great and growing importance of the Gulf coast has however made necessary a more

thorough-going improvement, and Congress has recently adopted a project for a through 9-foot channel, utilizing as far as possible existing channels, from the Mississippi to Corpus Christi. This will be sea-level except that a lock is required to enter or leave the Mississippi. On account of the sea island formation, it is practicable to continue such a channel from Corpus Christi, to the mouth of the Rio Grande, should it be found economically desirable. East from New Orleans there is a connection by lock to Lake Pontchartrain, whence a sheltered barge route exists along the coast to Mobile Bay, and thence to the vicinity of Carabelle, Fla., the general depth being 9 feet at mean low water. Surveys are in progress along the west coast of Florida to determine the need and practicability of the Gulf Intracoastal Waterway southerly to the proposed Florida Cross-State ship canal and on to the mouth of Caloosahatchee River.

8. The Sacramento-San Joaquin System.—These two rivers between them drain the central valley of California between the Sierras and the coast range, uniting to flow into San Francisco Bay. Most of their drainage area is rich agricultural land. The Sacramento, in its original state, had a fairly good channel for a considerable distance. An unusual and interesting problem, however, rose here in the last century, due to large scale hydraulic gold mining in the upper valley. The process adopted involved the washing into the river of an immense amount of sediment, the total amounting to many hundred millions cubic yards. This sediment choked the river and its tributaries, with serious results to navigation and to the flood situation. Due to the absence of adequate local regulation, conditions became so acute that Congress was forced to step in, and in 1893 created a board of Army Engineers, known as the California Debris Commission. The Commission drew up and has since enforced a system of regulations which prevented further damage from hydraulic mining. It also prepared a plan for the complete protection of the Sacramento Valley from the disastrous floods to which it is sometimes subjected, involving an elaborate system of levees, dams, floodways and channel enlargement. The project was adopted on a co-operative basis by the United States, the State of California and local land owners. While desired primarily for flood control, the above work is of material benefit to navigation, and other work is also being carried on specifically for navigation improvement. The Sacramento is now navigable up to the city of Sacramento with a depth of 10 feet, with lesser depths above.

The San Joaquin also handles an important river commerce up to Stockton on a 30 foot channel.

9. The Columbia System.—From its mouth to Vancouver, Washington, and to Portland, Oregon, on the Willamette, the Columbia has a very fine deep channel suitable for large ships. This stretch is a port approach. The upper Columbia and the Snake are large rivers but are broken in many places by falls and rapids. From Vancouver to the mouth of the Snake, the Columbia is generally navigable for shallow draft vessels except at two points, the Dalles and Celilo Falls. At both points the Government has constructed lateral canals with locks, having available depths of 8 and 7 feet respectively. There is also a project for clearing the river above Celilo Falls, and for minor work with a view to providing a 5-foot channel over the lower 218 miles of the Snake up to Pittsburg Landing. A large scale navigation improvement for the upper Columbia and Snake rivers must however, as in the case of the Tennessee, be done in connection with water power developments. Millions of horsepower are available on these rivers. A combined power and navigation dam is being constructed on the Columbia River at Bonneville, about 42 miles east of Portland, which was completed in 1937 and permits the extension of deep draft navigation to the Dalles 80 miles above Portland. The lock in the Bonneville Dam measures 76 feet wide and 500 feet in length and has the highest single lift of any navigation lock in the world.

The Columbia in its lower reaches has improved tributaries which, although their channels are limited, and little money has been spent on them, carry, in some cases, a very large commerce, though this is principally floated logs. The most important is the Willamette above Portland, Oregon.

10. Other Pacific Rivers.—A group of small or moderate sized rivers enter the Pacific or Puget Sound in Washington, Oregon and northern California. Their fall line is very close to the ocean, and below this they tend to have quite shallow natural channels with bad bars. The most important commercially are the Siuslaw, Umpqua, Coquille, Coos and Yaquina Rivers in Oregon and the Snohomish and Skagit in Washington. These have been improved to depths appropriate for their character of commerce, which is principally floated logs.

D. Tonnage and Value of Existing Commerce.—That for the principal waterways appears in the following table: (For full details see the annual reports of the Chief of Engineers, United States Army).

COMMERCE OF UNITED STATES WATERWAYS, 1937

	Short tons
Atlantic Coast Rivers:	
Penobscot River, Me.	805,981
Herring River, Mass.	347,000
Pawtucket, R. I.	408,711
Thames River, Conn.	422,457
Connecticut River below Hartford, Conn.	1,232,636
Hudson River (Spuyten Duyvil to Waterford, N. Y.)	11,091,186
Mantua Creek, N. J.	327,699
Delaware River, Philadelphia to Trenton	3,696,251
Elk and Little Elk Rivers, Md.	775,361
Potomac River below Washington	2,449,622
York River, Va.	350,389
James River, Va.	2,242,335
St. Johns River (Palatka to Lake Harney, Fla.	469,301
Miami River, Fla.	476,139
Gulf Coast Rivers:	
Mobile River, Ala., tributaries	1,663,807
Black Warrior, Warrior, and Tombigbee Rivers, Ala.	1,825,568
Bayou Teche, La.	1,454,684
Lake Pontchartrain, La.	1,100,277
Mermentau River, Bayou Nezpique, and Bayou de Cannes, La.	777,145
Bayou La Fourche, La.	870,522
Cedar Bayou, Tex.	530,977
Pacific Coast Rivers:	
San Joaquin River, Calif.	976,110
Sacramento River, Calif.	663,710
Umpqua River, Ore., including entrance	409,668
Coquille River, Ore.	451,948
Coos River, Ore.	632,469
Columbia and Lower Willamette Rivers below Vancouver, Wash., and Portland, Ore.	7,300,200

COMMERCE OF UNITED STATES WATERWAYS, 1937 —*Continued*

Pacific Coast Rivers—*Continued*

	Short tons
Columbia River from Vancouver, Wash., to The Dalles, Ore.	661,582
Skipanon Channel, Ore.	604,987
Willamette River (above Portland) and Yamhill River, Ore.	2,504,265
Youngs Bay and Youngs River, Ore.	811,814
Elokomin Slough, Wash.	536,425
Hoquiam River, Wash.	657,593
Snohomish River, Wash.	1,969,644
Westport Slough, Wash.	531,915
Coeur d'Alene Lake and St. Joe River, Idaho	356,239
Mississippi River and Tributaries:	
Mississippi River (Minneapolis, Minn., to the Passes)	28,307,790
Illinois River, Ill. (Ill. Waterway)	3,575,299
Missouri River: Mouth to Kansas City	416,474
Kansas City to Sioux City	566,706
Allegheny River, Pa.	3,436,550
Monongahela River, Pa. and W. Va.	24,927,507
Muskingum River, Ohio	839,465
Kanawha River, W. Va.	3,176,319
Ohio River, Pittsburgh to mouth	23,356,676
Cumberland River, below Nashville, Tenn.	468,881
Tennessee River, Knoxville to Paducah	1,377,107
Federal Canals and Connecting Channels:	
Cape Cod Canal, Mass.	3,538,566
Delaware River to Chesapeake Bay	1,436,828
Norfolk, Va., to Beaufort Inlet, N. C.	823,343
Jacksonville to Miami, Fla.	532,587
St. Marks River to Corpus Christi, Fla.	5,753,919
Lake Charles Deep Water Channel, La.	6,822,917
Sabine Neches Canal, Tex.	25,111,402
Aransas Pass to Corpus Christi, Tex.	6,615,525
Calumet-Sag Canal, Ill.	350,949
Grays Reef Passage, Mich.	5,575,681
St. Marys Falls Canal, Mich.	87,633,699
Chicago Sanitary Drainage Canal	2,469,822
Detroit River, Mich.	26,203,257
Multnomah Channel, Ore.	1,092,567
Canal and Locks at Willamette Falls, Ore.	565,369
Port Townsend Bay to Oak Bay, Wash.	472,814
Lake Washington Ship Canal, Wash.	1,731,016
State and Private Canals:	
New York State Barge Canal system	5,010,464
Navigation Canal, Inner Harbor, La.	1,822,618

The grand total (gross) for all rivers, canals and connecting channels was 342,343,716 short tons, valued at $5,939,272,119.

E. Relation of Waterways and Railroads. —In general terms the history of American internal waterway commerce has passed through three phases. The *first phase,* of growth, began as to our East coast with the colonization of the country, and as to the Middle West and West, with the advance of population in the 19th century. The rivers were usually the best, and frequently, the only means of transportation of freight and passengers, and without their utilization the settlement of the Mississippi Valley would have been vastly more difficult. In the first half of the 19th century there developed a large, flourishing and profitable commerce on the important rivers of the central valley. This was also a period of extensive canal construction, both in the Northeast and in the States bordering the Ohio and the Great Lakes. During this time there was no serious railroad competition. The *second phase,* of decline, dates roughly from the Civil War, and was synchronous with, and directly due to the expansion westward and southwestward of the great railroad systems. The *third phase,* which began some 15 or 20 years ago, is again one of growth, and of changed relations with the railroads.

The most important point to the student of the economics of inland waterways transportation, is its relation to rail transportation. Briefly, the proper conception of this relationship is that the two forms of transportation are correlative and are, or should be, co-operative, instead of competitive. This fact is beginning to be realized and acted on. The improper conception is that the two are naturally competitive and that one or the other must be driven from the field. This is the conception that ruled in the past. Throughout the second or highly competitive historical period, the railroads were the aggressors, usually with success, and the waterways were on the defensive, usually without success.

A railroad competing with a waterway has four important weapons. The first is the granting of competitive rates. A river can, of course, serve directly only the communities on its banks, whereas a railway can serve all communities. If permitted by law, a railway can lower its rates between water points until they are below what the water carrier must charge to earn money. If it does this the railroad will probably lose money on this particular traffic. It can however, recoup itself by correspondingly raising rates to off-water points. Thus it penalizes shippers on off-water points in order to drive the water carriers out of business. This end having been accomplished, rail rates between water points can once more be raised. Early railroad history was full of instances of this sort. Even after rail rates had been brought under the jurisdiction of the Interstate Commerce Commission, the practice of competitive rates continued, due to the commission so construing several successive laws under which it operated as to hold that railways could modify their rates in order to meet the effective water competition. It was not, indeed, until the passage of the Esch-Cummings act of 1920 that Congress wrote into a transportation act a full recognition of the Federal interest in fostering water transportation, in such a manner as effectively to influence the rate decisions along these lines. A study of the various Interstate Commerce acts throws a very interesting light on the gradual awakening of the country to the importance of its inland waterways.

The second weapon of the railroads has to do with joint rates. If a point a little distance from a river desires to enjoy the advantages of cheaper water transportation with another point on the same river, the freight must of course be gotten from the first point to the river bank before it is placed on the boat, and unless the distance is short enough for trucking, this part of the haul must be by rail. The shipper naturally desires to send his goods all the way through on a single bill of lading. If the railroad refuses to grant a through joint rate with the water carrier for the combined rail-and-water haul, the shipment cannot be made on a single bill of lading, which is likely to discourage the use of the rail-and-water route in preference to an all-rail route. If the railroad does grant a through joint rate, it may still demand, as its share of that rate, so large a proportion that the part remaining to the water carrier is insufficient to make it a paying concern. The commercial history of the Federal barge lines on the Mississippi-Warrior Rivers, referred to below, is one of continuous negotiation with the railroad in the attempt to get joint rates, and equitable divisions of those rates, so that both parties to the combined move could make a profit.

The railroad has also many natural advan-

tages over a river carrier. Except perhaps for some movement between river points, it can nearly always send fast or perishable freight more expeditiously. It can run its tracks to any point whatever. It can grant in-transit privileges which a water line would usually find great difficulty in granting. An important example is reconsignment privileges, by which a carload of goods can be shipped, say from Jacksonville, consigned to New York, and diverted enroute by telegraph to any other point, or held temporarily in a railroad yard, in order that the shipper may take advantage of the most favorable market. The railroads' ability to do this is due to the elaborate organization of their traffic, to the fact that they reach all important points, and to the fact that their carrying unit, i. e., the freight car, is a small one, which can be deflected or delayed without material effect on their operations.

Finally, the railroads, until quite recently have been far more efficient than the water carriers. The rolling stock, operation and organization of a Middle Western railroad in 1910 was incomparably superior to those of the same railroad when, 50 years before, it began fighting the water carriers on the Ohio and Mississippi Rivers. But in the same period there was in general little improvement of those water carriers. They did not have the capital or organization of the railroads, and they tended to an inefficiency and conservatism in their design and operation which might have been fatal to them even had not other means, both fair and unfair, been employed against them.

The situation thus brought about lasted without notable change almost until the World War. It was followed by a sudden and striking change. The most notable fact in American economic history in recent years has been the development of true *efficiency,* as distinguished from an activity which produced gigantic results but in a very wasteful manner. The growth of the country, the reduction of certain natural resources, and particularly the pressure of the war, taught us the lesson of the maximum economy in our commercial operations, which was learned long since by the more densely populated European countries. It is an inconvertible fact that, given an adequate channel and a modern and efficient water carrier, it is much cheaper to carry goods between two points by water than by rail. The country is beginning to realize that it is bad policy to permit the waste of this great potential asset of cheap water haul. On many of our principal waterways, notably in the Mississippi Valley, where for the past half century traffic was confined to short local hauls or to the movement of low grade material such as sand, gravel and stone, there has developed a demand for modern river freight service, and for equitable arrangements with the railroads so that unfair competitive rates shall be done away with, and so that joint rail-and-water hauls shall become practical. This is manifesting itself by the creation of modern terminals, the construction of suitably designed vessels, and a revision or pressure for revision of the rate structure.

One important factor has been the operation of the Federal Barge line, recently reorganized as the Inland Waterways Corporation, operating under government ownership and control on the Mississippi and Warrior Systems. It was established during the World War. Until very recently its operations showed a loss so considerable that private capital in all likelihood would either never have entered the field or would promptly have been driven from it. Being backed by the Government, however, it was able to take the loss, and at the same time to exercise continual pressure on the railroads for equitable rates and treatment. It is notable that many important railroad companies of the same territory have voluntarily made suitable arrangements with the barge line. During the calendar year 1935, the line carried 1,732,059 tons of freight, mostly medium or high grade, and showed a net profit of $703,107.38 on its investment after meeting maintenance, operating, and depreciation charges.

The full extent of this waterway recovery cannot be gauged by the statistics of the total traffic of the rivers. They have always carried a considerable tonnage, even in the worst years, and the *percentage* increase in many cases is not yet very large. The significant thing is the *character* of the increase, the change from purely local and low grade business to long hauls of medium grade material such as bulk grain and structural metal, and of high grade material such as package freight. Very significant in this connection are the activities of the important steel companies in the Pittsburgh district, which are now shipping their products on a large scale, in their own barges down the Ohio and Mississippi. The Ohio tonnage of this character has increased over sevenfold in recent years.

The changing attitude of the railroads is due to their realization of the proper relationship between rail and water transportation, which as stated above is that of co-operation rather than competition. The railroads will always be the backbone of internal transportation, and efficient water service cannot exist without their co-operation. On the other hand the waterways can perform very important services for the railroads. They can handle peak load movements, notably from large agricultural areas, which now on occasion tend to congest railroads, causing delays, damage to crops, losses to the shippers, and corresponding reduction of the purchasing power of the community, which in turn is reflected in smaller rail shipments of general merchandise. The waterways can in many cases enable the railroads to avoid the condition of an unbalanced haul, i. e., a heavy movement one way and a light movement the other, which of course involves a return haul of empty cars at a loss. The waterways can relieve the railways of much low grade bulk traffic, which it is difficult for the latter to haul at a profit, and the handling of which interferes with the movements of the high grade materials on which the railroads get their principal freight revenue. The waterways can assist in seasons of car shortage. Finally and most important, the saving arising from the inherent cheapness of waterways is a net saving and benefit to the entire community, which is certain to be reflected in its increased prosperity and purchasing power, and equally certain to be shared by all the important agencies of the community including the railroads themselves.

F. Theoretical and Actual Present Character of Waterway Commerce.—In an ideally co-ordinated transportation system, the question

of whether a freight movement would be by water would turn on four main factors.

1st. The peculiar adaptability of water transportation to low grade and medium grade bulk commodities. Where the value of the freight is small, the freight cost becomes a material item, and there is a more pressing need of seeking the utmost economy therein. Also the first cost and maintenance cost of the container become a material item, and it is far cheaper to build and maintain one 2,000-ton barge than forty 50-ton freight cars. Also this class of freight, moving on a single- or even double-track railroad, tends to slow down all movements thereon, while the same is not true on a river. Also its handling into and out of a single large container (barge) is usually less expensive than that for a number of small containers (freight cars).[1] Also it does not usually demand the fast freight or express service which the railroads *can* give to high-grade freight.

2d. The superior ability of the railroad to give express service between two points, unless one or both points are on or close to a connecting waterway, and unless the combined rail and water movement, if any, is very carefully organized. This is especially important in the case of perishables.

3rd. The inherent advantages possessed by railroads in such matters as intransit and reconsignment privileges, touched on above; particularly important where the shipper is a seller who must watch closely the price fluctuations in various markets.

4th. In any case involving a joint rail-and-water haul, the cost relations between line haul by land, line haul by water, and transshipment, it has been explained that, generally speaking, *line haul* by water, given suitable carriers and channels, is cheaper than line haul by rail, although the ratio between them varies widely. Assume a shipment from Jackson, Miss., to Springfield, Ill. This can go direct by rail at a cost per 100 lbs. which we will call R. It can also go by rail from Jackson to Vicksburg at a cost of R_1, thence by water to East St. Louis at a cost of W, and thence by rail to Springfield at a cost R_2. At both Vicksburg and East St. Louis it must be transshipped from rail to water. Call the transshippment costs T_1 and T_2. Then the total cost of the combined movement is $R_1+T_1+W+T_2+R_2$. Unless this is *less* than the single direct rail rate, the freight will not, and in the interest of economy, should not, move by the combined rail and water route.

The water route involves two costs which do not appear in the all-rail route, namely, the rehandling at Vicksburg and at East S. Louis. These two charges, in an economic computation, must therefore be absorbed into and spread over the cost of water haul between Vicksburg and East St. Louis, and will increase the cost per ton-mile of that haul.[2]

Evidently, the longer the water haul, the less its cost per ton-mile will be raised by the addition thereto of the fixed charges for rehandling. Two other elements are also to be considered. The combined haul will usually be longer than the straight rail haul, due particularly to the sinuosity of the average river compared to the average railroad. In the above illustration the shortest rail distance from Jackson to Springfield is 599 miles, but the distance by rail, water, rail is 926 miles. The other factor is that rail rates do not vary, and properly should not vary, *directly in proportion* to distance. The cost of a haul to the railroad itself consists of two parts, the cost of the line-haul proper and the cost of loading and unloading the cars at the termini, including switching, demurrage, etc. Naturally this fixed terminal charge affects the total cost per ton-mile more appreciably in short hauls than in long hauls. That is, it may cost the railroad only twice as much to load, haul 300 miles and unload, as it costs to load, haul 100 miles and unload. Therefore the rates which the railroad should properly charge for its two *short* hauls in the above example, namely from Jackson to Vicksburg and from East St. Louis to Springfield, while less than the rate for a single movement from Vicksburg to Springfield, are not less in proportion to the difference in distance; the *ton-mile* cost for either of the short hauls being greater than the *ton-mile* cost for the single long haul.

It is evident from the above that there will be many cases where a haul between two points, one or both of which is off water, can be made more cheaply by combined movement than by all rail; but also many cases where it cannot. Likewise, that the most important factor is the *relation of rail distances to water distances,* and that combined movement, to be truly economical, must in most cases involve a haul by water *quite long* in comparison to the rail hauls at one or both ends. Likewise, that the next most important factor is efficient terminal service and rehandling so that the costs T_1 and T_2 will be as low as possible.

With ideal organization we would therefore expect to see the following moving by water: (1) Nearly all low-grade and medium grade movements between all-water points. (2) A considerable part of all high-grade movements between all-water points, except that perishables would move to a limited extent only. (3) A large part of low and medium-grade bulk movements involving at least one land haul where the water haul was long in proportion to the land haul. (4) A smaller but considerable part of all high-grade movements, other than perishables, between such off-water points with a long water haul and short land haul. (5) Little or no movement of perishables between such points. (6) And very restricted movements in all cases where express service or reconsignment privilege are called for.

Considering the actual situation, case (1) is now the rule (coal in the upper Ohio Valley, logs in the west, oil, sand and gravel). Case (3) is the rule in some important cases (Western grain transshipped at St. Louis for New Orleans; ore, coal and grain on the Lakes, with one or two short rail hauls involved); but in other localities is not the rule. Case (2) is less general, though it is developing with efficient fast packet service (Mississippi, Hudson, Ohio, Sacramento). Case (4) is exceptional, existing

[1] This statement needs qualification in the cases where special and very efficient apparatus has been devised for loading and unloading railroad cars at points where there is an immense movement of a single bulk commodity.

[2] The published water rate may "absorb" the handling costs, so that the shipper is never billed specifically for them; i.e., the water carrier meets these costs out of the sums received for the line haul. This does not affect the principle involved.

only where, as on the Mississippi, equitable joint rates are being established.

In other words, the weakness of the waterways system is primarily in the *combined haul* province; and as between high-grade and low-grade freight, is primarily in the *high-grade* province. The second weakness involves line-haul and terminal efficiency on the waterways, touched on elsewhere. But both weaknesses need, for correction, continued readjustment of the relationship of rail and boat; and we end as we began, with the fact that this relationship is the key to inland waterway economies.

G. Benefits and Justification of Inland Waterways.—The principal benefits of improved inland waterways to the general public, or to any section of the public or to individuals, are:

(1) Reduced transportation costs, by a movement by water inherently cheaper than the same movement by rail or other means.

(2) Reduced transportation costs on material which, though it continues to move by rail, moves at a less cost through the reduction of rail rates to meet water competition.

(3) Increase in the value of land or other private investments.

(4) General development of tributary territory.

Of the above (4) is often of unquestioned importance. Large sections of our country would perhaps never have been developed to the point which they have reached today, and could certainly not have been thus developed so easily and cheaply, without the use of natural or improved water channels. This factor is, however, necessarily not computable in definite terms. Benefit (3) may often be very great, but is likely to affect only a limited number of individual owners. Therefore the student of economics, seeking a conception of general waterway benefits expressed in reasonably accurate terms, must usually confine himself to (1) and (2).

Referring to (2), it is of course true that when a railroad, in order to meet water competition, lowers its rate for certain hauls, all the shippers affected are benefited. Obviously, however, if the railroad does not raise its rates elsewhere, this benefit is at the direct expense of the railroad stockholders. If, as often occurred in the past, and as is mentioned above, the railroad does raise its rates elsewhere, the benefit to the favored shippers is at the expense, not of the railroad stockholders, but of the shippers in less favored non-competitive territory. Whether this shifting of money, so to speak, from the pockets of one shipper, or of a railroad stockholder, to the pockets of another shipper, is equitable, must depend in any specific case on whether past and present rail rates are too high, or too low, or to what extent, before the change, they were equitably distributed as regards to the various sections which the railroad serves and the various goods which it carries.

The subject of rail rates, which lies outside the scope of this article, is an exceedingly complex one. Many years ago the Government established the Interstate Commerce Commission as an agency for dealing with and regulating, among other things, rail rates. Such a Federal agency being in existence, empowered to regulate rates and operating under specific statutes and broad principles of equity, it is evident that the Federal Government should not in logic undertake activities which have for their sole end the regulation of those rates by other means. Congress has therefore frowned on the policy of improving inland waterways for the purpose of forcing a modification of rail rates. Any waterway project may have this incidental effect; but the recommendations of the War Department, and the action of Congress on any project tend to disregard this, and to give consideration solely to benefit (1) above, namely *the savings to the general public by commerce which, as a result of the improvement, will actually move on the waterway at a saving in actual transportation cost.*

The improvement of a water channel thus becomes in principle in no way dissimilar to the undertaking of any ordinary business enterprise. The improvement will cost a certain amount, which may be considered as capital cost, allowed for on the books by a reasonable carrying charge, say 4 per cent or 5 per cent, the range over which in former years the Government has borrowed money. The maintenance of this channel, plus the operation of locks, if any, constitutes an additional charge; and the sum of the two is in effect the annual cost of the waterway to the Government. Both figures can be arrived at in advance with considerable accuracy. The corresponding benefits consist of the tonnage which will annually move over the improved channel, multiplied by the saving per ton to the shipper moving his goods by this means instead of moving them by some other means. This saving, of course, does not go to the United States Treasury, but to the shippers who use the waterways, and in a diminishing degree to the purchasers of the goods, and, through various ramifications, to individuals or communities throughout the country. Nevertheless the Federal Government, being merely the agency of the American people, considers it sound business to invest a part of their money, collected by taxation into the Treasury, in waterway improvement, provided a reasonable profit to the people is made thereon through reduced transportation charges to various shippers, industries, etc., and provided these benefits are sufficiently widespread to make the matter of national rather than of purely local importance.

In thus balancing cost against benefits there must be considered: The actual amount of the gross savings, the degree to which they are distributed through the nation, and the proportion which they must bear to the cost in order to make the waterway a paying investment.

The estimate of gross savings involves a forecast of tonnages and of rate differentials. The accuracy with which it can be made varies greatly in different cases. It can, of course, never be arrived at with the same accuracy that inheres in a strictly engineering computation. A variety of factors enters. Differential rate figures are necessarily based on existing rail rates, whereas the improvement of the waterway may result in a change of these rates to an unpredictable extent (though the tendency is far less than in the past). Again, commerce tends to follow existing channels of transportation, all details of which are familiar to shippers and consumers, even though alternative channels may be in existence which

possess potentialities of savings. Again, where the use of the water channel would involve a combined rail and water movement there is opened up the whole complicated question of through the bills of lading, joint rail and water rates and their divisions, touched on above. Again, the utilization of a water channel involves the existence of capital willing and able to build and operate boats and terminals, and to make the necessary arrangements for interchange with land carriers. Again, as we have seen above, the character of the material to be moved is an important factor.

All these and other questions enter into estimates of the future commerce and future savings of the waterway, which form one of the most complex studies that confront the army engineers who make recommendations on such improvements. The inevitable uncertainty of such estimates in most cases leads the Government to undertake improvements only when the benefits, according to the best possible estimate, are well in excess of the cost. The situation is analogous to that of a man who invests capital in a business, the returns of which are somewhat uncertain, and who therefore naturally demands a larger prospective profit to compensate him for the risk. No exact formula in the case of waterways has been or can be evolved, as conditions vary so greatly. Speaking generally, it is not the tendency of Congress to adopt a project unless probable benefits, computed as above, are at least several times the annual costs to the Government computed as above.

The question of the *spread* of these benefits is one of fact and judgment. It is impossible to imagine a waterway, the benefits of which are shared in an exactly equal degree by all the people of the United States. Even with channels of such immense national importance as the entrance to New York Harbor, or the connecting channels of the Great Lakes, or the Panama Canal, there will be certain individuals and interests who derive a very material and immediate cash benefit therefrom, and other citizens to whom the benefit is either negligible or so indirect as to be incalculable. If, however, a certain channel will visibly benefit a large city, or an important section of the country as a whole, or will produce savings to an important group of interests whose products enter largely in the general commerce of the country, the tendency of Congress is to consider this as a national benefit which, if the savings in sight are large enough, justifies Federal assistance. If the apparent benefits are exclusively to a small community or a few individuals it is not a proper case for Federal assistance. There is an intermediate class of cases, where, while considerable national benefits are in sight, so large a share of purely local benefit is also visible that Congress demands co-operation in the project, usually in the form of a percentage (perhaps 50 per cent of the first cost, paid into the Treasury in advance). Many such co-operative projects are in existence, notably on the Pacific coast. There is also a tendency for the Government to confine its improvement to main channels of approach or arteries of commerce, leaving to localities the provision of branch channels, approaches to terminals and so on.

A computation of the total economic benefits of all the internal waterways of the country is an immensely intricate process. An attempt to work it out in elaborate detail would result in discovering so many factors incapable of exact evaluation that a rigidly accurate answer would be incapable of even theoretical determination. It is, however, possible to obtain a figure of the general «order of magnitude» of the correct one. The annual cost to the United States of its improved inland waterways, excluding the Lakes system, is not over $20,000,000. Annual direct freight savings work out at about $35,000,000, which is almost certainly small enough and may be as much as 50 per cent too small. Within the margin of error of such work it is therefore safe to say that our inland waterways carry themselves on a financial basis and return to the people an annual dividend of at least $15,000,000, perhaps several times as much, on the capital investment which the people, through taxation, have paid for their creation and upkeep. These figures, of course, disregard entirely the investment and operating costs of vessels, terminals, etc., owned privately; but since these exist and carry on business, it is evident that in the general case they operate at a profit.

The above figures are based upon the single factor of direct savings on freight actually moving by water. If all factors are taken into account they are obviously far too low. They disregard the incalculable factor of stimulation of trade and industry. They disregard the immense total increase in land and other values resulting from waterway improvements. They disregard the fact that many flourishing developments, agricultural, industrial and mining, would not be practicable at all were it not for the existence of water transportation. They disregard also such entirely non-navigation aspects as benefits of the Mississippi River improvement in the flood control of the lower valley, which in land values can probably be evaluated at billions of dollars. Finally, the figures take into account the cost to the United States of *all* Federally improved inland waterway channels, even though these are not now returning, so to speak, a profit. A number of instances exist of rivers which many years ago and over a long period carried so flourishing a commerce that they paid for themselves several times over, but on which for various reasons commerce has fallen into decay. These represent what in private business would be written off the books as obsolete plant that has been amortized. Such projects, granting the amortization of the funds originally spent on them by the benefits derived in the past, are no charge whatever on the Government. There are numerous such small waterways which remain on the books as technically approved projects, but on which for many years no money whatever has been spent, or will be spent unless a revival of actual or potential commerce should make it once more worth while. It is cases of this character which are sometimes mistakenly cited as examples of so-called Federal extravagance in waterway improvement.

H. Types of Carriers.—The full economy of internal water transportation can only be secured by vessel construction following the trend of mechanical development. In certain special cases this has occurred over a long period. The Great Lakes have developed a form

of large steam propelled ships of extraordinary efficiency. Excellent passenger and freight carriers operate on the Hudson River, between San Francisco and the Sacramento-San Joaquin system, on Chesapeake Bay, and at many other localities. On a few rivers, such as the Monongahela, where an extensive specialized commerce has developed, barge traffic has been brought to high efficiency. Generally speaking, however, until the marked revival of interest in inland water transportation of a decade ago the tendency was to depend on less efficient boats. The river steamers of the old steamboat days of Mississippi Valley history had not been adequately modernized, nor has barge traffic been properly developed. For further discussion of these vessel types see STEAM VESSELS.

Great strides have been taken in recent years in this direction. Among which may be mentioned the experiments and experiences of the Federal Barge Line on the Mississippi, Illinois, Missouri and Warrior rivers; the elaborate practical and theoretical studies of efficient forms of river transportation made by the so-called Towboat Board of Army Engineers; and the construction of floating plant by large corporations, on the Ohio system and elsewhere, for the movement of their own products. The following are the most important lines along which progress is to be made:

Propelling Machinery.—There is a large field for the introduction of more efficient machinery, either of modern steam engines or of Diesel.

Tunnel-Boats.—These are a form of screw propeller boat designed for operation in channels of limited depth, alternative to the stern-wheeler for towboat service on rivers. There is much controversy as to the merits of the two types, which cannot yet be considered settled. Irrespective of the undoubted merits of the stern wheel vessel, the tunnel-boat has great possibilities and is capable of further development.

Barges.—Transportation of freight by a fleet of barges propelled by one or more towboats is of course exceedingly economical, since the greater part of the freight is carried on vessels that do not have to be equipped with propelling machinery. This has long been recognized, and in the days before the temporary decline of Mississippi commerce, immense quantities of coal were shipped from Pittsburgh to the lower Mississippi by barge fleets. The old barges were, however, cheap structures of wood, the upkeep of which was expensive, and which were not suitable for anything except crude bulk freight. Modern construction tends to steel barges, so equipped that they can be used either for bulk freight or for package freight which requires shelter and more careful handling, and designed for maximum carrying capacity on limited draft. Such barges are rapidly coming into use on the Mississippi, Ohio and Hudson-Barge Canal systems. The oil companies are very active in developing tank barges. A demand exists for the design and introduction of an efficient refrigerated barge which can handle perishable agricultural products on a large scale.

Self-Propelled Barges.—A somewhat different line of development is toward a vessel which is self-propelled, and at the same time designed for a greater freight carrying capacity than the ordinary river steamer. These are coming into use on the lower Mississippi, and there is talk of similar development on the upper Mississippi and Hudson.

Light Draft Vessels.—The problem of economical water transportation on channels of 6 or 7 foot depth or more is not entirely solved, but the principal elements of its solution are at hand, and the rest is largely a matter of time and capital. A more difficult problem is the development along modern lines of crafts suitable for channels of 3 or 4 feet in depth. Such depth limitations greatly restrict the carrying capacity of a vessel, whether self-propelled or a towed barge, and the limitation on the amount of freight which can be carried seriously affects the revenue.

A great stimulus has been given to navigation on such shallow draft waterways in recent years by the development of the gasoline engine to a point where small and medium sized motor boats are comparatively cheap and foolproof, and there is a commerce carried in these vessels which in the aggregate is surprisingly large. This is however mostly of a local character, typically that pertaining to a single farm or small industry. An organized long haul business would require different treatment, involving perhaps the use of carefully designed light draft vessels propelled by gasoline or Diesel engines and handling a few cheaply but efficiently constructed barges. A great field for such transportation exists in the rivers of the Southeast and on the smaller tributaries of the Mississippi system.

I. Terminals.—As has been pointed out above, in almost no case can material move direct (i.e. by man or fixed mechanical handling) from origin to vessel and from vessel to destination. Even when the movement originates and terminates at communities on a waterway there is nearly always at least a truck haul to or from waterside, and in fully developed water transportation there will be in many cases a rail haul at either one or both ends of the water haul. Whether the land movement be by rail or truck there is involved an assembling of sufficient freight to fill the river carrier at the origin, and storage of this same freight at the destination until the land carriers can remove it. The cost of storage and handling at both ends is a legitimate part of the cost of water movement, and for the latter to develop its full economy these terminal charges must be minimized. Efficient terminals are therefore a vital element to water transportation. In no department of river transportation was less efficiency shown in the past. On many rivers the terminal problem was solved by the steamboat simply loading from or to the natural bank of the river, where sometimes a crude protection from the weather was provided. On the Ohio and Mississippi the common practice was to pave a stretch of sloping river bank with cobbles, so that no matter at what stage the river stood, the steamboat could come alongside and find firm ground for loading or unloading. A variant was the wharf boat, a barge moored along the bank, rising or falling with the stage of the river, to one side of which the steamboat would tie up and across which freight would be handled to the bank. Striking as it may seem, until very recent years such elementary methods, combined with the handling of the material by man power or by crude and inefficient machinery, were almost

universal. (This statement of course does not apply to the Great Lakes, nor to a few waterways such as the Hudson and the rivers of the upper Ohio Valley.)

Correspondingly, in no departments have more rapid advances been made in recent years.

The principles of efficient inland waterway terminal construction are in general the same as for sea-port terminals (See HARBORS, DOCKS AND BREAKWATERS). The two most important differences are: first, the prevalence in river transportation of barges and barge fleets carrying bulk commodities, which require a somewhat different arrangement of machinery for handling than to shiploads of similar commodities; second, and more important, the variation in stage of any rivers. Seaport terminals must be adapted to changes in tidal stage, and where there are great tidal variations, as in Northern Europe, special construction is necessary; but in the United States, tidal range is ordinarily too small to exercise a profound effect on ocean terminal design. On many of our large rivers, however, there are variations in height as great as 30, 50, or even 70 feet, and special treatment is called for.

Modern river terminals where variation of stage must be taken into account, are of three main types:

(1.) What may be called the normal inclined lift.—Here we have at the top of the bank, above flood water, a storage and assembly shed, and leading down the bank from this to the river an incline, sheltered from the weather, in which operates some form of mechanical conveyor. The conveyor track is jointed, and the lower end rests either on a gang-plank arrangement extending to the river carrier, or preferably on a wharf-boat. A vessel, to unload, moors to the outside of the wharf-boat; the freight is taken into the wharf-boat (which may be used as is a transit shed for the temporary shelter of freight) and is then placed on suitable carriers, say ordinary hand trucks, which are attached to the mechanical conveyor and hauled up the bank to the storage shed. Loading cargo on to the vessel is by the reverse process.

(2.) What may be called the parallel inclined lift.—This is designed to avoid two handlings, between the river boat at the bottom of the bank and the railroad cars at the top, by carrying the cars down to the river's edge. A spur track is built diagonally down the face of the bank at a sufficiently gentle slope so that a locomotive can move freight cars up and down it. The trestle on which the track is carried is built down to the level of low water. A barge is then constructed which carries, down its centre, a length of railroad track, and which is long enough to accommodate a suitable number of freight cars. One end of this barge is in contact with the fixed trestle so that there is a continuous track down the trestle and on to the barge. The barge, of course, rises and falls with the stage of the river; as the river rises, the barge is pulled along in the direction in which the trestle runs so that the rail connection between the two is always maintained. Thus there is in effect a jointed floating railroad spur. Alongside this barge carrying the track is ordinarily moored another barge which is the true wharf-boat. The river vessel ties up outside the wharf-boat and the freight is unloaded through it (being assembled temporarily within, as in a transit shed) and thence into the cars on the first barge.

(3.) Vertical lift.—In this system a fixed, or gantry, crane is built out from the top of the bank, suitably supported, to such a distance that at any stage of the river it overhangs a river vessel brought alongside the bank. The material is lifted mechanically directly from the vessel and carried up and then back to a point where it can be lowered into railroad cars, or alongside a transit shed or storehouse on the top of the bank.

Of these three methods, which are of course susceptible to many variations, (1) and (2) are obviously a combination of the old paved bank and wharf boat system, but with the introduction of mechanical handling and of suitable shelter for package or perishable freight. No. (3) is simply an adaptation of the ordinary wharf-side handling machinery of a seaport to the special conditions of high lift made necessary by great river variations.

Where no large variation in river stage occurs, the principles of terminal construction do not materially differ from those at ports save as the different capacities and dimensions of the river carriers must be taken into account.

Within recent years, largely by or under the stimulus of the Federal Barge Line, the principal cities of the Mississippi have installed various types of modern and efficient river terminals. Great activity is noted along the same line on other important rivers, notably on the Ohio, Warrior, Illinois and Missouri as the various communities make ready for the large general commerce which will inevitably develop.

The above remarks regarding the former inadequacy of river terminals apply more particularly to package freight and to freight handled by common carriers. In specialized cases, mechanical handling of bulk commodities by large individual corporations has become highly mechanicalized and efficient.

J. Future of Internal Waterways.—There is no doubt that the revival of American internal waterway traffic which has been so notable in recent years, will continue at an increasing rate. Inexorable economic law is driving the country to seek the most efficient way of carrying on the great processes of national life. It is sufficiently astonishing that the possibilities of immense savings, running into the hundreds of millions a year, through the intensive use of inland waterways, should have been overlooked so long and to such an extent as they have been. The current development is warrant that they will never be thus overlooked again.

From the point of view of channel construction, the broad lines of the future internal waterway systems are evident, and the channels themselves are in general completed or well advanced toward completion; what remains is the filling in of gaps and the linking up of certain isolated projects. A 9-foot waterway is now available from Pittsburgh to the Gulf of Mexico, with channels 6 feet to 9 feet deep on all the important Ohio tributaries; 9-foot channel from the mouth of the Ohio to St. Louis, and thence via the Illinois waterway to the Great Lakes at Chicago, a 9-foot channel will in 1938 be available to Minneapolis on the Mis-

sissippi, while by that time a channel 8 to 9 feet in depth on the Missouri up to Sioux City, Iowa, will also be available. These form the backbone of the Mississippi Valley system. Two important connecting channels are practically assured; first a 9-foot intracoastal waterway west from New Orleans down the Louisiana and Texas coast, and a suitable channel east to Mobile, whence the Warrior connects the main system with the Birmingham district and the Alabama coal fields. Second, the Great Lakes system, as concerns Lake traffic, is complete from Duluth to Buffalo, and the new Welland Canal ties in Lake Ontario. New York's 12-foot barge canal connects this system with the Hudson Valley and the Atlantic at New York, and Canada's 14-foot canal connects with the Atlantic via Montreal. On the Atlantic coast the existing intracoastal system, provides a continuous sheltered waterway from southern Florida to the industrial Northeast. The San Joaquin-Sacramento system is operating with great success. The numerous branches and minor tributaries of these four systems are in general already in shape, or with limited expenditure could be put in shape, to serve as feeders to the main arteries.

The full development of the Columbia system turns on the construction of dams on the Columbia and Snake, to develop the immense potential electric power here available. This will go hand in hand with navigation development, and power and navigation between them will build up a great Northwestern empire in the rather sparsely populated and undeveloped territory east of the Sierras.

The future of the Southeastern rivers, except in certain special cases like the Warrior, turns principally on two factors. One is their relation to the intracoastal waterway from Chesapeake Bay to Southern Florida. These rivers will then serve as feeders to that waterway and their commercial importance will thereby be greatly increased. The second is the solution of technical navigation problems, either by a greater depths or by the development of economical carriers for depths now provided. Sometimes one and sometimes the other will be required. In the majority of cases, what is lacking is less a good channel than an efficient use of it by efficiently designed shallow-draft carriers. The terminal problem must also be solved, with due regard to the violent fluctuations in the stage of most of these rivers. The same remarks apply to many minor tributaries of the Mississippi system, notably in the lower valley, and to important Texas rivers.

K. Co-ordination of River Development.—«River Planning.»—Mention has been made of such rivers as the Columbia and Tennessee, where power development by the construction of dams and regulating reservoirs must go hand in hand with navigation development. This is true of various streams, and the same principle applies to other interests. It is difficult to use a river for any important economic purpose without affecting, for good or ill, its utilization for other purposes. Thus, water power development tends to provide a canalized river and to make the flow more uniform, features in general beneficial to navigation, though the regulation of flow by power dams has on occasion been detrimental to navigation. Irrigation tends to withdraw from the river a certain amount of its flow and affect adversely both navigation and power. Flood control, if combined with protective works, such as levees, tends to hold the high water channel in place and cause it to scour deeper, thus benefitting navigation. Flood control by retention reservoirs to catch large floods is likely to be beneficial to both navigation, power and irrigation. Restriction of the flow of the river by any means at low water seasons may result, if the river ends in a tidal estuary, in salt water working up that estuary to the damage of neighboring agricultural land.

Thus the problem of a river must be envisaged *as a whole,* and every effort must be made to co-ordinate the various uses that the maximum of benefits results to all, and damage to none. This will nearly always imply some compromise, as the utilization of a river to the limit by any one interest regarding only itself may seriously damage other interests. Such a situation has already developed on certain rivers. This matter of what may be called, to borrow a term from the city planners, «*River Planning,*» is one worthy of the best attention of statesmen and engineers.

L. Comparison with Foreign Waterways.—The statement is often made that America lags behind Europe in the utilization of its inland waterways. This needs qualification. We have little to learn from Europe in *river engineering.* Modern American practice in locks and dams and in river regulation is fully up to European practice; in efficient dredging we are probably ahead of Europe; and the problems of certain of our rivers, such as the Mississippi system, are on a more gigantic scale than anything that Europe has to face. Also, where we have intensively developed our inland waterway commerce, as in the upper Ohio valley and the Great Lakes, I believe that we are abreast or ahead of Europe in economy and efficiency of transportation.

The real distinction is that found in many other fields, and is characteristic of the two cultures. Europe has arrived long since at the phase of dense population and intensive competition which we are now entering, and has learned the lesson, which we are now learning, of high efficiency and of careful planning and large capital expenditure to effect small savings. The Continental nations also tend much more than do we to government control of economic activities. We are behind Europe in such departments as efficient river craft for miscellaneous package movements on shallow draft streams, adequate terminals therefor, and a sound economic relation between water and land carriers. In the large European nations, notably Germany, problems of this character have received careful study by the central, provincial and municipal governments which own and operate terminals and transshipment facilities, just as in many cases they own and operate the rail and water carriers. Such degree of governmental control and operation is contrary to our national genius. Nevertheless, while the end must be attained here by working along more individualistic lines, it is the same end. We can with great profit to ourselves study the achievements of Europe in the matter of organized inland waterway commerce, while using our own methods to equal and surpass them.

II. The Great Lakes

From the point of view of commerce and navigation, the lakes are in a class by themselves. On the one hand, the system is strictly speaking an inland waterway, water connection to the sea being as yet possible only for inland waterway craft or the smaller types of ocean-going vessels. On the other hand, the lakes are themselves great inland seas, with ample natural depth for any ship afloat except in the harbors and connecting channels, susceptible to storms as serious on occasion as those occurring in the open ocean, and therefore navigated primarily by vessels which, though specially designed, are of the general magnitude of large ocean ships.

A. Agencies and Means of Improvement.—The agencies of improvement and the methods of obtaining and carrying out approved Federal projects are the same as with *Inland Waterways* (q.v.). Work done by the Federal Government consists, first, of the improvement of various lake harbors, of which the more important are mentioned below. A characteristic of harbor engineering on the lakes is the prevalence of breakwaters; the majority of the harbors had little or no natural protection, and it was necessary to create by breakwaters enclosed areas in the open lake or to protect the entrance to inner harbors where these were present. Due to the absence of tide and consequently of tidal scour, jetties constructed specifically for regulating purposes are not found. Entrances to lake harbors are frequently protected by a special lay-out of breakwaters known as the arrowhead type, diverging from the entrance to the shore in such manner as to produce a stilling basin and ameliorate wave effect.

Beside harbor work, the Federal Government has improved the connecting channels from Lake Superior to Lake Huron via the St. Marys River (Sault Ste. Marie or «Soo») by locks and dredging and has improved by dredging the connection from Lake Huron to Lake Erie via the St. Clair and Detroit Rivers. The connection from Lake Michigan to Lake Huron via the Straits of Mackinac has required but minor improvement. Connection from Lake Erie to Lake Ontario is made on the Canadian side by the Welland Canal. A navigable barge connection exists on American soil, using the main New York State Barge Canal to Three Rivers and thence by the Oswego branch of that canal to Oswego, but there is no record of any very considerable movement by this route.

From Lake Ontario there is a navigable connection by the St. Lawrence River, together with lateral canals on Canadian soil, to Montreal, which is a great ocean port.

B. Channel Depths.—At the adopted datum of mean low lake level, there is a through channel 24 feet deep in the St. Marys, St. Clair and Detroit rivers, and a channel 23.5 feet deep through the Welland Canal. The connection from Lake Ontario to Montreal is 14 feet deep.

All harbors in the four upper lakes handling an important commerce have depths of at least 18 feet, which is generally considered the least on which economical navigation can be carried on, using the modern type of vessels. The principal harbors and connecting channels have been or are being improved to provide a depth of 24 feet for downbound navigation.

The lake carriers utilize available depth to a much greater extent than do ocean carriers. It will be seen below that, while at our seaports 30 feet is generally considered as an appropriate depth for a first-class port handling a general foreign and coastwise business, the great majority of ocean shipping operates on considerably less draft. On the lakes, on the other hand, the bulk of the freight is carried in vessels designed to draw, when fully loaded, practically the entire amount of water available; and moreover, these vessels actually load to within an extraordinarily short distance of the existing depth, often entering or leaving harbors with but a few inches under their keels. Seasonal variations in depth are watched very carefully by the carriers, and vessel loadings are varied to correspond to them.

C. Commerce of the Lakes.—The principal commerce is in three bulk commodities of iron ore, grain and coal, and the less important items of limestone and pulpwood. This bulk traffic comprises probably the most efficient large-scale waterway commerce in the world. The iron ore moves from the Lake Superior mines mostly to the Lake Erie ports, where it is transferred to rail and carried to the great steel producing area of Pittsburgh and eastern Ohio. A total of 22,945,299 tons of ore moved over this route in 1934. It formed the major source of supply of our Ohio Valley steel industry, and the cheapness of the movements is directly reflected in the price of iron, steel and all their products. Grain, principally wheat, moves in great quantities from the American northwest to Duluth, Superior, Chicago and other ports, and from the Canadian northwest to the ports of Lake Superior. Thence it moves by water to American grain receiving ports on the lower lakes, principally Buffalo, or to Canadian lower lake ports for transshipment to Montreal, either by small lake vessels through the Welland and St. Lawrence Canals or by rail. The Buffalo grain destined for export moves east from Buffalo and other ports, to some extent by the New York State Barge Canal, but more largely by rail. The grain movement through the locks of the Soo in 1934 was 4,395,308 tons, and has been considerably higher in years of larger crops. The third movement is of westbound coal carried as return cargo by the same vessels from the Lake Erie ports to the upper lakes. In 1934 the movement through the Soo was 10,408,029 tons. There are lesser movements of limestone, pulpwood, etc., a considerable crosslake movement on Lake Ontario, and an important car-ferry movement across Lake Michigan by railroads which ship from East to West in this manner in order to avoid the congestion involved by routing through Chicago.

The package freight movement on the lakes is considerable. Considering, however, the extremely rich area tributary to the lakes, and the possibilities presented by them and by the New York State Barge Canal and Hudson River for through movements between the Middle West and the seaboard, such general commerce is far behind its ultimate potentialities.

The following table shows in summary form the commerce of leading Great Lakes ports:

COMMERCE OF THE GREAT LAKES

PORT	Short tons 1934	1937
Agate Bay, Minn.	3,663,678	11,118,361
Duluth-Superior, Minn. and Wis.	25,550,181	57,138,579
Ashland, Wis.	2,879,884	7,006,915
Presque Isle, Mich.	.....	4,674,744
Marquette Harbor, Mich.	847,763	1,157,763
Sault Ste. Marie, Mich.	560,169	838,612
Escanaba, Mich.	1,994,347	3,799,762
Menominee, Mich. and Wis.	664,463	826,591
Green Bay, Wis. (including De Pere)	1,872,454	2,529,282
Manitowoc, Wis.	1,225,081	1,361,544
Milwaukee, Wis.	6,083,400	6,617,802
Chicago, Ill. (including Chicago River, and Chicago and Calumet harbors)	8,319,809	18,612,301
Indiana Harbor, Ind.	5,455,215	7,936,660
Gary, Ind.	3,234,701	8,212,040
Muskegon, Mich.	1,130,104	1,896,093
Ludington, Mich.	1,571,232	1,720,560
Port Inland Harbor, Mich.	999,936	2,428,861
Frankfort, Mich.	898,519	1,176,748
Calcite, Mich.	3,262,258	7,401,210
Saginaw River, Mich. (ports on)	1,423,192	2,557,718
Detroit, Mich. (port of)	9,464,923	14,919,486
Toledo, Ohio	18,325,267	25,465,642
Sandusky, Ohio	6,341,507	8,102,772
Huron, Ohio	1,105,732	1,594,865
Lorain, Ohio	3,843,398	6,702,854
Cleveland, Ohio	8,658,596	17,385,842
Fairport, Ohio	2,506,988	4,237,657
Ashtabula, Ohio	6,366,898	12,393,058
Conneaut, Ohio	5,521,591	14,236,267
Erie, Pa.	4,091,017	6,537,160
Buffalo, N. Y. (by lake)	12,070,914	19,390,446
Buffalo, N. Y. (by New York Barge Canal)	1,751,756	1,627,211

The gross total for all Great Lakes ports was 296,493,500 short tons in 1937, valued at $3,743,590,241.

D. Ports and Terminals.—From a commercial point of view the harbors fall into the following classes:

(1) Those handling exclusively or almost exclusively the bulk commodities. The principal ones are Duluth, Agate Bay, Ashland, Escanaba, Marquette Bay, Toledo, Sandusky, Vermilion, Lorain, Fairport, Ashtabula, Conneaut and Erie.

(2) Those handling a considerable general commerce. The principal ones are Chicago, Milwaukee, Detroit, Cleveland and Buffalo, and there are a number of small ones, especially on Lake Michigan. Some of these, such as Buffalo, also handle a very large commerce of the bulk commodities. (It is not to be understood that these are less important than «(1)»; sometimes they are more important.)

(3) The car ferry ports, especially those on Lake Michigan. This lake, projecting so far south, tends to crowd down to its southern end, at Chicago, the trunk lines connecting East and West, resulting both in additional distance and in very serious congestion. A number of car ferry lines have therefore been established across Lake Michigan, with the very beneficient result of by-passing much of this traffic around Chicago.

(4) Finally there are some small fishing harbors, and some harbors, especially on the southern peninsula of Michigan, which in former days handled a great commerce in lumber and more than justified their existence, but which with the cutting out of the Michigan white pine have either relapsed into obscurity or turned to general commerce.

The shipping and receiving terminals for the major bulk commodities of the lakes have, like the other factors of this traffic, been brought to high degree of efficiency. Special machinery on a gigantic scale has been devised for the rapid dumping of ore, coal and grain into ships and its rapid removal therefrom. The construction of the terminals is closely co-ordinated with the construction of the ships. The record speeds to date are 16½ minutes for loading a 12,000-ton ship with ore, and 3 hours and 5 minutes for unloading the same quantity. This, of course, was a special performance. On the average, however, loading takes from 5 to 10 hours and unloading from 18 to 24 hours; and the big carriers are in the habit of leaving port almost immediately after they have received their loads, and of starting to unload almost immediately upon their arrival. The efficiency of this performance will appeal particularly to anyone who is familiar with the much longer «turn around» which is the usual rule at even the best organized seaports. Allowance must of course be made for the specialized character of the freight on the lakes, which lends itself to rapid handling, and for the immense volume which makes it economical to install highly expensive apparatus for this purpose.

Generally speaking package freight terminals have not been developed to a corresponding degree of efficiency. In this department, somewhat the same remarks can be made about the lakes ports as are made below regarding ocean ports.

E. Relation of the Lakes to Railroads.—The lakes form a channel of transportation alternative to that by rail.* In principle, therefore, their economics might be considered analogous to those of ordinary inland waterways as discussed above. The influence of a competitive spirit on the part of the railroads is definitely shown in the limitations of package freight movement. Forty or fifty years ago the lakes, especially the lower lakes, were fed by railroad lines running north and south, which were usually independent of the trunk lines that were beginning to develop east and west, and which, so to speak, played off the lakes carriers against the trunk lines for the haul to or from seaboard of the freight carried by them (the north-and-south railroads). This period was followed by railroad consolidation, and by agreements and understandings which are the basis of the present rate structure for so-called Central Freight Association Territory. As an additional means of suppressing water competition the trunk lines acquired the more important lake carriers. Several years ago the Interstate Commerce Commission formally divorced the lake general cargo carriers from the railroads. It is sometimes asserted that in spite of this action, the railroads are still able to exert a strong indirect influence over the activities of the water carriers. Whatever the truth as to this situation, there is no question that general cargo movement on the lakes is capable of great expansion.

The bulk traffic is however, another matter. We are not aware that the rail carriers have seriously attempted to take this away from the lake carriers; but if they should, they would enter a field where, as distinguished from the ordinary situation with regard to inland water-

*Excluding the car ferry movements, which represent practically floating bridges in extension of railroad systems and are organized and fostered by the railroads.

way movement, they would have to meet organization and capital comparable to their own.

The largest of the bulk movements—one-third of the total of 1935—is the eastbound iron ore, the terminals and carriers for which are controlled by the great steel corporations. Similarly, the eastbound movement of wheat at the cheapest possible figure is a matter of interest to the great dealers and exporters of that commodity. Finally, coal moves west in such quantities, because the predominating bulk movements (ore and grain) being eastbound, the carriers are naturally seeking a return cargo, and will make low rates and furnish good service to obtain it.

It is highly unlikely that any railroad or combination of railroads could, if it desired, seriously affect this movement by a rate war or by any other weapon such as in the past has been used against other inland waterways. It is also highly unlikely that any railroad or combination of railroads desires it.

This situation is an excellent illustration of the theory, advanced elsewhere in this article, that the proper relation of rail and water carriers is co-operative rather than competitive, and that the two may occupy a common field in their respective capacities with benefit to both. The magnitude and national benefit of the lake commerce is evident, and the important carriers and lines are commercially successful. Nevertheless, the neighboring territory is covered by a network of railroads which likewise are highly successful. It is unquestionable that a sudden stoppage of the Great Lakes' traffic would be as serious and embarrassing a matter to the railroads of this territory as it would be disastrous to the nation.

F. Benefits and Justification of the Lakes Channels.—The economic principles on which the channels and harbors of the Great Lakes are improved are in general identical with those applying to other inland waterways. The method of computing in dollars and cents their benefits is the same in principle as that for the other inland waterways, and can in practice be worked out with a much higher degree of accuracy, due to the simple and clear-cut character of the major items of traffic. The first cost to the Federal Government of these harbors and channels has been in round numbers $197,000,000. The carrying charge on this, plus maintenance, is approximately $12,000,000 a year. The gross direct freight savings to the nation amount to many million dollars a year resulting in large dividends on the investment. The enormous importance of the lakes to agriculture and basic industries cannot however be stated by a single sum such as this, since it is difficult to envisage the widespread disorganization which would follow its stoppage. If a national enemy could select one place in the continental United States to set off a carload of dynamite, with the purpose of doing the maximum damage to the nation's economic life, he might decide to explode it in the locks of the «Soo.»

G. Future of the Lakes.—The bulk commerce of the lakes has been brought to such a degree of efficiency that it is unlikely that the future will witness any striking changes save those brought about by the general development of the country. It may well be in fact, that the bulk movements will ultimately decline, due partly to the gradual exhaustion of the iron ore deposits, and partly to a greater domestic consumption of grain by our increasing population and a corresponding reduction of exports. The latter possibly is more problematical than the former.

Package freight movements on the lakes are, as stated, capable of large expansion, and it is altogether likely that the nation-wide movement for increased use of our waterways for general cargo will continue to be reflected in the lakes commerce.

Completion by Canada of the Welland Canal to a 25-foot depth will open Lake Ontario for the movement of the large carriers. This may result in the development of the Lake Ontario ports, both in the United States and in Canada, as receiving points for grain coming down the lakes, and as shipping points for coal, especially hard coal, going up the lakes, in competition with Lake Erie ports.

The traffic of the New York State Barge Canal, while considerable, is far below its potentialities, due to a variety of reasons which space does not permit the discussion of, and in spite of through rates from Lake Erie to seaboard in general lower than those of the corresponding rail lines. It is likely that with the passage of time and the working out of sound policies, this water outlet for the lakes will greatly increase in importance.

A proposal which has been advocated for many years is that of a water connection between the Atlantic Ocean and the Great Lakes, permitting ocean vessels to move direct to the lake harbors. This would have a profound effect upon the transportation situation of the lakes themselves and all the neighboring sections of the United States and Canada, and would represent perhaps the most ambitious engineering work ever undertaken by any nation. Two alternative methods have been suggested. One is for the canalization of the St. Lawrence from Lake Ontario to tidewater, commonly referred to as the St. Lawrence Waterway. This has been the subject of considerable study, and made a matter of technical investigation by an international board of engineers, American and Canadian. The proposal would also involve the ultimate development of about four and a half million horse-power of electric energy. The total estimated cost of the St. Lawrence Waterway project, including power development, is $543,429,000. The other method is by a ship canal across New York State. Several possible routes for this have been investigated by a board of Army Engineers.

The question of connecting the Great Lakes system with the Mississippi system has been discussed under «Inland Waterways» above.

III. Seaports and Harbors

The distinction between inland waterways and ports cannot be drawn rigidly. It turns on whether the harbor in question and the channel leading thereto are used primarily by vessels which traverse the open seas. In general the best criterion in doubtful cases is depth of channel, though there are numerous small fishing ports whose depths are less than those of some strictly inland waterways.

The present discussion, as in the case of inland waterways, is primarily descriptive and economic. For further data on terminals, port

organization, vessels which serve ports, and the technique of channel improvements, see HARBORS, DOCKS AND BREAKWATERS; STEAM VESSELS; DREDGE; HYDRAULIC ENGINEERING.

A. Channels.—The most important characteristic of a port channel is its depth. A large port or one of complex topography, such as New York, may have many channels, some of them adapted only to light-draft vessels. The depth of the main project channel is, however, the governing factor. The following are characteristic channel depths, and the corresponding types of traffic which they serve.

Channels in Excess of 30 Feet—These are provided at, and are needed by relatively few ports. Vessels requiring them are the very deep draft liners of the North Atlantic, whose principal terminal in the United States is New York; similar, though not so large, vessels in the trans-Pacific liner trade calling at the major Pacific ports; a few freight vessels, of which the principal examples are the largest oil tankers and certain freighters which carry iron ore from South America to New York, Philadelphia and Boston, often returning with coal. The number of these big ships is limited.

Channel Depth of About 30 Feet.—This depth, with the exceptions above given, is, at present, the usual standard for a seaport handling a general foreign and coastwise trade.

Channel Depths of 24 to 26 Feet.—Such channels are characteristic of ports having little foreign trade, or foreign trade of a class using only medium draft ships, such as the lumber trade of Central and South America, but having a large coastwise or intracoastal business. They may be called the major coastwise channels.

Channel Depths of 18 to 20 Feet.—These may be called minor coastwise channels, and are particularly adapted for the moderate sized steamers and other vessels which play an important part in the coastwise movement of lumber on the Atlantic, Gulf and Pacific.

Lesser Depths.—These are usually found in fishing harbors or in ports like the small ones on Chesapeake Bay, the commerce of which is handled by ships traversing comparatively sheltered waters.

The question of appropriate depths is a very interesting and complex one, turning as it does on the drafts of vessels in various forms of trade and on the trend of these drafts in future construction. Since the introduction of steam, vessels have in general tended to become of still deeper draft, and this tendency continues. The increase is however more noticeable and more regular in the case of the *average* vessel than in the case of the *largest* vessels.

In the case of very deep draft vessels, with the exception of oil tankers, there is apparent no decided tendency to go beyond the maximum adopted in the past decade. Vessels like the *Leviathan, Berengaria, Majestic,* etc., were constructed largely on account of commercial rivalry between different big steamship lines, or national rivalry between English and German builders before the World War. They are confined almost entirely to the so-called «Atlantic ferry.» It is generally understood that they were not paying investments. Careful cost statistics indicate that for the highest grade passenger service on the North Atlantic the typically most economic vessel has a draft of about 30 feet. The tendency in the post-war construction programs of the important Atlantic lines was toward vessels of such drafts as these and around 20,000 gross tons, instead of toward the mammoth types built just before the World War. However, two vessels exceeding 1,000 feet in length have recently been completed for Atlantic service and placed in commission.

The appropriate channel depth at any given port is of course modified by the tidal range, since if there is a large rise of tide the depth may be somewhat decreased and still permit vessels to enter by waiting a few hours for a satisfactory tide. It is also sometimes the practice to increase by 2 feet or so the channel depth over the bar at the mouth of the harbor, if difficult weather conditions are encountered there.

Widths of channels vary greatly according to the density of traffic, the danger of neighboring shoals, the curvature of the channel, and other factors. Ambrose Channel, the main approach to New York Harbor, has a width of 2,000 feet. At the other extreme, the Houston ship channel, which is practically a canal with soft bottom leading inland from Galveston Bay, has a present project width of from 250 to 400 feet. From 400 to 600 feet is usually found ample for a main approach channel in an open harbor.

B. Improvement of Harbors.—The Federal agencies for improvement of harbor channels, and the means of obtaining authorized improvements, are the same as those described under «Inland Waterways» above. For technical details of improvement, see other references. Briefly, it may be said that port improvement is achieved either by dredging to deepen channels, by jetties at harbor mouths which concentrate the tidal flow and cause it to scour a deep channel over the bar, or by breakwaters, which are protective structures built to enclose and shelter areas of a harbor or waterfront.

C. Location, Description and Functions of American Ports.—Coastwise trade is often considered as competitive with rail traffic. In general, however, a port cannot be considered as a competitor to a railroad, or even, like an inland waterway, as a complementary means of transportation. It is a necessary *supplement* to railroads, being the point at which the rail haul is extended by transshipment to water. The commercial history of American ports, therefore, is of competition not between a port and a railroad, but between different ports or groups of ports, each served by its own rail net. The commercial importance of a port is based primarily on the tributary territory which it serves as a gate of ingress and egress, principally by rail connections. Every important port is surrounded by a land area within which rail rates to or from the port are less than rail rates to or from other adjacent ports. This is its non-competitive tributary territory. Ordinarily it extends only one or two hundred miles into the interior. Beyond these lie areas which have the same rail rates to any one of a number of principal ports and in which therefore the competition by ports must be based entirely on factors other than rail rates.

There follows a classification of American salt-water ports, with channel depths and a brief description of tributary territory.

1. The Major North Atlantic Ports.—These are New York, with an approach channel of 40

feet, and numerous interior channels, some as deep as 40 feet; Philadelphia, the second salt-water port of the nation, with a project channel of 35 feet; Boston, with an approach channel of 40 feet; Portland, Me., with an approach channel of 35 feet.

New York is, and probably will always remain, the first port of the country. While immense quantities of coal, petroleum products and other bulk material move through it, largely on account of the dense population in the port district, its predominance is the most striking in the matter of miscellaneous package freight for import and export. Such freight habitually moves in less than shipload lots to or from a wide variety of overseas ports. It therefore tends to seek a port which has vessel service to all foreign ports of the world, even if this involves a long line haul and higher rail charges than would a movement to another port. In this class of material it is particularly true that «a port grows by its own growth.» With the unequaled variety of vessel service available, New York attracts to itself miscellaneous import and export business of a large part of the United States, and handles in terms of tonnage 25 per cent of all American imports and exports exclusive of those on the Great Lakes or moving by rail to and from Canada and Mexico. Its tributary territory (not of course exclusive) is a larger part of the entire country.

On rail shipments to or from points outside their limited non-competitive tributary territories and lying north of the Ohio and east of the Mississippi, the other principal northeastern ports have a differential under New York rates. A large part of the business goes to New York in spite of this, but the differential and other factors displace some of it to other points. Philadelphia, the largest of them, in addition to serving the great manufacturing area of eastern Pennsylvania, has a large tributary territory extending into the northwest. Boston's territory is principally Massachusetts, northern New York and Canada. Portland, outside of local traffic and coastwise coal receipts, is important principally as an overflow port for Canadian grain, after Montreal is closed in winter. Baltimore and Albany have a considerable hinterland of the West, and also a large traffic connected with the neighboring industrial sections.

At all these ports the question of the grain movement from the Northwest is of great importance. It fluctuates considerably. Important factors are the growing importance of Montreal; the predominance of New York for the export of grain by liners in part cargoes, as distinguished from ship-load movements in chartered or tramp vessels; the New York State Barge Canal; the deflection of grain from Boston on account of the rate situation; and the increasing demand of the ports to the south, including Norfolk, to obtain a share of the movement.

2. The New England Coastwise Ports.—This is a group principally on the southern shore of New England. The most important ones commercially are Providence, New Haven, Bridgeport, New Bedford, Fall River and New London. These principally serve the important high-grade industrial area of southern New England. Their major movements are coal and fuel oil inbound and an exchange of high grade freight with New York by the sound steamers. They are an illustration of the tendency of foreign trade to gravitate to a large port; though they have a tributary territory producing many exports and receiving many imports and though the larger sound ports have suitable depths for foreign commerce, nearly all such commerce is through New York, at which point it is transshipped to rail or coastwise steamers. Providence is, in a sense, an exception, having imports between half a million and a million tons; but most of it is petroleum products.

3. The Major South Atlantic ports.—These include Baltimore, with 37 feet; Wilmington, Del., with 30 feet; Wilmington, N. C., with 30 feet; Norfolk, Va., with 40 feet; Charleston, with 30 feet; Savannah, with 30 feet; and Jacksonville with 30 feet. In the past they have handled principally bulk commodities, and material produced or consumed east of the Appalachians, but they are making increasing efforts to take from New York and the other northern ports a larger share of the general commerce pertaining to the interior sections both south and north of the Ohio River. Norfolk and Newport News are primarily coal ports. They handle most of the coal exports of the United States, and ship many million tons in coastwise barges and ships to the northern ports. Wilmington, N. C., exports North Carolina cotton and receives fertilizer materials for local manufacture. Charleston's territory is largely limited to the Carolinas; it exports cotton and coal and receives fertilizer materials. Jacksonville is primarily a Florida port handling lumber, naval stores, and fertilizer material. Savannah, though with a harbor naturally inferior to either Charleston or Jacksonville, had, until recently, a commerce larger than either, and still handles coastwise a large tonnage in high grade material. Its major movements are inbound sugar and fertilizer materials and outbound cotton, resin and lumber, with an important general package business. All these ports in addition receive, mostly in tankers, quantities of petroleum products for interior distribution, and Charleston also ships a considerable tonnage of them.

4. The Major Gulf Ports.—These are New Orleans, with a 35-foot approach through Southwest Pass (of the Mississippi River), a 30-foot approach through South Pass, and ample depths up to the city; Galveston 35 feet and Texas City, with 33 feet; Houston, above Galveston, with 32 feet; the so-called Sabine ports, in eastern Texas, including Port Arthur, Beaumont and Orange, with depths of 30 to 35 feet in the approach channels; and Mobile, 32 feet. The leader is New Orleans, largely on account of its strategic situation near the mouth of the Mississippi, whereby it enjoys service to the interior both by the river, which contributes an important part of its commerce, and by the railroads following the general line of the river. It is the most important port of entry of vegetable food products from Gulf, Caribbean and South American points, and draws grain exports from the central and southern Mississippi basin and lumber exports from the stands in the lower Mississippi Valley. It also has an exceptionally important commerce in petroleum products. The Galveston Bay ports are the next in order on the Gulf, and their aggregate waterborne commerce in recent years has exceeded that of New Orleans.

Of the three, Galveston is primarily a shipping point for the Mississippi Valley grain and for Southern cotton, in which items it has in certain years exceeded New Orleans. Houston is most important as a cotton shipper. Both Galveston, Texas City and the lower stretches of the Houston ship channel handle a very large commerce of petroleum products, including both crude oil inbound from Mexico to be refined, and fuel oil and other products outbound.

The Sabine Ports—Port Arthur, Orange, and Beaumont—deserve a rating as first class ports on account of the great volume of their commerce, though it is principally petroleum products. They also handle some lumber. Lake Charles, in Louisiana, has been connected with this system by a 30-foot channel constructed as local expense. The remaining major Gulf port is Mobile; serving primarily the states of Mississippi and Alabama, and handling a large amount of lumber, and lesser quantities of bananas, molasses, fertilizer materials, and outbound metal products from the Birmingham district.

5. Secondary Ports—South Atlantic and Gulf.—These include Tampa, Fernandina and South Boca Grande, all important in the export of phosphate rock; Miami, a growing coastwise port; Freeport, Corpus Christi, Brownsville and Port Isabel, new ports, which promise to have an important tributary territory in southern Texas; Georgetown, S. C., Brunswick, Ga., Pensacola, Fla., Pascagoula and Gulfport, Miss., ports of varied importance.

6. Major Pacific Ports.—These include San Francisco, with 50 feet through the ocean bar and Golden Gate; Portland, Oregon, with 35 feet up the Columbia River (40 feet at the mouth); Seattle and Tacoma with almost unlimited depths; Los Angeles with 40 feet; and San Diego with 40 feet. San Francisco has long been, and still remains, the leading Pacific port of general commerce to and from the Orient, with a large tributary territory in the western United States. Its commerce is of a most varied character, outstanding items being agricultural and petroleum products outbound; lumber and metal manufactures inbound, and a heavy miscellaneous movement in both directions. Scattle and Portland probably stand next, the latter notable as a shipping point for Northwestern wheat and lumber, the former handling fuel oil, lumber and miscellaneous commerce. Tacoma has an important commerce, notably in copper and its ores and lumber. Los Angeles, in terms of tonnage, has recently outstripped them all, and indeed in 1934 was the fourth salt water port in the United States, nearly equalling Philadelphia. The greater part of its commerce is, however, outbound oil from the local fields and inbound lumber for local consumption. It has not yet developed a territorial hinterland in any way proportional to the bulk of its commerce, though ambitious plans in this direction are under way. San Diego's commerce is principally coastwise oil and lumber distributed to the neighboring territory.

7. Northwestern Lumber Ports.—This includes a number of ports on the northern California, Oregon and Washington coasts and on Puget Sound. Their depths vary considerably; in some cases natural harbors exist so deep that no channel work is necessary (e. g., Port Angeles), while at the other extreme there are ports presenting very difficult channel approaches, improvement of which is so expensive that only limited depths have been attained so far. Among the most important commercially are Grays Harbor, Everett, Bellingham, Olympia, Willapa, Coos Bay and Humboldt.

8. *Other Ports.*—Some minor harbors on the New England and New Jersey coasts, a number of small harbors on Chesapeake Bay, and a few on the Gulf, have channels ranging around 10 or 12 feet, a few greater and a few less. In general they are either primarily fishing harbors, or ports of call for small vessels moving in partly sheltered waters. They are quite numerous and require no special description, though their maintenance and success are often of vital importance to the neighboring territory and their aggregate contribution to national wealth and commerce is considerable.

D. Commerce.—The accompanying table on page 102 shows the commerce of the principal ports and groups of ports of the country. There is added another table showing the consolidated commerce for both ports and internal waterways corrected by eliminating all known duplications.

E. Design and Efficiency of Ports.—A port is a transshipment point from rail to water. It is also a storage point for inbound or outbound material held often for a considerable time while waiting transshipment. It is also frequently an important industrial centre, the products of whose industries are likely to move by the ships and railways which serve the port. It is also frequently a centre of population, the local consumption of which produces a large movement by both rail and water. Therefore the proper and efficient organization of its *purely port function,* that of transshipment, evidently requires a close coordination of the various facilities, involving not only the actual terminals but also the railroad yards and approaches, and the lay-out of the manufacturing, commercial and residential elements of the community with reference to the port facilities.

Too, often, in the past, our ports, notably those which are important cities, have concentrated their attention almost entirely on local and municipal matters, and have permitted the port facilities to grow up in a helter-skelter fashion. Several results are notable. For one thing, terminal design in many of our ports is far behind the best practice, two of the most common errors being long narrow piers with inadequate transit shed facilities, causing congestion, and the absence of adequate warehouses. For another thing, railroads have been permitted to develop, individually, sections of the harbor, and to use terminals in various ways to increase their business at the expense of other railroads, whereby the port, instead of being a single competitive unit, becomes in effect several competitive sub-ports in one locality. As a corollary to this, adequate interchange facilities between and among the various terminals and railroads, by a belt line or the equivalent, have in many cases not been developed. For another thing, there is ordinarily no adequate planning and zoning of the waterfront whereby industrial terminals, general package terminals, bulk terminals handling spe-

Commerce of Principal United States Ocean Ports, 1937

Note.—In thousands of short tons of 2,000 pounds. In addition to the commerce here shown, many of the ports have (1) commerce with ports on internal rivers and canals; (2) purely local port traffic, including in the case of New York, Philadelphia, and San Francisco, what is called intraport traffic between parts of a harbor for which separate statistics are maintained. These forms of traffic, although the aggregate tonnage is large, are of much less economic importance than foreign and coastwise traffic.

Ports	Imports	Exports	Coastwise Receipts	Coastwise Shipments
Grand total	43,764	52,910	145,373	153,461
Atlantic ports	33,885	16,459	99,662	41,600
Searsport	21	37	422	23
Portland, Me.	352	155	2,368	379
Portsmouth, N. H.	65	....	287	6
Boston, Mass.	2,678	473	12,614	1,179
Beverly, Mass.	28	....	509	52
Salem, Mass.	....	....	473	....
New Bedford and Fairhaven, Mass.	....	....	695	39
Fall River, Mass.	31	....	1,335	302
Providence, R. I.	259	51	4,710	570
New London, Conn.	21	....	610	107
New Haven, Conn.	28	....	2,999	629
Bridgeport, Conn.	11	....	1,607	233
Norwalk, Conn.	....	....	320	8
Stamford, Conn.	....	....	461	18
New York Harbor	14,859	8,065	30,892	7,988
Albany, N. Y.	474	160	1,539	189
Hempstead, N. Y.	....	....	298	17
Port Jefferson, N. Y.	....	....	102	2
Philadelphia, Pa.[1]	5,294	1,677	18,269	5,308
Wilmington, Del.	174	....	256	3
Baltimore, Md.	6,243	1,946	7,137	2,285
Hampton Roads, Va.	1,006	2,399	2,557	19,537
Richmond, Va.	17	....	113	57
Wilmington, N. C.	226	65	1,187	5
Charleston Harbor, S. C.[2]	578	281	1,361	263
Savannah, Ga.	642	444	1,608	628
Hollywood Harbor, Fla.	79	134	286	30
Jacksonville, Fla.	263	296	1,558	706
Miami, Fla.	43	61	615	102
Gulf Coast ports	5,977	20,942	14,140	77,555
Charlotte, Fla.	....	139	6	464
Tampa, Fla.	129	1,131	1,212	1,099
St. Andrews Bay, Fla.	44	36	327	221
Pensacola, Fla.	144	204	117	35
Mobile, Ala.	542	1,086	904	608
New Orleans, La.	3,560	2,656	3,239	3,650
Baton Rouge, La.	372	764	93	3,084
Lake Charles, La.	49	410	40	2,810
Terrebonne Bay, La.	....	....	....	1,634
Galveston, Tex.	295	1,625	636	2,069
Texas City, Tex.	16	1,096	1,319	5,843
Houston, Tex.	555	4,770	2,302	15,433
Port Aransas, Tex.	....	344	....	7,170
Sabine, Tex.	....	3	....	553
Port Arthur, Tex.	1	3,221	2,344	13,661
Beaumont, Tex.	112	1,759	1,196	14,943
Corpus Christi, Tex.	8	1,706	314	3,787
Pacific Coast ports	3,903	15,509	31,571	34,305
San Diego, Calif.	76	7	573	6
Los Angeles, Calif.	846	6,642	5,416	8,241
Estero Bay, Calif.	....	1,237	....	4,903
Ventura Harbor, Calif.	....	....	2	1,959
El Segundo, Calif.	....	517	748	1,568
San Luis Obispo, Calif.	....	768	5	1,823
San Francisco Bay	1,132	3,197	11,414	5,117
Stockton, Calif.	....	44	77	91
Long Beach, Calif.	158	467	891	967
Coos Bay, Ore.	....	278	46	329
Portland, Ore.	169	630	3,174	839
Astoria, Ore.	....	25	173	104
Hammersley Inlet, Wash.	12	....	167	335
Longview, Wash.	....	127	58	441
Grays Harbor, Wash.	....	275	215	512
Willapa, Wash.	1	61	13	202
Port Gamble, Wash.	....	6	90	342
Olympia, Wash.	....	25	259	324
Tacoma, Wash.	428	361	844	757
Seattle, Wash.	452	427	3,319	1,237
Everett, Wash.	54	55	582	352
Anacortes, Wash.	64	26	84	82
Bellingham, Wash.	6	85	167	356
Port Angeles, Wash.	297	26	186	294
Port Townsend, Wash.	56	....	338	60

[1]Includes Delaware River, Philadelphia to the sea, and Schuylkill River.
[2]Includes Ashley River.
Source: Annual Report of the Chief of Engineers, United States Army.

Waterborne Commerce of the United States, 1934 and 1937

[In thousands of short tons of 2,000 pounds]

	1934	1937
Foreign traffic: Coast ports	64,123	96,674
Great Lakes	13,775	17,739
Domestic traffic: Coast ports	203,620	287,813
Great Lakes	77,307	143,356
Rivers, canals and connecting channels	194,786	313,287
Net total	414,308	583,100
Foreign traffic: Imports	34,840	47,866
Exports	43,058	66,546
Domestic traffic	280,958	431,169
River, canal, etc., traffic: Coast	*39,621	*62,473
Mississippi River and tributaries	*63,191	*92,571
Interior rivers and other waterways	*354	*483
Canals and channels	*112,280	*186,816

*Gross.

cial material (notably the kinds having a high fire risk), etc., are grouped separately. It is also a general rule, as in the case of inland waterways, that the handling of bulk material is likely to be done with a greater proportionate efficiency than that of package freight. Certain large ports are exceptions to these rules; two examples are New Orleans and San Francisco. It is notable that in both these ports a public agency owns and operates the waterfront facilities.

Either public ownership and operation, or close public control and supervision, is extremely advisable if a thoroughly systematic and economical development is to be attained.

Recent years have seen definite progress in efficient port development. Several factors have contributed to this, including the general national trend toward greater efficiency mentioned above, and the ambition of many ports to turn from the almost exclusively bulk business of former days and obtain a larger share of the higher grade package freight. The industrial growth of the South and of the Pacific Slope has had a pronounced effect. Another important factor is the policy of Congress, exemplified in the Transportation Act of 1920, to demand terminal development as a requisite to channel improvement at Federal expense. This far-reaching policy has caused many ports to devote much money and skill to the modernizing of their terminals. An important new function of the army engineers is that of consulting with and advising ports in the matter of terminal development, in order that this may be co-ordinated with channel improvement.

F. Benefits and Justification of Ports.—Under section «G» of *Inland Waterways,* page 91, it was pointed out that the Federal Government improved a river on the strictly business basis of comparing the *cost,* i.e., carrying charge on initial investment plus annual maintenance, against profits, considered as the *savings in cost of transportation on material moving via*

the channel instead of by other means. An identical policy is applied in the case of Federal port and harbor channel improvements. In its application, however, certain complications are encountered, not present with inland waterways. An inland waterway, in the great majority of cases, is an alternative to some other means of transportation, usually rail. There is thus something definite to which, in any specific case, the cost of movement on the waterway can be compared. A port is also alternative to a railroad, so to speak, in the matter of coastwise hauls; that is, freight can either go through the port and move coastwise on a ship, or move direct to destination by rail. But with overseas trade there is no alternative means of transportation; it must go by ship in any case. The value of a port in this case can be ascertained only by comparison with another port. If the question arises of establishing a new port, or improving an existing one to serve new traffic, it is necessary to study what ports the expected traffic now moves through; what it costs, by rail and vessel, under existing conditions, to carry it to origin and destination; and how much this cost would be reduced, if the traffic were deflected to the new port. There must also be considered the possible development of entirely new commerce, through the superior facilities afforded by the new port or channel. Thus are computed the benefits which are weighed against the costs. As with inland waterways, there are uncertain factors to be carefully weighed; notably the inertia of trade, its tendency to move by an existing route where all facilities are provided and all details understood and arranged for, even though a new untried route exists which promises theoretical savings. This inertia is especially notable in the case of high-grade and package freight, which as explained tends to move to ports where there is liner service to numerous points. A new port usually starts its life principally with bulk movements of a few commodities in tramp or chartered bottoms, and the building up of a liner service and general cargo traffic is a slow process.

The rates by ocean vessels are usually «blanketed,» i.e., the same for similar commodities, for large groups of ports of both origin and destination. Therefore the differentials by which a port shows savings over another port are usually rail differentials.* As stated, an important port usually has a tributary area within which rail rates to it are less than to neighboring ports, and it is within this area that the «differential savings» computations apply. For the more remote hinterland, where rail rates are blanketed to a number of ports, no such savings can be computed.

The computation of «differential savings» is applicable to practically all *proposed new* projects for port development.

When, however, we try to apply to ports *in being,* to evaluate them, the method is not universally applicable. It would seem that we could take any given port, and, knowing the origin, destination and cost of movement of freight moving through it, could assume all this diverted to another port, and figure out how much more it would cost to move it. This is theoretically practicable, though very laborious, and though the question of what other port or ports to select may be difficult to decide. But there are cases where the computations would show no savings at all, but a loss. A large part of the trade that moves through New York could, *so far as rail rates go,* get to shipside more cheaply through other ports. But it continues to use New York: Because it is used to it; because of the great consuming capacity of the port district; because New York can furnish sailings to almost any port in the world; because New York is the financial and business center of the nation, and a great warehousing and distributing centre. Similar examples could be cited elsewhere.

These remarks are of special interest to one seeking to evaluate the transportation function of our ports as a whole. This can be done in theory, and approximated in practice, for inland waterways. It cannot be done for our ports even theoretically. If all our inland waterways were closed up, great disorganization would ensue, but given the money to build enough new railroads, it would still be possible to move the traffic. But if all our ports were closed up, our foreign trade would cease, with economic consequences impossible to predict.

It is, however, theoretically possible to evaluate our ports as a whole from the standpoint of *coastwise and intercoastal trade only,* for this at least could move by rail—given the railroads—if the ports were not there, and therefore rate differentials can be obtained.

On a different basis, the investment has made possible the collection of custom duties of about half a billion dollars a year.

G. Future of Our Ports.—The future of existing ports lies largely in the direction of more efficient terminals; better warehousing; a better co-ordination of rail and water movements; a more careful planning and zoning of the port area; and a closer municipal control of port activities, to eliminate wasteful intra-port competition. Ports which have specialized in low-grade bulk commodities, or in the serving of a small tributary area, or both, are reaching out for trade into more remote sections, and seeking higher grade traffic, and the liner service on which this depends. In recent years there have been notable strides in efficient port planning and terminal design and construction. Certain ports, as they grow, will need deeper water; but the importance of very deep channels is often much exaggerated. It is frequently the case with ports, as with rivers, that a community expects trade to appear magically on the provision of a deep channel; which is much as if a man should build a railroad track, and then expect trains to come from somewhere and run over it. An adequate channel is one essential to a port; but there are many other essentials. And as shown above, much of the world's commerce moves on very moderate drafts.

In the near future it is unlikely that there will be many entirely new ports of importance developed in this country. Most of the existing ones are not being used to capacity, or if they are, it is because the port lay-out and terminals are not of the highest efficiency. And a glance at our coast-line will show that there are few long stretches of coast, with important

*Also, theoretically, differentials on terminal charges. This is important in port competition, if the terminal charges are assessed in toto against the shipper. But where terminals are rail-owned, all or part of the terminal charge is often absorbed into the line-haul rate.

and productive hinterlands, where a port does not exist which is capable, perhaps with a little expansion and channel deepening, of serving the tributary territory economically. A few new ones may develop. In the main, however, the future lies with the existing ports, working toward better organization, more efficient service and greater diversification of trade.

Beach Erosion.—Closely allied with problems for the improvement of coastal and Great Lakes harbors is the question of stabilizing outer exposed shores, especially at localities such as bathing and recreational beaches where, in many instances, great damage may result to the shores from storm and wave action, and be highly detrimental, through drift of material, to the permanency of channel entrances. Congress has recognized the importance of undertaking measures to regulate and control the forces affecting the permanency of coastal beaches and shores and in the River and Harbor Act of 3 July 1930, authorized and directed the Chief of Engineers of the United States Army, under the direction of the Secretary of War, to cause investigations and studies to be made in co-operation with appropriate agencies of various States on the Atlantic, Pacific, and Gulf coasts, and on the Great Lakes, and the Territories, with a view to devising effective means of preventing erosion of the shores of coastal and lake waters. The act provided for the organization of a board of seven members, of whom four members are officers of the Corps of Engineers while three members are selected from among State agencies co-operating with the War Department. This board is known as the Beach Erosion Board. At the same time that the Beach Erosion Board was created a similar organization, designated as the Shore Protection Board, was also appointed, this latter board being composed of the Army Engineer members on the Beach Erosion Board, the primary function of the Shore Protection Board being to confine its studies to problems of erosion affecting Federal property only. Furthermore, Congress by Act of 26 June 1936, directed that investigations be made to determine methods of beach protection and restoration; that States, counties, municipalities, or individuals, be advised of appropriate locations for recreational facilities; and that data and information which the Beach Erosion Board may deem will be of value to the people of the United States be published from time to time. The amendment further provided that, in reporting on the advisability of adopting a project, the board shall determine the extent of the Federal interest therein and the share of the expenses, if any, which should be borne by the United States. State agencies desiring co-operative studies and investigation by the Beach Erosion Board may inaugurate such an investigation by applying either direct to the Chief of Engineers, U. S. Army, Washington, D. C., or through the U. S. District Engineer having jurisdiction in the locality affected. In general terms, an application for co-operation should show the authority of the agency under the laws of the State to conduct studies and investigations, and the extent which the locality is willing to co-operate with the Federal Government. Since its creation, the Beach Erosion Board has conducted co-operative studies of shore erosion including the preparation of plans for co-operative measures at localities in the States of Massachusetts, New York, Delaware, New Jersey, North Carolina, Florida, Louisiana, Michigan and California.

Bibliography.—*Official Publications.*—The 'Annual Report' of the Chief of Engineers, U. S. Army, is the original source of official data respecting the progress of improvements adopted by Congress. Part 2 of this report gives the only complete annual consolidation of data relative to the tonnage and value of the commerce of our ports and waterways. The individual projects are based upon reports on examinations and surveys, published separately as Congressional documents. Detailed information regarding the Great Lakes and connecting channels is contained in the 'Survey of Northern and Northwestern Lakes,' published by the United States Lake Survey Office, Detroit, Michigan, which office also issues charts of the channels and harbors of the United States. Other important official publications are as follows:

War Department, Corps of Engineers.—Port Series, consisting of some 37 volumes covering our major ports; *Transportation Series,* consisting of four volumes, two of which deal with the Great Lakes and two with the Mississippi River System; *Lake Series,* consisting of eight volumes covering ten of the important Great Lakes ports; Miscellaneous Series, Nos. 1 and 2 of which deal with charges at United States ports, while No. 3 is a special report on Foreign Trade Zones or Free Ports; Water Terminal and Transfer Facilities, published as House Document No. 652, 66th Congress, 2nd Session; Water Terminal and Transfer Facilities, published as House Document No. 109, 67th Congress, 1st Session; Experimental Towboats, published as House Documents Nos. 857, 63rd Congress, 2nd Session, and 108, 67th Congress, 1st Session.

Certain other official publications.—Annual reports of the Inland Waterways Corporation, War Department; Statistical Abstract of the United States, published annually by the Department of Commerce; reports on Transportation by Water in the United States, published in 1906, 1916, and 1926 by the Department of Commerce; Inland Waterway Freight Transportation Lines in the U. S., published by Department of Commerce in 1930; report of the Commissioner of Corporations on Transportation by Water in the United States in four volumes, published in 1909–10; Preliminary report of the Inland Waterways Commission, published in 1908 as Senate Document No. 325, 60th Congress, 1st Session; Preliminary and Final Reports of the National Waterways Commission, Senate Documents No. 301, 61st Congress, Second Session and No. 469, 62nd Congress, 2nd Session.

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WATERWORKS, systems of machinery and engineering structures, employed to supply water to individual manufacturing, mining and milling plants, and to municipalities, for domestic and industrial uses and for irrigation. Such systems existed during very early periods of history, and the waterworks of ancient Greece, Carthage and Rome may be readily traced and studied by the ruins of their reservoirs and

masonry aqueducts. In these earlier systems, gravity was depended upon for the delivery of the water, but force pumps were introduced about the middle of the 16th century, and extended greatly the general installation and use of waterworks systems. The waterworks built at London Bridge by Peter Maurice 1562 appear to be the first on record. The plant consisted of 16 force pumps, each 17 inches in diameter, and 30 inches long, which were driven by a current wheel, and raised 311,000 gallons of water per day to a reservoir at an elevation of 120 feet above the pumps, and from which the water was delivered by gravity, through lead pipes to buildings in the immediate vicinity.

In the United States, the first pumping plant installed to provide water for municipal purposes was that at Bethlehem, Pa., about 1760. It consisted of a five-inch wooden force pump, which raised water to a height of 70 feet through pipes of bored hemlock logs. This was replaced in 1761 by three single-acting iron pumps, each four inches in diameter, and of 18-inch stroke, operated by an undershot waterwheel. The first municipal water-supply system built in America, however, was that of Boston, in 1652. It was built by the Water-Works Company, and consisted of a reservoir about 12 feet square, to which the water from springs in the vicinity was conveyed through wooden pipes. From 1652 up to the close of the year 1800, the waterworks plants in the United States numbered 16, and had been located and built at the following named cities: Boston, Mass., 1652; Bethlehem, Pa., 1754–61; Providence, R. I., 1772; Geneva, N. Y., 1787; Plymouth, Mass., 1796; Salem, Mass., 1795; Hartford, Conn., 1797; Portsmouth, N. H., 1798; Worcester, Mass., 1798; Albany, N. Y., 1798–99; Peabody, Mass., 1799; New York City, 1799; Morristown, N. J., 1799; Lynchburg, Va., 1799; Winchester, Va., 1799–1800; and Newark, N. J., 1800. With the exception of the plants at Winchester and Morristown, they were all built by private concerns, but passed into the ownership of the respective municipalities from time to time up to 1860. The works at Winchester were built by the municipality, and those at Morristown were built by a private concern and still remain in private ownership.

A clear and concise consideration of the subject of waterworks may be facilitated by arranging the various requirements under the four general headings—quality of the water; sources of supply; modes of distribution, and public policy.

Quality expresses the fitness of the water for the special purposes for which it may be required. A good quality of water is characterized by freedom from turbidity and color, unpleasant taste and odor, and undue sewage contamination.

Taste is the first quality to be satisfied in drinking water. Even a perfectly safe water may be rejected because of nauseating flavor. This may often be remedied by dosing with chlorine and then removing the chlorine taste with sodium sulphite.

Turbidity is a condition caused by clay and silt suspended in the water. When the source of supply is a river, this condition is liable to great variation according to the amount and character of the rainfall over the watershed. Heavy rains of short duration are drained off with great erosive effect, and introduce into the flowing rivers vast quantities of finely divided inorganic matter. Such impurity, however, is more offensive than harmful, unless taken into the system frequently or in large quantities. It is removed by the use of settling reservoirs where the water is allowed to rest and deposit the heavier particles, before it is passed through the filter-beds by which the smaller particles are removed. (See WATER SUPPLY). Color is a condition more offensive to the eye than harmful to the health. The apparent color due to turbidity disappears under the processes of sedimentation and filtration, but true color, generally due to infusion of vegetable organic matter, such as leaves, grass, etc., is much more difficult to remove.

Odor is a condition which, although less frequent, is much more objectionable than turbidity or color. As a rule it is due to the life processes of minute organisms, and is removable to a considerable degree by filtration. It may, however, persist at certain times in the year and has been known to produce, or be followed by bowel disturbances among small children.

Sewage contamination is the most harmful of all the various forms of impurities natural or artificial that a water supply may be subjected to, and is the direct cause of epidemics of typhoid fever and various troubles of the intestines, which by undermining the constitution reduces its power of resistance to other diseases. The water may be somewhat purified by filtration, but the proper remedy is to remove the source of pollution. Failing this, even a much polluted water may be made reasonably safe for drinking by sterilization with chlorine.

The quality of water is ascertained by various kinds of analyses, physical, chemical and bacteriological. Physical analyses consist merely of comparisons of the given samples with standard solutions, and afford data relative to temperature, turbidity, color and odor. Chemical analyses indicate the time of past contamination and the nature of its origin—animal or vegetable, and the content of mineral salts. Bacteriological analyses are principally used to ascertain the absence or presence of the growths which cause bad taste and odor. Such analyses are capable of showing the number and probable origin of the bacteria present, but in matters of differentiation, as in the case of the typhoid germ from the harmless water bacteria, their operation is quite uncertain.

The results obtained by any set of analyses are generally interpreted by chemists and engineers by comparing them with other known facts, without attempting to establish a system of arbitrary standards. A minimum limit of impurity, however, may be stated, as follows:

(1) The best authorities consider water as unfit for drinking purposes when 100,000 parts of the liquid contain more than three parts by weight of mineral matter or one part by weight of dry organic matter, before it has been submitted to precipitation, or when it holds in suspension more than one part by weight of dry organic matter after six hours of perfect repose in a reservoir.

(2) When the same amount of liquid contains in solution more than two parts by weight of organic carbon, or three parts of nitrates.

(3) If it exhibits a distinct color under day-

light when placed in a white porcelain dish, to the depth of one inch.

(4) When 100,000 parts of the liquid contain more than two parts by weight of a salt of any metal except calcium, magnesium, potassium and sodium.

(5) When 100,000 parts of the liquid contain in solution, suspension, or chemical combination, more than 0.5 part of arsenic.

(6) When 100,000 parts of the liquid, after the addition of sulphuric acid, contain more than one part by weight of free chlorine.

(7) When 100,000 parts contain more than one part by weight of sulphur in the form of sulphuretted hydrogen, or a soluble sulphuret.

(8) When 100,000 parts of the liquid holds in suspension more than 0.5 part of petroleum or hydrocarbon, or exhibits a film of the same upon its surface.

(9) When the acidity is greater than that produced by two parts by weight of hydrochloric acid to 1,000 parts of distilled water.

(10) When the alkalinity is greater than that produced by adding one part by weight of caustic soda to 1,000 parts of distilled water.

(11) When 10 cubic centimeters of water contain more than 100 harmless bacteria. This is the requirement of the government for water served on railroad trains in interstate commerce, and is adopted by all bottlers of table waters.

In general, a large percentage of chlorine and nitrates, together with the presence of *Bacillus coli communis,* an organism originating in large quantities in the human intestines, indicate sewage contamination.

A very simple but reliable test for sewage contamination was suggested by Heisch. To half a pint of the suspected water placed in a clear colorless glass-stoppered bottle, add a few grains of the best white lump-sugar, and expose the bottle freely to daylight in the window of a warm room for a week or 10 days. If the water remains clear it may be considered safe, but if it become turbid, it is open to grave suspicion of sewage contamination.

Turbidity or a precipitate which follows upon the addition of baryta water indicates the presence of carbonic acid; chloride of barium is used in the same way as a test for sulphates; nitrate of silver for chlorides; oxalate of ammonia for lime salts; sulphide of hydrogen, slightly acid, for salts of antimony, arsenic, bismuth, calcium, copper, gold, lead, mercury, platinum, silver and tin; an alkaline (by ammonia) solution of sulphide of ammonium, for salts of aluminum, chromium, cobalt, iron, manganese, nickel, and zinc. Chloride of gold or mercury and the sulphate of zinc are the reagents for organic matter.

Hardness of water is a quality that bears chiefly upon its use for boilers and for laundry purposes. The hardening impurities are principally the salts of lime and magnesia. Their carbonates produce temporary hardness which may be removed by boiling, when the carbonic acid is dissipated and the insoluble bases are deposited as incrustations on the bottoms of the kettles and boilers. The carbonates are less troublesome to the human constitution than to steam users, but the sulphates, chlorides and nitrates of lime cannot be dissipated by ordinary boiling and are productive of what is known as permanent hardness. Ordinarily pure water can take up only about two grains of carbonate of lime per imperial gallon of 70,000 grains, but when carbonic acid is present, that amount of water will dissolve as much as 20 grains of the carbonate. The degree of hardness is estimater according to the number of grains of soap the solution is capable of neutralizing. Thus, one, two and three degrees of hardness represent the neutralization of 10, 20 and 30 grains of soap, respectively. The amount of waste, in the wear of clothes and soap, and the destruction of many valuable food properties by the use of hard water is not fully appreciated by the general public. It is safe to state that the money value of that waste far exceeds the cost that would supply an abundance of water for domestic purposes from a source free from impurities.

Systematic processes for softening water have been employed in the United States, principally in connection with manufacturing plants. The first process was invented by Prof. Thomas Clark, of Aberdeen, Scotland, in 1841, and consists of mixing the water supply with lime water or milk of lime, and allowing it to subside for a period ranging from 12 to 24 hours, when the water is drawn off while the precipitate is left behind. The first softening plant in connection with a municipal water supply in America is that connected with the waterworks of the city of Winnipeg, Manitoba. The source of supply is a number of artesian wells, and the water obtained is very hard. The softening process employed is a modification of that of Clark, and includes a variety of settling and filtering devices, into which the water is pumped and mixed with the lime solutions and then drawn off and distributed by direct pressure pumping into the mains. Its working provides a water more beneficial to the health, and better for domestic purposes, than that of the Red River, which formed the original water supply of the city. (See WATER SOFTENING).

While boiling is a very cheap and thoroughly effective process of purifying water, and may be used by householders in general, distillation, owing to its expense, may be employed only in special cases, in connection with artificial ice plants, the conversion of salt water into fresh water at sea, and in the various industrial arts.

Waste by leakage from the mains and poorly constructed flushing devices varies from five gallons upward per capita, and its reduction to a minimum is essential to the economical operation of any system of waterworks, but it is especially important when the service is by pumping, for the cost of pumping the waste is proportionally equal to that which is actually used. This is true also when the source of supply is distant and the purity of the water depends upon the conservation of its quantity. This can only be accomplished by careful workmanship in the construction of the plant; careful pipe laying; the use of high-grade, self-closing plumbing fixtures, especially those devices used for flushing water-closets and the installation of meters not only to detect leaks and other causes of waste in the houses, but to form the basis for charges against the consumer and compel carefulness on his part. This, however, brings the matter to a point where it is necessary to harmonize good practice with

public policy. The details of district meter systems and the inspection of service pipes are minor problems as compared with the equitable adjustment of water rates according to the various classes of consumers. In general, although the district plan is but a poor competitor of the house meter system, it has produced good results in controlling waste and detecting leaks whenever it has been employed. See also HYDRAULICS; HYDROSTATICS.

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WATIE, Stand, Cherokee Indian leader and soldier: b. Oo-yoo-ge-lo-gi, near the site of Rome, Ga., Dec. 12, 1806; d. Sept. 9, 1871. His father, David Oowatie (Uweti), was a Cherokee of pure Indian blood and his mother was the child of a white father and a Cherokee mother. His given name was Degataga, which, rendered into English, signified "standing together," whence came his English given name, Stand. His surname was a contraction of his father's given name. Elias Boudinot, known also as Buck Watie, was an elder brother of Stand Watie. Major Ridge was his uncle. In common with his immediate kinsmen, Stand Watie was active in his support of the removal treaty and was marked for assassination at the same time they were, but was warned in time to save himself. He was thenceforth regarded as the head of the Ridge, or Treaty Party, in the Cherokee Nation. At the outbreak of the Civil War, he espoused the cause of the seceding states, raised a regiment for the Confederate service, commanding it with the rank of colonel until May 1864, when he was promoted to the grade of brigadier general. After the close of the war he engaged in various business enterprises.

WATKIN, wŏt'kĭn, SIR **Edward William,** English railway promoter: b. Salford, Lancashire, England, Sept. 26, 1819; d. Northenden, Cheshire, April 13, 1901. He was engaged in the warehouse of his father, a London merchant, from 1829–1845, when he became secretary to the Trent Valley Railway Company, and thenceforward continued in the railway business, becoming general manager and director in various leading companies. He was chairman of the South Eastern in 1866 and of the Metropolitan in 1872, extricating each from financial difficulties. While president of the Grand Trunk Railway of Canada he prosecuted negotiations which resulted in the confederation of the five British North American provinces. He was elected to Parliament for Great Yarmouth in 1857, but was unseated by petition. In 1864–1868 he was a member for Stockport, and for Hythe in 1874–1895. He was knighted in 1868, and created a baronet in 1880.

WATKINS, wŏt'kĭnz, **John Elfreth,** American scientist: b. Ben Lomond, Va., May 17, 1852; d. New York, New York, Aug. 11, 1903. He graduated from Lafayette College in 1871, and for a year was mining engineer for the Delaware and Hudson Canal Company. In 1872–1873 he was engineer of construction for the Pennsylvania Railroad until he lost one leg in an accident. From 1874 to 1886 he was chief clerk of the railroad. He was appointed curator of the United States National Museum in 1886, holding this office until 1892. As superintendent and curator he built a noteworthy technological collection pertaining to the transportation industry.

He wrote much about the growth of railroad and telegraph systems, including *The Evolution of the Railway Passenger Car* (1888); *History of the Pennsylvania Railroad, 1845–96* (never published).

WATKINS GLEN, village, New York, and Schuyler County seat; altitude 477 feet; on the New York Central and Pennsylvania railroads, and two state highways; 18 miles north of Elmira, at the south end of Seneca Lake. It is in an agricultural region from which grapes are shipped and grape juice is manufactured. There are two plants which make salt by evaporating brine.

The main entrance to the park and ravine of Watkins Glen is on the village main street. The first settlers came here from Connecticut in 1788 and called the place Salubria. It was incorporated in 1842 as Jefferson; but in 1852 was renamed Watkins for Dr. Samuel Watkins, an early settler who had laid out and mapped the village. The present name dates from 1926. The electric light and power plants are public. Government is by mayor and council. Pop. (1940) 2,913; (1950) 3,052.

WATKINS GLEN, ravine, in New York, partly in Watkins Glen Village, Schuyler County, traversed by Glen Greek. It is noted for its picturesque scenery and its great beauty. It was privately owned until 1906 when it became a state park reservation. Since then additional acreage has been purchased and the total area is now 540 acres. The rock formation of the district is Devonian shale cut into narrow gorges by glaciation during the Pleistocene period. At Watkins Glen cliffs rise 200 feet above the stream which drops 700 feet in a series of cascades and rapids along its two-mile route through the gorge.

WATLALA or **WATLALLA INDIANS,** wät-lä'lä, a tribe of the Chinookan stock of North American Indians, who call themselves Kwikwulit, and who have also been known as Wahclellah, Dog River, or Cascade Indians. They formerly occupied the Cascades and about the Dog River, which discharges into the Columbia about midway between the Cascades and The Dalles, in Wasco County, Oregon. They numbered but 80 souls in 1854; in the next year they entered into the Wasco Treaty, by which they agreed to move to the Warm Springs Reservation, where a few of them now are, while the others are still about the Cascades. Their language is almost identical with that of the Wasco Indians.

WATLING STREET, wŏt'lĭng, one of the great Roman roads, starting at London, England, and going past St. Albans to Wroxeter near Shrewsbury, thence to Chester. A branch went to Lincoln and Leicester. Traces of the road are still found, and some are used; a street in London retains its name. It was the line of division in the Treaty of 878 between Alfred and Guthrum the Dane, and is today the boundary between Warwickshire and Leicestershire.

After the Conquest, Watling Street was on

a list of four royal roads recorded by Norman lawyers. Icknield and Ermine streets, and Fosse Way were the other roads, and charters name them as boundaries. In the Elizabethan period the custom began of giving the name Watling Street to many old roads which either were Roman or were thought to be so in various parts of Britain. This was the case with the road from York north to the Wall of Pius, and with the road from Dover to London.

Of the origin of Watling nothing is now known; it was once written Waeclinga Straet, and may be a corruption of Stratum Vitellianum; a hint of the title survives in the name Wattlesborough, on Watling Street near Wroxeter.

WATLINGS ISLAND. See SAN SALVADOR, island, Bahama Islands.

WATMOUGH, James, United States naval officer: b. Whitemarsh, Pa., July 30, 1822; d. Washington, D.C., Jan. 18, 1917. He was educated at the University of Pennsylvania, and from 1843–1844 was acting midshipman. He served in the Mexican War, and participated in the capture of California. In the Civil War he commanded the South Atlantic Squadron and took an active part in the operations on Stono River and James and John islands. Later he became general pay inspector of the navy, and from 1873–1877 was paymaster general. In 1884 he was retired and in 1906 was created rear admiral.

WATONGA, wȧ-tŏng'gȧ, city, Oklahoma, and Blaine County seat; altitude 1,460 feet; on the Chicago, Rock Island and Pacific Railroad; 50 miles southwest of Enid. It is in an agricultural and stock-raising region. There are grain and lumber mills, cotton gins, and poultry packing plants. Other manufactures are dairy products, gypsum products, and bedding. Located on the Chisholm Trail, Watonga was settled in 1892, and incorporated in 1893. Pop. (1940) 2,828; (1950) 3,249.

WATROUS, wô'trŭs, **Harry Willson,** American artist: b. San Francisco, Calif., Sept. 17, 1857; d. New York, N. Y., May 9, 1940. After attending private schools in New York he went to Paris and studied art at the Académie Jullian and Atelier Bonnât, becoming a pupil of Boulanger, Lefebvre, and Bonnât. Later he established himself in New York City and spent much time painting intimate scenes of city life. His Paris paintings show meticulous attention to detail, a quality which he abandoned for a time after his return to America, when he turned to figure studies and landscapes. Most of his paintings are of small size, exquisitely finished and occasionally of somewhat unconventional conception. He received many awards and prizes for his work. He was secretary of the National Academy of Design, 1898–1920, and president in 1933. He belonged to the Art Commission Associates of the City of New York, and was president of the Louis Comfort Tiffany Foundation. He married Elizabeth Nichols, also an artist, in 1887. Among his works are *Passing of Summer* (Metropolitan Museum, New York) and *A Study in Black* (St. Louis Museum).

WATSEKA, wŏt-sē'kȧ, city, Illinois, and Iroquois County seat; altitude 634 feet; on the Chicago and Eastern Illinois, and the Toledo, Peoria and Western railroads; on the Iroquois River; 78 miles south of Chicago. It is in an agricultural and stock-raising region. Soft drinks, dairy products, and batteries are manufactured. The city was laid out in 1860 on the site of a trading post and named South Middleport. In 1865 it was renamed for Watch-e-kee, Indian wife of G. Hubbard, first white settler of the region. Incorporation was in 1867. Pop. (1940) 3,744; (1950) 4,235.

WATSON, wŏt's'n, **Alfred Augustin,** American Protestant Episcopal bishop: b. New York, N. Y., Aug. 21, 1818; d. April 21, 1905. He was graduated from the University of the City of New York in 1837, studied law and in 1841 was licensed to practice in the New York State Supreme Court. He then turned his attention to theology, and in 1845 took priest's orders in the Episcopal Church. During the Civil War he served as chaplain in the Confederate Army, and in 1884 was consecrated bishop of East Carolina.

WATSON, David Thompson, American lawyer: b. Washington County, Pa., Jan. 2, 1844; d. Atlantic City, N. J., Feb. 24, 1916. He graduated from Washington College in 1864, studied law two years at Harvard, was admitted to the bar, and practiced law in Pennsylvania. In 1903 he was one of three United States' Counsels before the Alaskan Boundary Commission.

WATSON, Elkanah, American businessman and agriculturist: b. Plymouth, Mass., Jan. 22, 1758; d. Port Kent, N. Y., Dec. 5, 1842. He was apprenticed at 15 to John Brown of Providence, R. I., founder of the famous mercantile firm, and when 19 was entrusted by him with $50,000 to be invested in cargoes for the markets of Europe. He made the journey to Charleston, S. C., successfully and his journal, subsequently published, is the best existing account of the principal towns of the colonies at the time of the American Revolution. He opened a branch house in Nantes, France, in 1779, meeting with much success for three years, when he lost his property through the crash of French finances. He returned to America in 1784, engaged in trade between South Carolina and Haiti until 1788, and in 1789 removed to Albany, where he was an active promoter of public enterprises. He projected an internal canal for New York State, founded the Bank of Albany, organized the first agricultural society in New York, aided the establishment of western stage routes, and was an earnest worker for improved educational advantages. He also sponsored the first county fair in the United States. He removed to Port Kent on Lake Champlain in 1828.

He published *Tour in Holland* (1790); *History of the Rise and Progress, and Existing Condition of the Western Canals in the State of New York* (1820); *History of Agricultural Societies on the Modern Berkshire System* (1820).

Consult Watson, Winslow C., *Men and Times of the Revolution; or Memoirs of Elkanah Watson* (1856).

WATSON, George Lennox, English naval architect: b. Glasgow, Scotland, Oct. 30, 1851; d. there, Nov. 12, 1904. After a five-year connection (1867–1871) with leading shipbuilding firms in Scotland, he established himself

in Glasgow in 1872 as a naval architect. His first success was made in 1873 with the racing yacht *Clotilde*. Subsequently he designed more than 400 vessels, including, besides racing yachts, passenger, mail and cargo steamers, and some of the largest steam yachts afloat. Among his racing yachts were *Vanduara* (for John Clark of Paisley); the cutter *Britannia* (for the prince of Wales, later Edward VII), and the *Thistle, Valkyrie II,* and *Valkyrie III,* competitor's for the *America's* cup.

WATSON, Henry Brereton Marriott, English novelist: b. Melbourne, Australia, Dec. 20, 1863; d. London, Oct. 30, 1921. Graduated from Canterbury College (Christchurch) in 1883, he went in 1885 to England, where he took up journalism in 1887. He wrote much for the *National Observer* and was assistant editor of *Black and White* and the *Pall-Mall Gazette.* Among his works are *Marahuna* (1888); *The Web of the Spider* (1891); *The Adventurers* (1898); *The Skirts of Happy Chance* (1901); *The House Divided* (1901); *Godfrey Merivale* (1902); *Alarums and Excursions* (1903); *At a Venture* (1911); *Chapman's Wares* (1915); *The Pester Finger* (1919). With J. M. Barrie he was joint author of the drama *Richard Savage.*

WATSON, James Craig, American astronomer: b. Fingal, Ontario, Jan. 28, 1838; d. Madison, Wis., Nov. 22, 1880. He was graduated from the University of Michigan in 1857, was appointed professor of astronomy there in 1859, and in 1879 accepted the chair of astronomy at the University of Wisconsin. He accompanied the eclipse expeditions to Iowa in 1869 and to Sicily in 1870, and was in charge of the expedition to Peking, China, for the observation of the transit of Venus in 1874. He was the discoverer of 23 asteroids, and of several comets, receiving the Lanlade Medal from the Paris Academy in 1870 for the discovery of six asteroids in one year. In 1867 he was elected to the National Academy of Sciences, an institution to which he bequeathed $16,000 for a research fund and the Watson Medal. He published *Popular Treatise on Comets* (1861); *Theoretical Astronomy* (1868); *Tables for Calculation of Simple and Compound Interest and Discount* (1879), etc.

WATSON, John, Canadian philosopher: b. Glasgow, Scotland, Feb. 25, 1847; d. Jan. 26, 1939. He was graduated from Glasgow University in 1872 and that year became professor of mental and moral philosophy at Queen's University, Kingston, Ontario (later emeritus professor). He wrote *Kant and His English Critics* (1881); *Schelling's Transcendental Idealism* (1882); *The Philosophy of Kant as Contained in Extracts from His Own Writings* (1888); *Comte, Mill and Spencer, An Outline of Philosophy* (1895); *Hedonistic Theories, from Aristippus to Spencer* (1895); *Christianity and Idealism* (1896); *An Outline of Philosophy with Notes Historical and Critical* (1898); *Philosophy of Kant Explained* (1908); *Interpretation of Religious Experience* (1913); *The State in Peace and War* (1919).

WATSON, John (Ian Maclaren), English Presbyterian clergyman and author: b. Manningtree, Essex, Nov. 3, 1850; d. Mount Pleasant, Iowa, May 6, 1907. He was educated at Edinburgh University, New College (Edinburgh), and the University of Tübingen, was licensed to preach by the Free Church of Scotland in 1874 and appointed assistant minister of the Barclay Church, Edinburgh. In 1875 he was ordained minister of Logiealmond (Perthshire) Free Church, whence he went in 1877 to Free Saint Matthew's, Glasgow, and in 1880 to the Sefton Park Presbyterian Church of Liverpool. He was Lyman Beecher lecturer at Yale in 1896, and in 1900 moderator of the Synod of the Presbyterian Church of England. Among his religious works are *The Upper Room* (1896); *The Potter's Wheel* (1898); and *The Life of the Master* (1901). He also published several works of fiction, beginning with *Beside the Bonnie Brier Bush* (1894), a very successful collection of sketches of life and character in Highland and semi-Highland parishes, and including further *The Days of Auld Lang Syne* (1895), *Kate Carnegie* (1896), *A Doctor of the Old School* (1897), *Afterwards* (1898) and *Rabbi Saunderson* (1898); *Life of the Master* (1901); *Inspiration of Our Faith* (1905); *Children of the Resurrection* (1912).

WATSON, John Broadus, American psychologist: b. Greenville, S. C., Jan. 9, 1878. He was graduated at Furman University in 1900, and took his Ph.D. at the University of Chicago in 1903. He was assistant and instructor in psychology at Chicago in 1903–1908; and 1908–1920 occupied the chair of experimental and comparative psychology at Johns Hopkins University and was also director of the psychological laboratory there. He was commissioned major in the aviation section of the Signal Corps of the United States Reserves in 1917. He is now vice president of William Esty & Co., New York. He was editor of the *Psychological Review* 1908–1915 and from 1915 to 1927 editor of the *Journal of Experimental Psychology;* and joint editor of *The Journal of Animal Behavior.* Author of *Animal Education* (1903); *Behavior* (1914); *Behaviorism* (1925); *Ways of Behaviorism* (1928).

WATSON, John Crittenden, U.S. naval officer: b. Frankfort, Ky., Aug. 24, 1842; d. Washington, D.C., Dec. 14, 1923. He was graduated from the United States Naval Academy, 1860; promoted master in 1861 and assigned to the *Sabine.* He was transferred to the *Hartford,* flagship of Admiral David Farragut, in 1862 and served under him throughout the war. He participated in the battles of Fort Jackson and Saint Philip, served in the passage of the Vicksburg batteries in 1862, of Fort Hudson in 1863 and was engaged at Mobile Bay in 1864. He received rank as lieutenant commander in 1866, as commander in 1874 and in 1877–1880 was in command of the *Wyoming.* He was lighthouse inspector in 1880–1886, promoted captain in 1887 and commodore in 1897. In the Spanish-American War of 1898 he commanded the blockading squadron on the northern coast of Cuba, was transferred to the command of the *Oregon* later in that year and in 1899 succeeded Admiral Dewey in charge of the Asiatic squadron at Manila, with rank of rear admiral. In 1900–1902 he was president of the naval examining board and thereafter was president of the examining and retiring board. He retired in 1904.

WATSON, John Fanning, American antiquary: b. Batsto, N. J., 1780; d. Germantown, Pa., 23 Dec. 1860. He was a bookseller in Philadelphia for many years and made a careful study of early and Revolutionary history. His publications include 'Annals of Philadelphia' (1830); 'Historic Tales of the Olden Times in New York' (1832); 'Annals of New York City and State' (1846); 'History of the United States' (1856).

WATSON, Musgrave Lewthwaite, English sculptor: b. Hawkdale, Cumberland, near Carlisle, 1804; d. London, 28 Oct. 1847. Meeting Flaxman in London in 1823 he gained the friendship of that sculptor, through whose influence he was admitted to the schools of the Royal Academy. He subsequently visited Rome, working under Chantrey (q.v.) and Behnes. His productions include a terra cotta relief, 'Suffer Little Children to Come Unto Me'; and statues of Flaxman, Nelson, Chaucer and Queen Elizabeth.

WATSON, Paul Barron, American author: b. Morristown, N. J., 25 March 1861. He was graduated from Harvard in 1881, subsequently studied law and was admitted to the bar and has practised in Boston. His published writings are a 'Bibliography of the Pre-Columbian Discoveries of America,' privately printed in 1881, and included in the fourth (enlarged) edition of 'America Not Discovered by Columbus,' by R. B. Anderson (q.v.); 'Marcus Aurelius Antoninus' (1884); 'The Swedish Revolution under Gustavus Vasa' (1889); and 'Tales of Normandie' (1930).

WATSON, Richard, English Anglican prelate: b. Heversham, Westmoreland, August 1737; d. Calgarth Park, Westmoreland, 4 June 1816. He was graduated from Trinity College, Cambridge, in 1759, became professor of chemistry there in 1764 and in 1771 was appointed regius professor of divinity. He became archdeachon of Ely in 1780 and in 1782 was consecrated bishop of Llandaff. His writings include 'An Apology for Christianity' (1776); 'Chemical Essays' (5 vols., 1781–88); 'An Apology for the Bible' (1796), etc. Consult his son Richard, 'Anecdotes of the Life of Richard Watson' (1817).

WATSON, Richard, English Methodist clergyman: b. Barton-upon-Humber, Lincolnshire, 22 Feb. 1781; d. London, 8 Jan. 1833. He joined the Wesleyan Methodists at 15 and began preaching. He was ordained in 1800 and shortly afterward joined the Methodists of the New Connection, returning to the Wesleyans in 1812. He was appointed secretary of the Wesleyan Missionary Society in 1817 and in 1826 was president of the conference. He was for a time editor of the Liverpool *Courier* and wrote 'Apology for the People Called Methodists' (1800); 'Life of the Rev. John Wesley' (1831); 'A Biblical and Theological Dictionary' (1831); 'An Exposition of the Gospels of Matthew and Mark' (1833), etc. His collected works were edited by Thomas Jackson, in 13 vols., 1834–37, with 'Memoir.'

WATSON, Robert Spence, English publicist and lawyer: b. Gateshead, 8 June 1837; d. 1911. He was educated at University College, London, and established a law practice in Gateshead and Newcastle. He was president of the National Liberal Federation in 1890-1902 and has taken an active part in educational movements in Newcastle He is also known for his writings on economic subjects, particularly the labor question. His publications include 'Industrial Schools' (1867); 'Higher Education in Boroughs' (1868); 'The History of English Rule and Policy in South Africa' (1879); 'Irish Land Law Reform' (1881); 'The Relations of Labor to Higher Education' (1884); 'Boards of Conciliation and Arbitration and Sliding Scales' (1886); 'The Peaceable Settlement of Labor Disputes' (1889); 'Labor, Past, Present and Future' (1889); 'The Recent History of Industrial Progress' (1891); 'The Duties of Citizenship' (1895); 'Reform of the Land Laws' (1906), etc.

WATSON, Sereno, American botanist: b. East Windsor Hill, Conn., 1 Dec. 1826; d. Cambridge, Mass., 9 March 1892. He was graduated from Yale in 1847, studied medicine at the University of New York and in 1867–69 was botanist to the government exploration of the 40th parallel under Clarence King (q.v.). In 1871 he became assistant curator at the Gray Herbarium at Harvard and from 1874 until his death was curator there. He was elected Fellow of the National Academy of Sciences in 1889. Among his publications are 'Botany'; Vol. V of 'Reports on the Geological Exploration of the 40th Parallel' (1871); 'Bibliographical Index to North American Botany, Part I, Polypetalæ' (1878); with W. H. Brewster and Asa Gray, 'Botany of California' (2 vols., 1876–80), etc.

WATSON, Thomas, English poet: b. London, about 1557; d. 1592. While his fame may seem to have been eclipsed by that of Spenser and Sidney, among his contemporaries he was equally popular for his pastoral and love poetry. He lived in a learned age and translated the 'Antigone' of Sophocles into very elegant Latin. His 'Melibœus, Thomæ Watsoni; seu, Ecloga in Obitum Domini Francisci Walsinghami, Equitis Aurati' (1590) was a graceful Virgilian tribute to the memory of the statesman and diplomat Francis Walsingham (q.v.). His sonnets, 'Tears of Fancie; or Love Disdained,' evidently gave suggestions to Shakespeare in the composition of his 'Sonnets.' Consult Arber, 'English Reprints' (1892).

WATSON, Thomas Edward, American politican: b. Columbia County, Ga., 5 Sept. 1856; d. Washington, D. C., 26 Sept. 1922. He entered Mercer University but left before graduation and took up the study of law and was admitted to the bar in 1875. He began the practice of his profession at Thompson, Ga., and rapidly attained a reputation as one of the leading lawyers of the State. In politics he was at first a Democrat; was elected to the State legislature in 1882 and served as Democratic elector-at-large in 1888. He was active in the Farmers' Alliance movement and finally affiliated himself with the People's Party; in 1890 he was elected to Congress on the Populist ticket and for some time edited a Populist paper at Atlanta. While in Congress he obtained the first appropriation for the rural free delivery of mail. He was the Populist Party's candidate for Vice-President in 1896 and the Presidential candidate of the People's Party in 1904 and 1908. He was elected to the United States Senate as a Democrat in

1920 for the term 1921–1927. His publications include *Napoleon: A Sketch of His Life* (1902); *The Life and Times of Thomas Jefferson* (1903); and *Political and Economic Handbook* (1908).

Consult Woodward, C. V. *Tom Watson: Agrarian Rebel* (New York 1938).

WATSON, William, American scientist: b. Nantucket, Mass., Jan. 19, 1834; d. Sept. 30, 1915. After graduating from the Lawrence Scientific School of Harvard in 1857, he became an instructor there from 1857–1859; he then spent four years in Europe collecting information on technical education, which, when communicated to William Barton Rogers, first president of the Massachusetts Institute of Technology, played a part in the development of that institution. From 1865–1873 Watson was professor of mechanical engineering and descriptive geometry there. In 1884 he was elected secretary of the American Academy of Arts and Sciences. In addition to numerous articles he published *Papers on Technical Education* (1872); *A Course in Shades and Shadows* (1889); *Paris Universal Exposition: Civil Engineering, Public Works and Architecture* (1892); and *The International Water Transportation Congress, 1893* (1894).

WATSON, Sir William, English physician and scientist: b. London, England, April 3, 1715; d. there, May 10, 1787. As a botanist, a doctor, and an experimenter in electricity, Watson was in the first rank of the men of his time. He attended the Merchant Taylors School in 1726 and then served an apprenticeship to an apothecary, studying botany in particular, an interest which later led him to introduce the Linnaean system of classification into England.

In 1741 he was elected a fellow of the Royal Society, to which he contributed many papers on natural history, electricity, and medicine. He was licensed to practice medicine in 1759. In electricity his discoveries paralleled Benjamin Franklin's and in 1762 he advocated Franklin's lightning conductors for a British powder magazine.

He continued experimenting for many years after winning the Copley Medal in 1745, and it became the fashion in society to visit his home in London to observe his experiments. His medical work was chiefly concerned with epidemics, but he reported a cure for muscular rigidity by means of electricity, as well as observations on inoculation for smallpox.

WATSON, Sir William, English poet: b. Burley-in-Wharfedale, Yorkshire, Aug. 2, 1858; d. Ditchling Common, Sussex, Aug. 11, 1935. He began writing verse at the age of 14 and in 1880 published his first volume, *The Prince's Quest,* which showed the influence of Keats and William Morris and found favor with Rossetti. It was not until the publication of *Wordsworth's Grave and Other Poems* in 1890 that he gained recognition.

Odes and Other Poems (1894) contained *Vita Nuova,* one of his most admired poems, and in 1902 there appeared his *Ode on the Day of the Coronation of King Edward VII.* In 1928 he published *Selected Poems with Notes by the Author* and after his death there appeared *The Poems of Sir William Watson* (1930).

Watson was passed over for the laureateship when Alfred Austin died in 1913 and the honor went to Robert Bridges, but he was knighted in 1917. Watson's work was carefully wrought, conservative and romantic, and he belongs in the ranks of the minor British poets.

WATSONVILLE, wŏt's'n-vĭl, city, California, Santa Cruz County, is located at an altitude of 25 feet on both sides of the Pajaro River, about 5 miles from Monterey Bay and two miles south of the Big Basin State Redwood Park, on the Southern Pacific Railroad. It is in an agricultural and fruit growing region. Apples are one of the chief products and strawberries, lettuce, apricots, garden crops, and spray chemicals are also shipped from here. Industries include vegetable and packing houses, vinegar works, and evaporating plants. Watsonville was laid out in 1851, incorporated in 1868, and became a city in 1903. A mayor-aldermanic form of government was established in 1950. Pop. (1950) 11,572.

WATT, wŏt, **James,** Scottish engineer and inventor: b. Greenock, Renfrewshire, Scotland, Jan. 19, 1736; d. Heathfield, near Birmingham, England, Aug. 25, 1819. Having determined to adopt the trade of mathematical instrument maker, he spent a year in London learning the art, in which he attained great dexterity. After his return to Scotland, he endeavored to set himself up in business in Glasgow. In this he might not have succeeded—owing to the opposition of established men in the craft—had he not been appointed in 1757 mathematical instrument maker to the university, which lay outside of the jurisdiction of the Glasgow municipality. While thus employed he was also active in preparing surveys and reports in connection with canal, river, and harbor work.

It was during this period that he planned and completed most of his improvements of the steam engine. The idea of a separate condenser first occurred to him in 1764; in January 1769 he took out the patent for the improvements which incorporated this idea. Previous to Watt's time the cylinder itself had been used as a condenser and the jet of cold water introduced into the cylinder to condense the steam so reduced the temperature of the cylinder that three times as large a supply of steam (so Watt estimated) was demanded as was really needed. Watt set to work to condense the steam in a separate receptacle. The change was so important as to make him almost the inventor of the modern engine. But it was not until 1774 that he joined Matthew Boulton (q.v.), a manufacturer in Birmingham, in order to carry his improvements into execution. The two men originated the term *horsepower;* the *watt* and the *kilowatt* units of power, are named in Watt's honor.

Soon the Soho Engineering Works in Birmingham, where the steam engines were manufactured, had acquired a European fame.

Watt retired from the business in 1800, when his patent, renewed in 1775 for 25 years, expired. He was a fellow of the Royal Societies both of London and Edinburgh and one of the few Englishmen elected to the National Institute of France. Besides the separate condenser, Watt made other improvements in the steam engine. He devised the sun-and-planet gear wheel, made use of the expansion principle to obtain the double engine, applied a speed governor to steam engines, and invented the throttle valve. He built the first indicator for draw-

ing a diagram of steam pressure, patented a fuel-saving furnace, invented copying ink, and independently discovered the chemical composition of water. His memory was retentive and the range of his reading wide. Chemistry, architecture, music, law, metaphysics, and language were the principal subjects which, in addition to physical science and its practical application, engaged his attention, and in all of them his knowledge was wonderfully extensive, minute, and accurate. The significance of his work places him among the foremost of inventors. See also STEAM; STEAM-ENGINE.

WATT, SIR Robert Alexander Watson, Scottish physicist: b. Brechin, Scotland, April 13, 1892. Educated at Dundee University College, and was connected with the Meteorological Office of the Department of Scientific and Industrial Research from 1915 to 1936; he became superintendent of the Bawdsey Research Station of the Air Ministry (1936–1938). He has held various advisory posts and has been responsible for the development of British and American radar systems. He holds 14 patents for radio direction finders, of supreme value in World War II. He was knighted in 1942.

WATT, *in electricity,* the unit of activity or rate of doing work, named for James Watt (q.v.). See ELECTRIC MEASURING INSTRUMENTS; ELECTRICAL UNITS.

WATTEAU, wŏt'ō; Fr., vȧ-tō', **Jean Antoine,** French painter: b. Valenciennes, France, Oct. 10, 1684; d. Nogent-sur-Marne, July 18, 1721. His parents, whose situation in life was humble, with difficulty contrived to give him the instructions of a very inferior master in the country. In 1702 he went to Paris, in company with a scene painter, with whom he continued to work for a few months. Soon afterward he found employment with one Claude Gillot, who, although only a painter of decorations for ballet and a designer of costumes and of patterns for tapestry, was a true artist. With him he found an opportunity of practicing in all these branches of art and when he left him he found another master in Claude Audran, a very able man, keeper of the Luxembourg, who was of great service in opening to him the famous gallery of the palace in which Rubens had painted in allegory the history of Marie de Médicis. From the study of the great Flemish master he improved his coloring and when he left Audran in 1709 he was a consummate master of his art and a painter of *fêtes galantes.* He now began to paint on his own account, but met at first with little encouragement. He failed to secure the Prix de Rome, which would have enabled him to visit Italy, but soon afterward scored a triumph by his *Un Départ de Troupes.* He was admitted to the Académie in 1717 as a painter of *fêtes galantes* and produced many pictures whose power and grace in drawing and coloring his rivals strove in vain to emulate. His subjects were all genre, military, and civil. He excelled in reproducing the costumes, airs and graces of the fashionable world of his time. His *L'occupation selon l'Age* sold in 1891 for $27,300. The finest collection of Watteau paintings is in Berlin, others are to be seen in the Wallace collection, London, in the Louvre, Paris, and in the Leningrad, Vienna, Edinburgh and Glasgow galleries. See also PAINTING—*The 18th Century.*

WATTERSON, Henry, American journalist: b. Washington, D. C., Feb. 16, 1840; d. Jacksonville, Fla., Dec. 22, 1921. Privately educated, he began journalistic work as editorial writer for the Washington *Star.* In 1861 he joined the Confederate Army as a private and later was aide-de-camp to Gens. Nathan B. Forrest and Leonidas Polk. In 1862 he withdrew from the army to edit the *Rebel* at Chattanooga, a daily paper, recognized as an organ of the Confederate government, but, in 1864 he returned to the army and had part in Gen. Joseph E. Johnston's campaign, and the siege of Atlanta. At war's end he revived the publication of the Nashville *Republican Banner;* in 1867 he became editor of the Louisville *Journal.* This paper he united with the *Courier,* under the name of the *Courier-Journal,* of which he became editor in chief and which he made one of the leading Southern newspapers. He was active in politics as a member of the Democratic Party, although a leader in the Liberal Republican program of 1872; was delegate at large to every Democratic National Convention from 1872–1892, and was permanent chairman of that of 1876. He was a member of Congress in 1876–1878, and hotly opposed all greenback ideas. Though a staunch supporter of S. J. Tilden for the presidency, yet in Congress he was one of the leaders in obtaining a peaceable adjustment of the election dispute, and approved the appointment of the Electoral Commission, 1877 (q.v.). In 1896 he refused to support the Chicago platform of the Democratic Party, and was affiliated with the Gold Democrats. As a defender of the tariff, he was not over strenuous, believing that its main purpose was to raise revenue. He was ever antagonistic to trust policies and the dominance of industry by great capital. As speaker and editor he was a consistent advocate of free trade, and particularly of a policy of conciliation between the North and the South. He retained his vigor of utterance and influence in politics in his latter days. He published *Oddities of Southern Life and Character* (1882); *History of the Spanish-American War* (1899); and *Abraham Lincoln* (1899). In 1911 he was conspicuous as being among the first to urge the fitness of Woodrow Wilson for the presidency. His famous slogan "To hell with the Hapsburgs and Hohenzollerns" in 1917 was largely instrumental in arousing the United States to war against the German atrocities and brutal disregard of the rights of neutral nations. On March 2, 1919 a worldwide tribute was paid him in the special "Marse Henry edition" of the Louisville *Courier-Journal* in which over 200 thinkers and statesmen of the world voiced their esteem of the veteran editor.

WATTLEBIRD, wŏt"l-bûrd, or **WATTLE CROW,** an Australian honey eater (*Anthochaera carunculata*) so named from the large reddish wattles on its neck. It is about the size of a magpie, and is of bold, active habits. An allied species (*Dyottornis paradoxus*) inhabits Tasmania.

WATTLES, arborescent shrubs (*Acacia*) of Australia and Tasmania, in some places growing to good-sized trees. They have foliage which is compound or reduced to phyllodia, and pretty, crowded flowers, in globose or cylindrical heads. The wattles furnish a gum, used as an adhesive in cotton-printing; the stems make poles, which are serviceable for many

«bush» purposes. The bark is a valuable tanning material, known as mimosa- or wattle-bark, and many of the acacia forests have been killed by the stripping of their cortex for this purpose. A good quality of tan-bark is obtained from *A. decurrens* and *A. mollissima,* the black, green or feathered wattle found also in South Africa. It is one of the most graceful of the acacias and least destructive of this thorny race to person and clothing. The silver wattle (*A. dealbata*) is a taller tree than the black wattle, with ashen-tinted young foliage. The African wattle is *A. natalitia;* the Alpine, *A. pravissima,* from the Victorian Alps. *A. juniperina,* the prickly wattle, is an evergreen shrub of Australasia. The raspberry-jam wattle (*A. acuminata*) of the same region, yields a cabinet wood, having the odor of that sweetmeat. The wallaby- (*A. rigens*) and varnish-wattle (*A. verniciflua*), are also Australian shrubs. The soap-pod wattle is the same as the soap-nut of India. Savannah wattles are West Indian trees (*Citharexylum quadrangulare* and *C. cinerea*) of the verbena family.

WATTMETER. See ELECTRICAL TERMS.

WATTS, wŏts, **George Frederick,** English painter: b. London, 23 Feb. 1817; d. there, 1 July 1904. He studied in the Royal Academy and in 1837 exhibited there two portraits of young ladies and a subject-picture entitled 'The Wounded Heron,' and afterward contributed to various art exhibitions, notably the Royal Academy, the Grosvenor Gallery and the New Gallery, about 300 pictures of various kinds. Some of these are landscapes and seascapes; a few, such as 'The Sempstress' and 'Under the Arch,' portray contemporary life; but the finest and most characteristic are portraits and allegorical or ideal subjects. His portraits include those of the most eminent men and women of his age and perhaps form his chief claim to renown, as they were the basis of his reputation as an artist, and yet many of his idealistic pictures will continue to be copied after all the portraits are forgotten. Of his other pictures the following may be mentioned: 'Isabella Finding Lorenzo Dead' (1840); 'Paolo and Francesca' (1848); 'Life's Illusions' (1849); 'Sir Galahad' (1862); 'The Wife of Pygmalion' (1868); 'Daphne' (1870); 'The Curse of Cain' (1872); 'Dedicated to all the Churches' (1875); 'Love and Death' (1877); 'Time and Death' (1878), like the preceding one of his most notable pictures; 'Orpheus and Eurydice' (1879); 'Psyche' (1880); 'The Rider on the Pale Horse,' 'The Rider on the Black Horse,' 'The Rider on the White Horse' and 'The Rider on the Red Horse,' all apocalyptic pictures of 1883; 'Love and Life' (1884); 'Rain Passing Away' (1884); 'The Angel of Death' (1888); 'The Wife of Plutus' (1889); 'She Shall be Called Woman' (1892), a large picture of Eve; 'For He Had Great Possessions' (1894); 'The Outcast' (1895); 'Jonah' (1895); 'Love Triumphant' (1898); 'Court of Death' (1902). He was in Italy during 1843–47, and was powerfully influenced by Titian and Tintoretto. In 1847 his colossal oil-pictures of 'Echo' and 'Alfred inciting the Saxons to prevent the Landing of the Danes' were awarded a prize of £500 in another Westminster Hall competition. The latter of these now adorns a committee room of the Houses of Parliament. He completed a fresco, 'Saint George Overcomes the Dragon,' in 1853, for the Houses of Parliament and at a later date painted in fresco the west end of the new hall at Lincoln's Inn. After 1896 he was on the list of retired academicians. A large number of his portraits, presented by him to the nation, are now in the National Portrait Gallery, and some of his best allegorical paintings were presented to the National Gallery of British Art (Tate Gallery). To use his own words, he painted ideas rather than objects and the poetic idealism to which he was faithful throughout all his long career stood in the way of extensive popularity. His drawing was of the utmost correctness and his coloring often extremely fine, but while his allegorical subjects were often great in conception and treatment they sometimes required too much literary exposition to appeal to the ordinary picture lover in a clear and direct manner. His 'Life' has been written by his wife, Mary S. Watts, and appeared in London in 1912 in three volumes. Consult also Monkhouse, 'British Contemporary Artists' (1889); Bateman, 'G. F. Watts' (1901); Chesterton, 'G. F. Watts' (1904); Chesterton, G. K., 'G. F. Watts' (New York 1909).

WATTS, Isaac, English Congregational divine: b. Southampton, 17 July 1674; d. Stoke, Newington, London, 25 Nov. 1748. He was educated for the ministry at an academy in Stoke-Newington. In 1696–1702 he was a private tutor, in 1699–1702 was assistant to Isaac Chauncy, minister of the Congregational chapel in Mark Lane, London, and in 1702 succeeded to the pastorate. The congregation here was a distinguished one. Watts remained nominally pastor until his death, though from 1713 ill-health frequently interrupted his ministry, and Samuel Price was made co-pastor. Watts had in his own time great popularity as a writer, his manuals of religious instruction and his works of popular divinity having large circulation; while his 'Horæ Lyricæ' (1706) admitted him to Johnson's 'Lives of the Poets' and was reprinted in 1834 in a series of 'Sacred Classics' with a memoir by Southey, and his hymns, numbering in all about 600, were the chief part of the psalmody of English Nonconformist congregations. At the beginning of the 18th century only a few unimportant hymns had been written for Dissenters' use, the rule of Calvin having permitted only canticles and metrical Psalms. The dearth of suitable tunes and the custom of «lining out» hampered Watts' work; he had, too, many defects in rhyme and diction, was at times rhetorical and at others prosaic. But a number of his hymns are among the finest and most popular in English. Many are found in all hymn-books, and about a dozen remain in very general use. A collection was made in 1707, a second edition appearing in 1709. He published in 1722–24 doctrinal treatises of an Arian tendency, but grounds are wanting for believing that he finally passed to that position. His 'Works' were edited by Jennings and Doddridge in 1753; the 'Posthumous Works' were published in 1779. The former were reprinted with additions, and a memoir by Burder, in 1810. Consult Gibbons, 'Memoirs' (1780); Milner, 'Life' (1834);

Julian, J., *Dictionary of Hymnology,* 2d ed. (New York 1907); Benson, L. F., *The English Hymn: Its Development and Use in Worship* (New York 1915).

WATTS, Mary Stanbery (Mrs. Miles Taylor Watts), American author: b. Delaware County, Ohio, Nov. 4, 1868. She was educated at the Convent of the Sacred Heart, Cincinnati, and early engaged in literary work. She is well known as a writer of short magazine fiction and of novels dealing with American life. Author of *The Tenants* (1908); *Nathan Burke* (1910); *The Legacy* (1911); *Van Cleve* (1913); *The Rise of Jennie Cushing* (1915); *From Father to Son* (1919); *Luther Nichols* (1923).

WATTS, Thomas Hill, American politician: b. Butler County, Ala., Jan. 3, 1819; d. Montgomery, Ala., Sept. 16, 1892. He was graduated from the University of Virginia in 1840, established a law practice in Greenville, Ala., was elected to the state legislature in 1842, 1844–1845, and to the state senate in 1853. He opposed the secession movement, but upon the secession of Alabama accepted the situation. He was appointed colonel in the Confederate army and fought at Shilo, but resigned shortly afterward to become attorney general in the Confederate Cabinet. He was elected governor of Alabama in 1863, but was unseated by the federal government at the close of the war. He was thereafter engaged in law practice at Montgomery, and with the exception of 1880–1881, when he served in the legislature, held no further public office.

WATTS-DUNTON, Theodore, English poet, critic and novelist: b. Saint Ives, Huntingdonshire, Oct. 12, 1832; d. Putney, June 6, 1914. He was educated privately at Cambridge and for a time studied law, but had already gained a reputation as a writer of sonnets when he joined the staff of the *Examiner* as literary and art critic. Later he joined the *Athenaeum* staff, and for many years was one of the chief contributors to that review, his criticisms of poetry being of the most illuminating character. In 1897 he published a poem entitled *Jubilee Greeting at Spithead to the Men of Greater Britain,* which met with wide appreciation; and in the same year collected in *The Coming of Love, and Other Poems,* some of the more important of his poetical contributions. *Aylwin,* a novel or romance published in 1898 (privately printed in 1883), forms a striking prose counterpart to the *Coming of Love,* and contains excellent pictures of gypsy life.

Watts-Dunton also contributed largely to the *Nineteenth Century* and other periodicals. Several of the notices in Ward's *English Poets* are from his pen, and the valuable critical article on poetry in the *Encyclopaedia Britannica* was written by him. He and Swinburne (q.v.) were intimate friends. Later publications are *The Christmas Dream* (1901), and *The Renaissance of Wonder* (1902). On occasion Watts-Dunton makes free use of the Romany dialect, which he has carefully studied. His best work is probably the critical, especially that dealing with the principles of verse.

WATT'S DYKE. See Offa's Dyke.

WAUGH, wô, **Arthur,** English author: b. Midsomer Norton, Somerset, Aug. 24, 1866; d. London, June 26, 1943. He was graduated from Oxford in 1889, became a journalist in London in 1890, was London correspondent of the New York *Critic* in 1893–1897, in 1894 was sub-editor of the London *New Review;* in 1895–1902 was literary adviser to Kegan, Paul and Company, and was chairman and managing director of Chapman and Hall, Ltd. He wrote *Gordon in Africa* (1888); *Alfred, Lord Tennyson, a Study* (1892); *Legends of the Wheel* (1898); *Reticence in Literature* (1915); *Traditions in Literature* (1919); and edited Johnson's *Lives of the Poets* (6 vols., 1896); *Biographical Edition of Dickens* (1902–1903); *A Hundred Years of Publishing* (1930).

WAUGH, Evelyn Arthur St. John, English novelist: b. London, October 1903. The son of Arthur Waugh, he is best known for his ironical treatment of the ways of higher society in such novels as *Vile Bodies* (1930) and *Brideshead Revisited* (1945). He also wrote *Rossetti, His Life and Works* (1928) and an historical novel *Helena* (1950). His writings subsequent to 1930 show the influence of his conversion to Roman Catholicism.

WAUGH, Frederick Judd, American artist: b. Bordentown, N. J., Sept. 13, 1861; d. Provincetown, Mass., Sept. 10, 1940. He studied at Pennsylvania Academy, and in Paris, and worked abroad in 1892–1907. He exhibited at the Paris Salon and at the Royal Academy, London, and also worked as a newspaper illustrator in London. He gained a considerable reputation as a painter of marine subjects. His work is well represented in both public and private collections. He was elected to the National Academy of Design in 1911 and 1929 was awarded the Palmer Memorial Marine prize of $1,000. Among his works are *The Roaring Forties* (The Metropolitan Museum, New York); *Surf and Fog, Monhegan* (Art Institute, Chicago); *After a Northeaster* (National Gallery, Washington); *The Blue Gulf Stream* (Pennsylvania Academy). Author and illustrator of *The Clan of Munes* (1916).

WAUKEGAN, wâ-kē'gan, city, Illinois, Lake County seat, 40 miles north of Chicago, on Lake Michigan, and on the Chicago, North Western; Elgin, Joliet and Eastern (Belt Line); and Chicago, North Shore and Milwaukee (electric) railroads; and on federal and state highways. At an altitude of 669 feet, the city is on a bluff about 80 feet above the lake, and many ravines in the city are bridged for highways. There is a fine beach and a good harbor, giving Waukegan the advantages of lake traffic, especially in coal. It is an agricultural region, a summer resort, and a residential suburb, but has important manufactories. The chief products are: wire and wire products, asbestos roofing, chemical and pharmaceutical supplies, outboard motors, refrigerator units, enameled and finished iron castings, conveying and sealing machines, and leather. Great Lakes Naval Training Station is just south of Waukegan; and a little farther south is Fort Sheridan.

There was a French outpost here until about 1760. Pottawattomi Indians continued to live here long after this region became a part of the United States (1783). By Indian treaty white men were forbidden to settle here until after August 1836. The first white settler came in

1835 and the place was called Little Fort until 1849 when it was incorporated and took the Indian name Waukegan, which also means Little Fort. The Chicago North Western reached the town in 1855 and in 1859 it became a city. Government is by mayor and council. Pop. (1950) 38,946.

WAUKESHA, wô'kĕ-shô, city, Wisconsin, seat of Waukesha County, on the Fox River, 15 miles west of Milwaukee on the Chicago and North Western; Chicago, Milwaukee, St. Paul and Pacific; and Soo Line railroads; and at an altitude of 821 feet. It is an industrial city in a fertile agricultural area, where dairy farming is conducted extensively. Its industrial output is varied, including metal castings and articles of aluminum and iron; wire netting; window shades; leather goods; furniture, and gasoline engines. Quarrying is still another Waukesha industry, and bottled mineral waters, for medicinal and beverage use, are shipped out. From about 1870 to the 1900's, Waukesha might have been called the Saratoga of the West; it was widely favored as a watering place. The city has good schools and a public library, and is the seat of Carroll College (Presbyterian, coeducational), founded in 1841. The State Industrial School for Boys also is located here.

The Potawatomi Indians, who had a village here, ceded their land to the federal government in 1833. First white settlement was in 1834; it was known for some time as Prairieville. Its present name is Indian, meaning "little fox." Pop. (1950) 21,233.

WAUKON, city, Iowa, seat of Allamakee County, 85 miles northwest of Dubuque; on the Chicago, Milwaukee, St. Paul and Pacific Railroad. The region is agricultural, and Waukon's industries include flour mills, creameries, and stockyards. Here each year, in October, is held a celebration of Corn Day, with a program including a hog-calling contest. Unusually good trout fishing is found in the streams near by. Waukon, settled in 1851, has mayor and council. Pop. (1950) 3,158.

WAUPACA, wô-păk'ȧ, city, Wisconsin, seat of Waupaca County; 47 miles northwest of Oshkosh; on the Soo Line, and the Green Bay and Western Railroad. It is situated at an altitude of 868 feet in an agricultural and stock-raising region. The surrounding area was formerly engaged principally in lumbering, but Waupaca became one of the state's first centers for potato production and marketing, and still stands high in this activity. Within a few miles of the city there are more than a score of small, picturesque lakes, and the regional climate and scenery have brought Waupaca into favor as a summer resort. The streams and lakes afford excellent sport. Its name is an Indian word for "white sand bottom." Pop. (1950) 3,921.

WAUPUN, wô-pŭn', city, Wisconsin, in Dodge and Fond du Lac counties, 68 miles northwest of Milwaukee; on the Chicago, Milwaukee, St. Paul and Pacific Railroad. At an altitude of 888 feet, it lies in fertile farming country, in which there are creameries, condenseries, and canneries. The Wisconsin State Prison is located here, established in 1851. It has workshops in which goods are produced for use in state penal and charitable institutions. The city has two monuments: "End of the Trail," and "Angel of Peace," by James Earle Fraser and Lorado Taft, respectively. The municipality was founded in 1838. Pop. (1950) 6,725.

WAURIKA, wô-rē'kȧ, city, Oklahoma, seat of Jefferson County, 23 miles south of Duncan, on the Chicago, Rock Island and Pacific; Wichita Falls and Southern; and Wichita Valley railroads; in oil and cotton area. Pop. (1950) 2,327.

WAUSAU, wô'so, city, Wisconsin, seat of Marathon County, 140 miles north of Madison on the Wisconsin River; the Chicago, Milwaukee, St. Paul and Pacific, and Chicago and North Western railroads; and federal and state highways. It is at an altitude of 1,212 feet. Four miles to the southwest is Rib Mountain State Park with the highest point in the state (1,940 feet); the beautiful Dalles of the Eau Claire River are near by; and to the northwest is the lake region. The city lies on both sides of the river and the slope is gradual. The airport has land and water landings. At the western boundary of the city are the grounds of the Wisconsin Valley Fair and Exposition. Wausau is in a region of extensive lumbering, granite-quarrying and dairying interests, famous for its red clover and honey. There is abundant hydroelectric power. The chief manufactured products are lumber, veneers, sash and doors, boxes, toothpicks and other wood products; paper, electric motors and batteries, trailer and motor parts; shoes, animal feeds, malted milk and other dairy products; leather, chemicals, iron, steel, aluminum products, and dressed granite. A large employers' liability insurance company has its home office here. Besides good public and parochial schools and an adult and vocational training school the city has an extension division of the University of Wisconsin, offering years of college credits. There are 20 parks in the city.

The government is administered under a revised charter of 1892, which provides for a mayor and a council of 18 members elected for four-year terms. Many of the early settlers were German. The name is Indian for "far away." A dam and sawmill were built here about 1840. Wausau was platted in 1852 and existed under a town organization until 1861, when it was incorporated as a village. On March 18, 1872 it was chartered as a city. Pop. (1950) 30,414.

WAUSEON, wô'sē-ŏn; wô-sē-ŏn', village, Ohio, seat of Fulton County, 32 miles west of Toledo, on the Wabash; New York Central; and Detroit, Toledo and Ironton railroads. Its industries are food canning and miscellaneous manufactures. It has a public library, a public auditorium, and recreation centers. Settled in 1835, named for an Ottawa Indian chief, and incorporated in 1854, Wauseon has mayor and council. Pop. (1950) 3,494.

WAUTERS, wou'tĕrs, **Emile Charles Marie,** Belgian painter: b. Brussels, Nov. 29, 1846; d. Dec. 11, 1933. He was for four years the pupil of Portaels and of Gerome at Paris. His picture *Fair Edith finding the Body of Harold on the Field of Hastings,* attracted wide attention and he was sent by his government to attend in a professional capacity the opening of the Suez Canal. He returned from the East with many sketches and genre pictures and materials, out of

which he afterward painted his panorama, *Cairo and the Banks of the Nile.* His historical pictures are characterized by strong drawing and beauty of coloring. He did over 200 portraits of European contemporaries.

WAUWATOSA, wô-wà-tō'sà, city, Wisconsin, in Milwaukee County, five miles west of Milwaukee, on the Chicago, Milwaukee, St. Paul and Chicago Railroad, and the Soo Line. Its industries include lumber, cement, chemicals, and castings. It has a public library, city and county parks, and playgrounds. Settled in 1834, it became a city in 1897, and has mayor and council. Pop. (1950) 33,324.

WAVE MECHANICS. See QUANTUM THEORY—*Modern Developments.*

WAVELL, wā'vĕl, **Archibald Percival, 1ST EARL WAVELL,** British army officer and statesman: b. Colchester, England, May 5, 1883; d. London, May 24, 1950. From early childhood Viscount Wavell was destined for a military career, his father and grandfather having been army generals. Accordingly, he followed the conventional path, going first to Winchester School, then to the Royal Military College, Sandhurst. In 1901 the 18 year old lieutenant joined his father's regiment, the Black Watch, and was sent to South Africa where the Boer War was nearing its close. After a period at the Staff College from which he graduated in 1910 he spent two years on leave in Russia. There he became so proficient in the language that three decades later he was still able to carry on a conversation in Russian, and as a member of a mission to Moscow was the only British delegate able to speak with Premier Stalin in his own tongue.

At the outbreak of the First World War in 1914 Major Wavell went to France as a staff officer. Two years later he was wounded, losing the sight of one eye. After convalescence he joined the Russian Army in the Caucasus as British military attaché. Promoted brevet lieutenant colonel in 1917, he was attached to General Allenby's staff, Egyptian Expeditionary Force. Promoted brigadier general commanding Allenby's 20th Corps the following year, he relinquished that appointment in 1919 to become brigadier general of the general staff of the entire Egyptian Expeditionary Force.

After his Palestine campaigns, regimental duties on the Rhine, staff work in England and his military studies occupied him. In 1921 he was granted a full colonelcy in the regular peacetime establishment. His book, *The Palestine Campaigns* (1928), revealed a profound military intelligence coupled with a keen understanding of political factors rarely encountered among professional soldiers. Advanced to the rank of major general in 1933 at the age of fifty, he was the youngest officer of that rank in the British Army.

In 1935 General Wavell became commander of troops in Palestine and Transjordan. The following year he revisited Russia as the first British officer invited to attend the Red Army maneuvers. Returning again to the Middle East in 1937, he succeeded Sir John Dill in the Palestine command, but shortly afterwards relinquishing it, having been appointed commander in chief, Southern Command. A year later he was promoted lieutenant general. From 1939–1941 he was commander in chief of British forces in the Middle East; general (1940); commander in chief of British forces in India (July 1941); supreme commander of all allied forces in southwest Pacific (January 1942); of Allied forces in India and Burma (March 1942); field marshal (December 1942); viceroy of India (1943). In the latter year he was created Viscount Wavell of Cyrenaica and Winchester, and in 1947, shortly before India gained her freedom, was made an earl.

Wavell was the author of *The Palestine Campaigns* (1928); *Allenby, A Study in Greatness* (1940); *Generals and Generalship* (1941); *Allenby in Egypt* (1943); *Other Men's Flowers: An Anthology of Poetry* (1944); *Speaking Generally* (1946); and *The Good Soldier* (1947).

WAVELLITE, wā'vĕl-īt, an attractive, radiated mineral essentially a hydrous basic phosphate of aluminum, $4Al(PO_4)_2Al(OH)_3 + 9H_2O$. It rarely occurs in distinct orthorhombic crystals; usually it is in more or less complete spherical aggregates, externally showing crystal terminations and with radiated structure. Its hardness is 3.25 to 4, and its specific gravity about 2.32.

WAVERLEY, 'TIS SIXTY YEARS SINCE, a novel by Sir Walter Scott. It was the earliest of the world-famous series of romances to which it gives its title, and was published in 1814. The author withheld his name at first, from doubt as to the success of the venture. The continuance of the concealment with subsequent issues followed perhaps naturally; Scott himself could give no better reason afterward than that "such was his humor." Although the authorship of the series was generally credited to him, it was never formally acknowledged until the avowal was made in 1827 at a dinner for the benefit of the Edinburgh theatrical fund. *Waverley* is a tale of the rebellion of the Chevalier Prince Charles Edward, in Scotland in 1745.

WAVERLY, city, Iowa, Bremer County seat, 15 miles north-northwest of Waterloo on the Cedar River; the Chicago, Rock Island and Pacific, the Illinois Central, the Chicago Great Western the Waterloo, Cedar Falls and Northern railroads; and federal and state highways. It is in an agricultural, stock- and poultry-raising region and has a large number of butter, cheese, and condensed milk factories; corn canneries; a furniture factory; chemical works, and a considerable printing and publishing industry. The Wartburg College (Lutheran, coeducational) is here. Waverly Museum, belonging to the college, has exhibits from New Guinea of war clubs, spears, and grass skirts, as well as a valuable ornithological collection. The city is governed by mayor and council. Pop. (1950) 5,124.

WAVERLY, village, New York, in Tioga County, 15 miles east-southeast of Elmira on the Chemung River, and the Delaware, Lackawanna and Western, the Erie, and the Lehigh Valley railroads. The surrounding region is largely devoted to general farming and stock raising, and Waverly is a shipping point for large quantities of butter, cheese, milk, eggs, poultry, and vegetables and fruits. It has only small local industrial establishments. The village adjoins two municipalities across the line in Pennsylvania, Sayre and Athens; and many Waverly workers are employed in the Lehigh Valley Railroad's shops in Sayre. Waverly has a public library,

a town hall, and a high school. Pop. (1950) 6,037.

WAVERLY, village, Ohio, Pike County seat; altitude 570 feet; on the Scioto River; 20 miles by rail south of Chillicothe; on the Detroit, Toledo and Ironton, and the Norfolk and Western railroads. It is the trading center of a farming area, and has manufactures of lumber, wood products, and concrete products. The old Ohio and Erie Canal ran through Waverly. Founded in 1829, it displaced Piketon as county seat in 1861. Pop. (1950) 1,679.

WAVES OF ASSAULT. In modern warfare the intense effort demanded of assaulting troops, and the successive attacks which they must make, necessitate a deep formation. The several echelons thus constituted have been given the name of *waves*. But this term does not signify a uniform formation. The foremost waves, generally the first and the second, advance in line; those following are in various formations, for example, in lines of small columns. Moreover, to facilitate the leading of the echelons, the waves are formed by the simultaneous advance of tactical units not deployed in single line but themselves extended in the direction of depth, from which it results that a company or battalion will form a part of several successive waves. Formation for the assault does not consist of the deployment of rigid lines capable only of a movement straight to the front, but, on the contrary, of placing side by side tactical units which are capable of being led and even maneuvered.

WAVES AND WAVE MOTION. Energy may be transferred from one point to another or from one object to another by actual contact of the source of energy with the receiver. An example of this process is a locomotive moving a train of cars. Another very important method of transmitting energy is by means of waves. Modern communications depend largely on waves. Moreover, the great stream of energy from the Sun can be described in terms of wave motion.

Wave motion is characterized by the fact that a transport of matter does not take place. We have all seen waves on the surface of water, or waves running across a field of grain in a summer breeze. The second illustration clearly shows that the medium—in this case, the stalks of grain—is not transported but merely moves back and forth within a limited locality. We might be tempted to conclude that water is transported in wave motion when we see waves roll up on a shore. The motion does carry some water up on the shore, but, as the waves roll back, the net result is no transport of matter. The stalks of wheat at the edge of a field which bend over the fence and out of the field may be compared to the waves rolling up on the shore. In all wave motion it is the state of motion or disturbance that is handed on from one particle or region of a medium to the next. As a result, only the wave form travels onward.

Transverse and Longitudinal Waves.—Waves may be classified according to the motion of parts of the medium relative to the movement of the wave form itself. If the end of a long, horizontal stretched cord is made to vibrate up and down, a wave travels along its length. In this case, each segment of the cord moves transversely to the direction of travel of the wave form, and the result is a transverse wave. If one end of a long, spiral spring is suddenly compressed a short distance, the motion is transmitted to the adjacent coils. These in turn pass it on to the others, and a longitudinal or compressional wave passes along the spring. A sound wave in air is a longitudinal wave.

Waves on water surfaces, though easily observed, are some of the most complex we find in nature. If a small chip is placed on the surface of the water, it will be found to move in an elliptical or circular path as a wave passes its position. Both longitudinal and transverse motions are present in this case. Compressional waves can travel *through* water just as they can through air or any gaseous or liquid medium. A gas or liquid does not permanently resist a change of form which does not involve a change in volume and hence will transmit only compressional waves through its interior. Neither of these media will transmit a transverse wave.

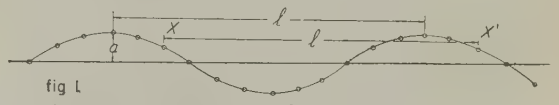

Fig. 1. Displacements in a transverse wave.

A flashlight photograph of a transverse wave traveling to the right is shown in Fig. 1. The particles normally on the straight line are displaced upward or downward. The maximum displacement (a) is called the amplitude of the wave. The distance (l) from crest to crest or from X to X^1, two points in the same phase, is called the wave length. In general, and certainly for sound waves, l is much greater than a. The number of waves per second that would pass a fixed observer is called the frequency of the wave. The wave length, frequency, and velocity are simply related as follows: Velocity = wave length $\times$ frequency. This formula is true for any type of wave.

In Fig. 2 is shown the displacement of particles in a medium through which a longitudinal or compressional wave is passing. In regions marked N, the particles have normal spacing or density, at C they are closer together, and at R they are farther apart. Regions C and R are called condensations and rarefactions, respectively. Fig. 1 can be used to represent a longitudinal wave if we allow distances above the horizontal line to represent forward displacements of the particle in the longitudinal wave, and distances below the line to represent backward displacements.

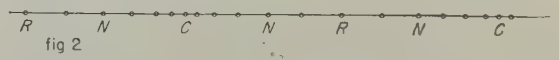

Fig. 2. Displacement of particles in a longitudinal wave.

Harmonic Waves.—The wave form shown in Fig. 1 is that which would be obtained by attaching a pen to the end of a vibrating tuning fork and moving it across a piece of paper. Such a wave is called a simple harmonic wave and is very common in nature. In his *La théorie analytique de la chaleur*, published in 1822, Baron Jean Baptiste Joseph Fourier (q.v.), French geometrician and physicist, proved that by properly combining simple harmonic waves any wave form encountered in nature can be represented accurately. A pure tone is produced when a sound wave can be represented by a simple harmonic

wave. The complex note of an organ or other instrument, or of the human voice, can be represented by a combination of simple harmonic waves. The wave with the lowest frequency is called the fundamental; the other waves that may be combined with it have frequencies which are integral multiples of the fundamental, and are often called overtones. It is the presence of different overtones that makes the quality of one voice or instrument differ from others. Fourier's discovery is not restricted in application to sound waves, but is also very useful in analyzing any wave or periodic phenomenon.

Wave Velocity.—The velocity of compressional waves through a medium depends on its density and elastic properties. An increase in density reduces the velocity; an increase in the forces required to produce a deformation increases the velocity. Within wide limits, the velocity is independent of amplitude and frequency of the wave. For extreme values of amplitude and frequency, however, the velocity is altered. For example, the sound wave from a large cannon travels somewhat faster near the gun that at some distance from it, where the amplitude is diminished. The velocity of sound in air also depends on the temperature. By measuring the velocity of earthquake waves through the earth, scientists are able to determine some of the characteristics of the interior of the earth.

The velocity of a transverse wave on a stretched, flexible cord depends on the tension of the cord and its weight per unit of length. The velocity of large waves on the surface of water depends upon several factors, including the depth of the water and the wave length of the wave. Tiny ripples have a velocity that depends on the surface tension of the water. Here again we note the complexity of waves on the surface of a liquid.

Interference; Light and Radio Waves.—A distinguishing characteristic of waves is that two trains of waves may combine so that at one point their effect (amplitude) is increased, and at another they may cancel one another or interfere. The fact that two light beams may be made to interfere and give zero intensity at certain points leads us to conclude that light can be represented as a wave motion. The interference pattern of two sets of waves can easily be seen on the surface of water. It was the demonstration of interference made by Thomas Young (q.v.), about 1800, that led to the acceptance of the undulatory or wave theory of light.

Radio waves are similar to light waves except that their wave lengths are much greater. The possibility of interfering with radio waves is well known. Light and radio waves differ from the other waves we have considered in that a material medium is not necessary for their propagation. Moreover, not all of the properties of light can be described in terms of waves. See also Acoustics; Harmonics; Interference; Light; Telegraphy and Telephony, Radio; Undulatory Theory of Light; Vibration.

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WAVEY. See Geese.

WAX, fatty solid animal substance, of which the typical sort is called beeswax. Various similar substances of vegetable and animal origin bear the name. Beeswax is secreted by bees in constructing their hives, and a very similar vegetable product enters into the composition of the pollen of flowers, covering the envelope of the plum and of other fruits, especially of the berry of the *Myrica cerifera,* and in many instances forming a kind of varnish to the surface of leaves. It is distinguished from fat and resinous bodies by its not readily forming soaps when treated with alkaline solutions. Common beeswax is always more or less colored, and has a distinct, peculiar odor, of both of which it may be deprived by exposure in thin slices to air, light and moisture, or more speedily by the action of chlorine. At ordinary temperatures wax is solid and somewhat brittle; but it may be easily cut with a knife, and the fresh surface presents a characteristic appearance, to which the name of waxy lustre is applied. Its specific gravity is 0.96. At 155°F. it enters into fusion, and boils at a high temperature. Heated to redness in a closed vessel it suffers decomposition, yielding products very similar to those which are procured under the same circumstances from oil. It is insoluble in water, and is only dissolved in small quantities by alcohol or ether.

In bleaching wax the wax must be melted, with a degree of heat not sufficient to alter its quality, in a caldron so disposed that the melted wax may flow gradually through a pipe at the bottom of the caldron into a large wooden cylinder that turns continually round its axis, and upon which the melted wax falls. As the surface of this cylinder is always moistened with water, the wax falling upon it does not adhere but quickly becomes solid and flat, and acquires the form of ribbons. The continual rotation of the cylinder carries off these ribbons as fast as they are formed, and distributes them through the tub. When all the wax ribbons to be whitened are thus formed, they are to be put upon large frames covered with linen cloth, which are supported about a foot and a half above the ground in a situation exposed to the air, the dew and the sun. If the weather be favorable, the color will be nearly discharged in a few days. It is then to be re-melted and formed into ribbons and exposed to the action of the air as before. These operations are to be repeated till the wax is rendered perfectly white, when it is cast into cakes or other commercial form.

The principal applications of wax are to make candles and medicinal cerates; to give a polish to furniture or floors, for which purpose it is largely used in the United States; to form a lute or cement, for which it is used by chemists; and to serve as a vehicle for colors. By modern painters colors previously prepared in oil are sometimes diluted just before being laid on in a mixture of wax and oil of turpentine. This practice is much resorted to by French artists, especially in mural paintings. The object is to keep the painting free from that lustrous appearance which often renders it difficult to be seen properly in consequence of reflection. Wax also forms a principal ingredient in modelers' wax and gilders' wax. In the former the other ingredients are druggists' lead-plaster, olive oil, yellow resin, and whiting; and in the latter verdigris and sulphate of copper. Sealing-wax is not properly a wax at all, but is composed of resin lac and some less brittle resin. The largest consump-

tion of wax takes place in Roman Catholic countries, where large quantities are required for the candles used in religious ceremonials.

Chinese wax comes from the ash tree on which it is secreted by an insect. It resembles spermaceti. Cork wax or cerin is extracted from cork by an alcoholic process. Mineral wax or ozocerite is a waxy paraffin. Shoemaker's wax is a mixture of pitch and tallow. Wool wax is the solid greasy product obtained from sheep washing, is used as a dressing for leather, and is an adulterant or base for ointments. See also WAX, VEGETABLE.

Wax Figures.—The employment of wax in imitative art dates from a period anterior to historical times, although, according to Pliny, the art of casting it in molds was not practiced previous to the time of Lysistratus, its reputed inventor, who flourished about 300 B.C., and whose productions were chiefly portraits cast in plaster molds taken from the face. Wax portraits eventually became common. Among the Romans, who placed them in the vestibules of their houses, they were regarded as an evidence of ancient nobility, as none were allowed to possess such images whose families had not borne some curule magistracy.

In the Middle Ages, wax was employed in the construction of images of saints and of votive images, and those who practiced sorcery melted before a slow fire wax figures of the persons against whom their incantations were directed.

In the latter half of the 15th century Andrea del Verrocchio and Orsino Benentendi gained considerable reputation by some figures of Lorenzo de' Medici, their joint production, which consisted of frameworks of wood or skeletons for the bodies and limbs, while the heads, hands, and feet were cast in wax and painted in oil colors to counterfeit life. They were furnished with glass eyes and natural hair, and were habited in the costume usually worn by Lorenzo.

The manufacture of life-sized wax figures is still carried on to a considerable extent, but has long ceased to be considered a branch of the fine arts. In the preparation of anatomical models and pathological examples, however, wax has been very advantageously employed, the invention being due to Gaetano Giulio Zumbo, a famous modeler in colored wax, who flourished in the latter half of the 17th century. In the succeeding century the celebrated collection of anatomical models in the Institute of Bologna was begun under the direction of Ercole Lelli. In the Museum of Natural History at Florence are several chambers devoted to preparations by Felice Fontana, Antonio Susini, and other celebrated modelers; the Musée Dupuytren at Paris is famous for its morbid specimens; and almost every city of Europe now has its collection.

The collection of wax figures at the Eden Musée in New York was for about 50 years prior to 1910 one of the show features of the city. In London, Madame Tussaud's Museum is world famous. See TUSSAUD, MARIE GRESHOLTZ.

WAX, Mineral. See HATCHETTINE.

WAX, Vegetable, a solid, fatty substance, resembling animal wax, which is secreted by many plants, sometimes in large enough quantities to be of commercial importance. On foliage, it forms a varnish or coating, which prevents excessive transpiration or wetting of the cells; and on twigs and flower pedicels, by its slippery surface it keeps unwelcome insects from reaching the flowers and robbing them of their honey. The whitened undersurfaces of some willow leaves and the bloom of fruit are composed of wax either in granules or rods, or spread over the cuticle.

The most familiar example in America of the hard fat or wax in quantity is on the bony nutlets of the wax myrtles or bayberries (*Myrica*). The gray-coated drupes of *M. carolinensis* clustering on the bare twigs are conspicuous in seashore regions, after the leaves are fallen; the wax clinging to their rough, granular surfaces when melted is a greenish, hard substance, sharing the balsamic odor of the plant. It was used in colonial times as a basis for candles and for soap. Other species furnish a similar wax and are known as candleberries or tallow trees. (See WAX MYRTLE.)

Carnauba wax is exported from Brazil for candles and as a substitute for beeswax. It is the coating on the young leaves of the wax palm, *Corypha cerifera,* indigenous to tropical South America. The young leaves are removed and dried; the wax granules may then be shaken off in the form of a fine dust, melted, and caked. Japan wax is a waxlike, hard fat, which is largely exported from Japan to Europe, in yellowish, hard cakes with a resinous, rancid odor, and often covered with a powdery efflorescence. See also SUMAC OR SUMACH.

WAX MYRTLE, mûr't'l, an evergreen shrub or tree with aromatic leaves, unisexual flowers borne in catkins, and often with waxy fruits, belonging to the genus *Myrica,* family Myricaceae. Fifty species occur in moist habitats in the Northern Hemisphere. Some are cultivated as ornamentals. The name candleberry is applied to two species of the eastern United States: *M. cerifera,* a small tree up to 30 feet tall with a waxy coating on the fruits, leaves, and young stems which grows in woods and swamps of the southeastern states; and *M. pennsylvanica,* a shrub with less waxy herbage, found on the northeastern coastal plain. The bluish white wax, when mixed with tallow, serves for the making of fragrantly burning candles. The name sweet gale refers to a common species of the British moors, *M. gale.* The California bayberry, *M. californica,* is a small tree in the redwood forest of the Pacific coast.

WAXAHACHIE, wôk-sȧ-hăch'ē, city, Texas, seat of Ellis County; altitude 585 feet; 42 miles southeast of Fort Worth. It is served by the Chicago, Rock Island and Pacific, the Fort Worth and Denver, the Missouri-Kansas-Texas of Texas, and the Southern Pacific railroads, and has an airport. It is an important cotton center and has cottonseed oil mills, a cotton compress, and a textile mill manufacturing duck and similar heavy goods. The city has a standard school system and a public library. It is the seat of the Southwestern Bible Institute, founded in 1927. Trinity University, formerly located here, was removed to San Antonio in 1942. Waxahachie was founded in 1847 and incorporated in 1871. Pop. (1950) 11,204.

WAXBILL, an African weaverbird (q.v.), one of the section of the family called blood finches on account of the prevalence of red in the plumage. This has long been a favorite among cage birds and is sold by dealers all over the world. It is nearly five inches long. The

beak is bright red and somewhat swollen. A bright red stripe passes between the eyes and the middle of the breast, and the belly is a beautiful reddish brown. The upper surface of the body is brownish gray, the lower surfaces lighter, everywhere traversed by very fine blackish wavy lines; wings and tail are brown. Waxbills are varied in color by breeders, who have developed some with bright blue tints. Their song is not very musical, but they are pretty and affectionate to a high degree. Their food and care should be similar to those given a canary. Some of the birds look like miniature pheasants.

WAXFLOWER or **MADAGASCAR JASMINE.** See STEPHANOTIS.

WAXWING, a woodland bird of the genus *Bombycilla* (also known as *Ampelidis*), a small isolated group of birds of the Northern Hemisphere, characterized by their shrikelike beaks, silky brown plumage, tall erectile crests, and especially by the tips of the wing and tail quills terminating in flattened scales closely resembling red sealing wax. The northern or Bohemian waxwing (*B. garrula pallidiceps*) makes its home near the Arctic coasts of both continents and breeds there in trees, long before the snow has disappeared in the spring. Sometimes it is not seen in the United States or central Europe for years but will appear locally in large numbers. These erratic movements, doubtless due to presence or absence of food which consists of both insects and berries, were regarded by the superstitious peasants as a sign of pestilence or war. See also CEDAR WAXWING.

WAXWORKS, collections of wax figures, usually representations of real persons. See TUSSAUD, MARIE GRESHOLTZ; WAX—*Wax Figures.*

WAY, Right of. See RIGHT OF WAY.

WAY OF ALL FLESH, The, a novel by Samuel Butler (q.v.), published posthumously in 1903. A severely critical study of Victorian life in general and domestic life in particular, it traces the history of four generations of the Pontifex family from that of John Pontifex, a rural carpenter of considerable amateur attainments in the arts, to that of his great grandson, Ernest, who emerges as the hero of the tale and who is searchingly tested by circumstance before he is allowed to find his way to a secure plateau of worldly wisdom, literary accomplishment, inherited wealth, and permanent bachelorhood in London. Butler's well-known iconoclasm is directed with particular relentlessness upon Ernest's father, Theobald, a Church of England clergyman, who rears his son from infancy with equal parts of stupidity and impatience, plus liberal doses of cruelty and bullying, all the while convinced that he never departs from the loftiest possible conception of Christian duty. Lesser persons of thematic importance include Ernest's mother, a woman of limited intelligence but unlimited powers of self-dramatization; the pretty, dipsomaniac Ellen, onetime servant in Theobald's household with whom Ernest forms a temporary union after his release from prison; and Ernest's godfather, Overton. It is Overton who ostensibly tells the whole story from the point of view of an interested family friend. As spokesman for the author, he may be considered a self-portrait of Samuel Butler in later life.

Subsequent generations of readers are prone to find *The Way of All Flesh* somewhat too didactic and even at times improbable, more especially at moments when the lives of its characters are manipulated to illustrate one or another of the novelist's preconceptions concerning the role of heredity and environment in human affairs. At the same time, however, the book has been judged by time to contain its full share of gifted and compelling story, the illusion of life being very nearly absolute for long and brilliantly sustained passages. There is likewise the consideration that it has proved to be a rich mine of material for later writers with similar interests, however little the source may be recognized or admitted. Among those who have openly acknowledged their indebtedness is George Bernard Shaw, who writes of Butler's autobiographical masterpiece as follows in the preface to *Major Barbara:* "It drives one almost to despair of English literature when one sees so extraordinary a study of English life . . . making so little impression that when, some years later, I produce plays in which Butler's extraordinarily fresh, free and future-piercing suggestions have an obvious share, I am met with nothing but vague cacklings about Ibsen and Nietzsche. . . . Really, the English do not deserve to have great men."

MARKHAM HARRIS,
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WAY OF THE WORLD, The, a play by William Congreve (q.v.). The author was already the leading playwright and one of the most elegant gentlemen of London when in 1700, in his 30th year, he brought out at Lincoln's Inn Fields *The Way of the World* with his friend Mrs. Ann Bracegirdle in the principal role of Millamant. The play was written with a conscious aspiration "to write only to the few refined." It was the author's purpose "to design some characters which should appear ridiculous, not so much through a natural folly (which is incorrigible and therefore not proper to the stage) as through an affected wit, a wit which at the same time that it is affected is also false." The venture was not entirely a success and Congreve's career as a playwright was at an end.

It may profit us to inquire why the play failed and why in spite of its failure it is hailed as one of the greatest of the world's comedies. By the time of Congreve there had been added to the overemphasis and grotesqueness of Ben Jonson's comedy the refining touch of Molière. Comedy now becomes an art of manners, a pattern of human ingenuity at its wittiest and best. It was Congreve's distinction that he best adapted the technique of town living to the technique of the stage. Interested in character he is even more interested in social groups:

> poets oft in one piece expose
> whole belles—assemblees of coquettes and beaux.

The play is rendered caviar to the general by its superabundance of dazzle, a radiance that conceals, as by principle, the real humanity of some at least of the characters. Moreover, the characters quite run away with the author in their good spirits and lavish life, leaving his plot unclear and a matter of raveled ends and hasty explanations. But these things cannot be counted faults by one who loves

Congreve. He only among English writers has raised the artifices of character to universality. In language, observation, wit he presents a fine texture of grace that provokes and satisfies thoughtful laughter. Millamant is one of the rarest creations in literature, the woman entrancing as distinguished from the woman emotional or the woman instinctive. Though he is dealing with a conventionalized society Congreve's characters are thoroughly individualized in their several relationships with that society. As is natural for such a society, most of the characters are women, but the characters that stand out, with one exception, are men. Written after Jeremy Collier's blast against the immorality of the stage, the play shows some of the restraining influence of this divine's charges. It was often presented during the 18th century, but has been the particular delight of the study. Editions: Ewald, A. C., ed., Mermaid Series, 1887; Street, G. S., *Comedies of William Congreve,* 1895.

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THOMAS H. DICKINSON.

WAYCROSS, wā'krŏss, city, Georgia, Ware County seat; altitude 138 feet; 96 miles southwest of Savannah, and 58 miles west of Brunswick; on the Atlanta, Birmingham and Coast; and the Atlantic Coast Line railroads. In this area are forests of pine, cypress and gum, creating several local industries. The city is a commercial center for lumber, naval stores and cotton. It has manufactures of lumber, caskets, veneer, footwear, beverages, apiaries, and a hatching and a refrigerating plant; and, until 1937, was important for the marketing of furs and alligator hides. Before state-wide prohibition went into effect in Georgia, Waycross secured virtual prohibition by the imposition in 1883 of a license fee of $20,000 upon dealers in intoxicating liquors and by increasing this fee to $30,000 in 1892. The educational institutions include a high school for whites, established in 1890, a high school for Negroes, and public and private schools. Waycross was settled in 1870, incorporated in 1874 and became a city in 1909. The waterworks are municipally owned. Pop. (1940) 16,763; (1950) 18,899.

WAYLAND, wā'land, **Francis,** American college president: b. New York, March 11, 1796; d. Providence, R. I., Sept. 30, 1865. He was graduated from Union College in 1813, studied in the Andover Theological Seminary, was a tutor at Union College 1817–1821; in 1821 became pastor of the First Baptist Church of Boston and took a leading place in the ranks of American preachers, his sermon on *The Moral Dignity of the Missionary Enterprise* (1823) being particularly well known. After holding a professorship at Union (1826–1827), he became president of Brown University. During the 28 years of his administration he greatly developed the institution and was one of the pioneers of the elective system in American universities. Subsequent to his resignation (1855) he was for a year and a half pastor of the First Baptist Church of Providence, after which he devoted himself to various kinds of religious and humanitarian effort. He was the author of many valuable works, including *Elements of Moral Science* (1835); *Elements of Political Economy* (1837); *The Limitations of Human Responsibility* (1838); *Domestic Slavery Considered as a Scriptural Institution* (1845); *The Elements of Intellectual Philosophy* (1854); and *Sermons to the Churches* (1858). Consult Murray, S. O., *Francis Wayland* (Boston 1891); Wayland, F. and H. L., (his sons), *A Memoir of the Life and Labors of Francis Wayland* (New York 1867).

WAYLAND, **Francis,** American legal scholar, son of the preceding: b. Boston, Mass., Aug. 23, 1826; d. New Haven, Conn., Jan. 9, 1904. He was graduated from Brown University in 1846, took his M.A. degree from Yale in 1872, and began law practice in Worcester, Mass., in 1850, removing in 1858 to New Haven. He was judge of probate in 1864–1865, and lieutenant-governor of Connecticut in 1869. In 1872 he became professor in the law school of Yale, and in 1873 dean of the school. In 1903 he resigned the deanship. The development of the school from a minor local institution to its present condition, with adequate financial basis and wide curriculum, is due chiefly to him. He was president of several organizations, including the American Social Science Association, the board of directors of the Connecticut State Prison, the Prison Aid Association from 1872, and the Organized Charities Association of New Haven from 1878. He was prominent as a writer and speaker on sociological and charitable topics and criminology, and was joint author, with his brother, H. L. Wayland, of the memoirs of President Wayland (1867).

WAYLAND THE SMITH (AS. *Weland;* ON. *Völundr;* Icel. *Voelund;* OHG. *Wiolant, Wielant;* Ger. *Wieland;* Fr. *Galans, Galant, Galland;* Lat. *Guielandus*), a smith of Teutonic legends.

According to the elder Edda (q.v.), Voelund and his two brothers, Slagfid and Egill, settled in the Valley of Ulfdal, and lived with the Valkyries. After seven years, two brothers left in search of their wives, but Voelund remained at home accumulating wealth. He then went in to the service of King Nidung who cruelly lamed him by cutting the sinews of his legs, and transported him to an island where he was forced to work. As revenge, Voelund murdered the king's two sons, mounted their skulls in silver cups and presented them to the king, set the eyeballs in precious metal and gave them to the queen, and lastly, turned their teeth into pearls which he gave to the king's daughter, Baudvilde, whom he later violated. Voelund then put on a feathered robe and flew away. In various other versions, the smith was apprenticed to Mimer (Mimir) and wrought Mimung along with other famous swords to which there are many literary allusions.

A striking analogy may be seen in the story of Daedalus (q.v.) who entered the service of Minos, as Weland did of Nidung; Minos had a daughter, like the Scandinavian king; and Daedalus, like the Scandinavian hero, incurred the vengeance of the king he served. Each in turn violated the king's daughter, and escaped by making wings and flying. Other comparisons show similarity to Vulcan, the Roman god of fire, and Hephaestus (q.v.), the Greek god of metalworking. The Scandinavian sources for the story are *Voelundr Quida,* an early ballad in the Edda,

and *Wilkina Saga*, which is probably of German origin.

In Anglo-Saxon literature, there is a poem fragment which retraces the story and tells the grief of Beadohilde; in *Beowulf*, a hero leaves his best suit of armor, which was the work of Weland, to his companion, Higelac; *Deor's Lament* retells the story; King Alfred, in translating the *Consolations of Philosophy* by Boethius, writes: "Where are now the bones of the wise Weland, the goldsmith who was formerly most famous?"; in the Arthurian tale of Geoffrey of Monmouth, Rhydderic gives to Merlin precious stones and vases which were the work of Weland; in *King Horn*, Rimenhild gives a sword named "Bitterfer" to Child Horn; Chaucer, in the *Merchant's Tale*, refers to Wade, the sea giant father of Weland, and in *Troilus and Cressida* (book 3, line 614), makes another allusion. The legend that in a vale in Berkshire at the foot of White Horse Hill, a traveler might tie his horse, leave money for the fee, retire, and upon returning, would find his horse shod, was used by Sir Walter Scott in *Kenilworth*. The earliest known record of Weland is on a fragment of an 8th century Northumbrian styled casket.

WAYNE, Anthony, American Revolutionary officer: b. Waynesborough, Chester County, Pa., Jan. 1, 1745; d. Presqu' Isle (now Erie), Pa., Dec. 15, 1796. He was the son of Isaac and Elizabeth Iddings Wayne, and grandson of Capt. Anthony Wayne, who had emigrated from Ireland and in 1724 acquired a tannery and some 500 acres of land near Paoli, Pa., naming the estate Waynesborough.

Young Anthony attended his uncle Gilbert Wayne's local school, and in 1759 his father sent him to the Philadelphia Academy (now the University of Pennsylvania).

In 1765 Wayne was sent by a Philadelphia land company to survey a wild tract of about 100,000 acres in Nova Scotia and supervise its settlement. He returned to Philadelphia to marry Mary Penrose, daughter of a wealthy merchant, on March 25, 1766, and the couple immediately sailed for Nova Scotia. Wayne, however, was able to persuade only about 50 European immigrants to take up homes there; the soil would not grow sufficient grain to feed the settlers, and the threat of starvation ended the venture early in 1767. Back at Waynesborough, Anthony helped his father run the farm and tannery, a profitable business to which he succeeded upon the elder Wayne's death in 1774.

As anti-British feeling mounted in the colonies, Wayne became active in politics, was elected to the Pennsylvania Assembly in 1774, and organized a regiment in Chester County in 1775. On Jan. 3, 1776, he was commissioned colonel of the 4th Pennsylvania Battalion ordered to assist Benedict Arnold in his retreat from Quebec.

Wayne reached Albany, N. Y., by sloop and then marched his troops to Lake George, where small boats carried them up Lake Champlain and the Sorel River in Canada to the St. Lawrence River. On June 10, 1776, there was a sharp battle at Three Rivers, near Quebec, where Wayne unexpectedly met an overwhelming force of British. He withdrew to Fort Ticonderoga, N. Y., and remained there for almost a year as commander, with a force of 2,500 men. He was promoted to the rank of brigadier general on Feb. 21, 1777, but this did little to offset his disgust with the wretched conditions and inactivity at the fort.

On April 12 Wayne joined Washington at Morristown, N. J., and took command of eight regiments known as the "Pennsylvania Line," composed of descendants of Scotch-Irish and German settlers. He instilled magnificent *esprit de corps* into this group, which he was to lead through many trying months. On July 24, 1777, he was sent to Chester, Pa., to train militia recruits, and after a short visit at Waynesborough returned to the army, then camped north of Philadelphia.

The American cause was now approaching its gravest crisis, as Sir William Howe with a formidable force advanced on the capital at Philadelphia. Wayne took a prominent part in the fighting around the city. On Sept. 11 his division held back 7,000 Hessians at Brandywine Creek (Chad's Ford), Pa., while the rest of Washington's army escaped Howe's flanking movement and retreated. At Paoli, late in the evening of Sept. 20, while obeying orders to harass the enemy, Wayne was driven back by a bayonet charge under Gen. Charles ("No Flint") Grey, who had superior numbers. Accused of negligence in this defeat, Wayne demanded a court martial, which acquitted him "with the highest Honor." At the Battle of Germantown, Oct. 4, his command pushed the British almost three miles south, but he was later forced to retreat because of confusion in a heavy fog.

Philadelphia had been lost, and the American Army withdrew to Valley Forge. There, during the terrible winter of 1777–1778, Wayne shared the sufferings of his men, although his comfortable estate was only five miles south. After a month's furlough due to ill health he successfully raided New Jersey for cattle desperately needed at the Valley Forge encampment.

In the latter part of June, 1778, Sir Henry Clinton began the evacuation of Philadelphia and headed for New York. On June 28, at Monmouth, N. J., Washington attacked his long baggage train. The crack British guards, flower of the army, retaliated with a bayonet charge against Wayne's forces which had been ordered by Washington to harass the enemy's center. The guards were repulsed with great loss, but the American Army was incapable of resuming the offensive and during the night the British continued their march north.

During an indefinite leave of absence beginning Feb. 1, 1779, Wayne lobbied in the Pennsylvania Assembly for more effective aid for his ragged soldiers. On June 24 he received Washington's letter to join him below West Point, N. Y., and take command of the new light infantry, composed of picked troops from several states. At midnight July 15, 1779, Wayne stormed Stony Point, N. Y., an almost impregnable fort standing out on a high rock near the west bank of the Hudson River, threatening the security of West Point. Three columns waded waist-deep over a flooded marsh to the attack, the center firing noisily while the other two flanked the fort with bayonets on empty muskets. Personally leading one of the columns, Wayne subdued the garrison in the most brilliant action of his career, one of the great exploits of the Revolutionary War. His astonishing victory—followed by clemency for the defeated, so that only 63 British soldiers were killed—sparked the morale of troops and civilians throughout the country. Messages of congratulation and rejoicing flooded Congress. The marquis de Lafayette warmly congratulated Wayne. The following day Washington rode down to express his thanks, and on July 20 sent a message to Congress declaring that Brigadier General Wayne's "own conduct throughout the whole of

this arduous enterprise merits the warmest approbation of Congress. He improved upon the plan recommended by me, and executed it in a manner that does signal honor to his judgment and to his bravery. In a critical moment of the assault, he received a flesh-wound in head with a musket-ball, but continued leading on his men with unshaken firmness." Congress presented a medal to Wayne in recognition of his gallant achievement. His victory was a great blow to British prestige.

It was such headlong daring, often bordering on recklessness, which won for Wayne the appellation "Mad Anthony." Always in the heat of every action, he chose the post of greatest danger, exhibiting a boldness that gained him the universal affection of his troops.

The light infantry was dissolved on Jan. 1, 1780, and Wayne returned to Philadelphia to plead once more for the army, then at Morristown. On the evening of Sept. 26, 1780, while camped at Haverstraw, N. Y., Wayne received word from Washington of Benedict Arnold's treason at West Point. Wayne marched his Pennsylvania regiments 16 miles in four hours to protect the fortress, his prompt movement forestalling a possible British attack.

The Pennsylvania Line, payless for nearly a year, lacking food and clothing, and with many serving beyond their period of enlistment, mutinied at Morristown on the night of Jan. 1, 1781. Wayne, chosen as their intermediary to the State Assembly, won most of their demands. Yet, when ordered to join Gen. Nathanael Greene and Lafayette in the South, Wayne could muster only 800 men. Before they were ready to leave York, Pa., a court martial condemned three mutineers to death when another revolt seemed imminent.

At Green Springs, Va., July 6, 1781, false information lured Wayne into a trap with a swamp behind him and Gen. Charles Cornwallis' entire army of 4,000 men waiting in ambush before him. Wayne called for a daring advance, leading the British to believe American reinforcements had arrived. Before Cornwallis could recover, Wayne's 500 troops had steadily retreated over a narrow causeway. One of Lafayette's sentries accidentally shot Wayne in the thigh on Sept. 2, an injury which limited his activity at the siege of Yorktown, Va., where Cornwallis surrendered on Oct. 19, 1781.

British resistance continued in the South, and in February 1782 Wayne was sent by Washington to serve under Greene in Georgia. He camped at Ebenezer, near Savannah, with 600 men, while Gen. Alured Clarke held the port with 1,800 British regulars. Wayne made a remarkable four-mile march over a causeway and crossed a vast swamp on the night of May 24 to assault 450 redcoats under Col. Thomas Brown, completely unnerving them and forcing them back to Savannah. On June 24 he roused his sleeping men in time to rout 300 Creek Indians—British allies—killing their leader, Chief Guristersijo (Emistisiguo), with a sword thrust. No longer able to hold Savannah, the British evacuated the city on July 11. In September Wayne had a violent attack of fever from which he never completely recovered, and late in July 1783 at last sailed for home. He had liberated Georgia with an incredibly small force, and that state rewarded him with an 847-acre rice plantation located 12 miles northwest of Savannah.

Wayne arrived in Philadelphia in shattered health, but the care of his close friend and physician, Sharp Delany, and the companionship of old friends proved a good tonic. Upon his retirement in October 1783 Congress belatedly appointed him brevet major general, and he became a member of the Pennsylvania Council of Censors, a body which tested the validity of Assembly acts. He spent his evenings lavishly entertaining the most famous people of the day, forgetful that such indulgence aggravated his frequent attacks of gout. As representative of Chester County in the Pennsylvania Assembly in 1784 and 1785 he worked for fair treatment of loyalist refugees and for the licensing of his favorite art, the theater, which was still forbidden in Quaker Philadelphia.

Late in 1785 Wayne went to live on his Georgia plantation, which he eventually lost to creditors after a bitter financial struggle. After he had served for a year (1791–1792) as congressman from Georgia, his seat was declared vacant following evidence of fraud in his election and irregularity in his residence qualification.

Meanwhile, ignoring the peace treaty of 1783, the British had still been holding forts in the Northwest Territory and inciting various Indian tribes to attack American settlers; and in November 1791 Gen. Arthur St. Clair had suffered a crushing defeat by the Indians. To cope with the situation, President Washington recalled Wayne and in April 1792 named him major general in command of the army in the West. Wayne enlarged the army and began training his raw recruits. In the midst of this program (April 1793), he learned of his wife's death at Waynesborough.

On April 30 Wayne began a march of over 400 miles into enemy territory. Profiting by St. Clair's mistakes, he maintained constant vigilance, set out excellent scouts, and built three strong forts on the way. On Aug. 20, 1794, he met about 2,000 Indians at Fallen Timbers (near present Toledo), Ohio, and with only a third of his 3,000 men taking part, drove the Indians in 40 minutes to British-held Fort Miamis, and thoroughly cowed them. Washington appointed Wayne sole commissioner to negotiate peace with the Indians. While awaiting their reply he built Fort Wayne, Indiana, to command the waterways to Lake Erie. On Aug. 3, 1795, the Indians finally signed a treaty at Fort Greeneville, Ohio, which brought peace for 15 years.

After a brief and triumphant return to Philadelphia on Feb. 6, 1796, Wayne was sent west again to take possession of the British forts abandoned under Jay's Treaty of 1795. He sailed from Detroit, Mich., to the Presqu' Isle, Pa., blockhouse on Nov. 17, 1796, and died there Dec. 15. He left two children, Margaretta and Isaac, who subsequently brought their father's remains to the family plot in the graveyard of St. David's Church in Radnor, Pa., July 4, 1809.

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GEORGE M. TODD.

Approved by General Wayne's great-great-great grandson, William Wayne.

WAYNE, James Moore, American jurist: b. Savannah, Ga., c.1790; d. Washington, D.C., July 5, 1867. He was graduated at Princeton University in 1808, was admitted to the bar in

1810 and engaged in practice at Savannah. He served for two years in the Georgia legislature, was mayor of Savannah in 1823, and was judge of the Superior Court in 1824–1829. He was a member of Congress in 1829–1835; and was appointed by President Jackson an associate justice of the Supreme Court of the United States, Jan. 9, 1835. He was a recognized authority on admiralty jurisprudence. He opposed the rechartering of the United States Bank.

WAYNE, village, Michigan, in Wayne County; altitude 660 feet; 17 miles southwest of Detroit; served by the Pere Marquette and New York Central railroads; and by a federal highway. Industries include the manufacture of motors, wire cloth, automobile bodies, and aircraft, truck equipment, tractor equipment, and hydraulic equipment. Wayne also is an agricultural community. The village was founded in 1824, and was incorporated in 1869. Government is by a council and manager. Pop. (1950) 9,372.

WAYNE, city, Nebraska, and Wayne County seat; altitude 1,455 feet; 100 miles northwest of Lincoln and 90 miles northwest of Omaha; on the Chicago and North Western; and Chicago, St. Paul, Minnesota, and Omaha railroads. It is in an agricultural region, in which the principal products are oats, corn, alfalfa, seed crops. Wayne makes extensive shipments of grain, hogs, poultry and eggs, cattle, hay and vegetables. It has the Nebraska State Teachers College, two high schools and public graded schools. Wayne was laid out in 1881, when the railroad from St. Paul to Sioux City was being built. Pop. (1940) 2,719; (1950) 3,595.

WAYNESBORO, wānz'bŭr-ō, city, Georgia, Burke County seat, altitude 261 feet, on the Central of Georgia and Savannah and Atlanta railroads; one federal and three state highways; 33 miles south of Augusta. The surrounding country grows pecans, asparagus, fruit, cotton, and field peas, and Waynesboro ships cotton and fertilizer. Veneers, lumber, canned vegetables, clothing and ginned cotton are the principal factory products; there is a steel fabricating plant. There is a Confederate monument here; and the Bowie house was the home of Rezin Bowie, brother of James Bowie, inventor of the bowie knife (q.v.). Named in honor of Gen. Anthony Wayne, the town was laid out in 1783, and incorporated in 1888. It has a mayor and council. Pop. (1940) 3,793; (1950) 4,461.

WAYNESBORO, borough, Pennsylvania, in Franklin County; altitude 713 feet; 20 miles south of Chambersburg; on the Pennsylvania, and the Western Maryland railroads. Apples and peaches are grown extensively in the county, and Waynesboro is a storage and shipping point for fruit. Its industrial plants produce textiles, shoes, metal fencing, structural steel, and heavy machinery. There is a public library. One of the original Mason and Dixon mileposts is preserved near by. Confederate forces passed through Waynesboro on the way to and from Gettysburg. The borough has council and manager. Pop. (1940) 10,231; (1950) 10,334.

WAYNESBORO, town, Virginia, independent of any county; altitude 1,295 feet; situated on the eastern border of the Shenandoah Valley, at the foot of the Blue Ridge Mountains, and at the southern end of the Shenandoah National Park; 12 miles southeast of Staunton, 96 miles northeast of Roanoke, and 124 miles northwest of Richmond. It is on the Chesapeake and Ohio, and the Norfolk and Western railroads; modern highways; and near the Skyline Drive, which extends along the crest of the Blue Ridge Mountains. Situated in a fertile agricultural area, which produces chiefly corn, wheat, hay, livestock, poultry, apples and other fruit, and has considerable dairying, it is a center of trade and industry. Its industries include the manufacture of rayon, silk, and woven fabrics, furniture, stoves, pumps, windows, organs, flour, feed, food, and dairy products, while it is also a center of apple packing and fruit processing. It has a modern public school system, and located here are the Fishburne Military School for boys, and Fairfax Hall, a preparatory school and junior college for girls. In the vicinity are many scenic attractions. About 14 miles southeast of Waynesboro, in the George Washington National Forest, is the Sherando Lake Forest Camp, a recreational center, with a 25-acre lake for bathing, hiking trails, picnic grounds, and the like.

The site of Waynesboro was first settled around the middle of the 18th century, and prior to the American Revolution a hamlet sprang up here on the trail across the Blue Ridge through Rockfish Gap to Kentucky and Tennessee. Gradually two rival towns grew up adjacent to each other, Waynesboro, named in honor of Gen. Anthony ("Mad Anthony") Wayne, of Revolutionary War fame, and Basic City, which continued a separate existence until 1923, when it was merged with Waynesboro. The Virginia Central Railroad, now the Chesapeake and Ohio, reached Waynesboro in 1854, and service by the Norfolk and Western was begun in 1882. During the Civil War the Battle of Waynesboro occurred at a ridge west of the town on March 2, 1865 (see SHENANDOAH VALLEY, MILITARY OPERATIONS IN). After a weak resistance, the greatly outnumbered Confederate forces, under Gen. Jubal A. Early, retreated in disorder, hotly pursued by Custer's Union cavalry as far as the south fork of the Shenandoah River and to Greenwood Station. Some 1,450 out of 1,800 Confederate soldiers and officers were captured, thus destroying General Early's army, while several miles of the Virginia Central Railroad in the vicinity of Waynesboro were destroyed. Waynesboro's growth was slow until the arrival of several new and important industries, beginning in the 1920's, following the discovery of its advantages as a manufacturing center, since when it has made rapid progress. It has council-manager government. Pop. (1940) 7,373; (1950) 12,357.

WAYNESBURG, borough, Pennsylvania, Greene County seat; altitude 1,035 feet; 40 miles south of Pittsburgh; on the Pennsylvania, and the Monongahela railroads. It is in an agricultural region, and in the natural-gas and oil belt. Its principal industrial products are brick, chemicals, and flour. There are stone quarries near by. The borough is the seat of Waynesburg College (q.v.). The settlement was laid out in 1796, and named for Gen. Anthony Wayne. Pop. (1940) 4,891; (1950) 5,514.

WAYNESBURG COLLEGE, Waynesburg, Pa., was founded in 1849. It was estab-

lished and is under the control of the Pennsylvania Synod of the Cumberland Presbyterian Church. It offers three regular courses, classical, literary, and scientific, which lead to the degrees of A.B., B.L., B.S., and A.M. for graduate work. It is coeducational.

WAYNFLETE or **WAINFLEET, William of** (WILLIAM PATYN, PATTEN, or PATTON), English prelate: b. Wainfleet, Lincolnshire, Eng., 1395; d. Aug. 11, 1486. The son of Richard Patyn, alias Barbour, he was educated at Oxford between 1426 and 1429. A favorite of Henry VI, he was appointed first headmaster of Eton College in 1442 and made second provost in 1443. In 1447 he succeeded Cardinal Beaufort as bishop of Winchester, a position he held the remainder of his life. He founded Magdalen Hall in 1448 and in 1558 Magdalen College (q.v.). From 1456 to 1460 he served as lord chancellor and took an active part in the privy council. Despite the fact that he had released Henry VI from the Tower on Sept. 29, 1470, he was generously treated by the Yorkists. He cooperated with Edward IV in the restoration of Eton College which was completed in 1480, received the king there the following year, and entertained Richard III in state in 1483. He endowed a free school at Wainfleet in 1484, and upon his death in 1486, was buried at Winchester Cathedral.

WAYS AND MEANS, Committee on, a partisan, standing committee of the House of Representatives which prepares all legislation regarding public finance, including taxation. It was first used in the Congress of 1789, and six years later became a standing committee. In 1850, it was given temporary right-of-way over other House committees, and during the Civil War, this privilege became permanent. Its 25 members are elected by the House and are approved by party caucuses. Chairmanship is given to one of the majority leaders, and approximately one third or one fourth of the members belong to the minority party. Majority and minority members frequently prepare separate bills for legislation.

WAYSIDE INN, formerly the home of an English family by the name of Howe, near Sudbury, Mass., about 20 miles from Cambridge. Also known as Red Horse Inn, founded 1686, it is the scene of Henry Wadsworth Longfellow's *Tales of a Wayside Inn* (q.v.). It was purchased by Henry Ford in 1923 and made into a Longfellow shrine.

WAYZGOOSE or **WAYGOOSE,** formerly wakegoose, a term for the annual festival in England given by a master printer for his employees in August to mark the beginning of the season of working by candlelight. It developed into a summer outing for all employees of a printing establishment.

WAZIRABAD, a town in Punjab, India, situated on the river Chenab, about 62 miles north of Lahore. A railroad connects it with Sialkot and Jammu. Nearby is one of the famous gardens in Punjab, and the great Alexandra Bridge over the Chenab is north of the town. Wazirabad is known for its cutlery, sword-sticks, and canes. Iron, steel, and boat-making are its chief industries. Pop. (1931) 20,707.

WAZIRISTAN, wä-zē-rĭ-stän′, independent tribal territory, situated west of the Suliman Range, north of Baluchistan, and east of Afghanistan. The country of the Waziris has at various times been the scene of military operations owing to the depredations and raids of the Waziris on the caravans transversing the Gomul Pass. The British government had maintained political agencies in both Northern and Southern Waziristan. The principal town is Kaniguram. It is a mountainous country, with much fine scenery, and a delightful climate except in some valleys. The Waziris, a portion of whom are known as Mahsuds, are a hardy race of Afghans and settled peaceably within part of India where they cultivate the land. Their crops are wheat, maize, and barley; they raise horses and sheep, and iron and wood are exported.

WAZZAN, wä-zän′ (Arab. for Ouezzane, wĕ′zän), French Morocco, an inland town, picturesquely situated on the steep northern slope of a two-peaked mountain, in the hill country 90 miles southeast of Tangier. It is a sacred city of refuge, and a place of pilgrimage, the headquarters of the grand sherif, the spiritual ruler of Morocco. The principal buildings are the great mosque and the tombs of a long line of sherifs. The trade is, as elsewhere in Morocco, in the hands of the Jews. Pop. (1936) 16,442; (1941 est.) 20,230.

WEA, a tribe of the Algonquin stock of North American Indians, belonging to the Miami confederacy. The name is probably a contraction from various words meaning eddy current, Wawiaqtenang, Wayahtónuki, or wayaqtonwi. The Algonquins named Detroit Wawaqtenang. When first known to the whites in 1672–1703, they were in Wisconsin, but they seem to have gradually drifted southward, and in 1701 one of their villages was on the site of the present Chicago, Ill., and in 1719 their chief village was on the Wabash below the mouth of the Wea Creek, in Indiana. They were hostile to the whites in western Virginia, in which their country was situated, but they finally signed the celebrated treaty at Greenville, Ohio, on Aug. 3, 1795. In 1820 they sold their last lands in Indiana and moved with the Piankashaw to Illinois and Missouri. In 1832 they again sold their lands and the main body moved to Kansas. Rapidly decreasing, the Wea and the Piankashaw united with the Peoria and Kaskaskia of the Illinois confederacy in 1854; at this time their population aggregated 259, largely mixed-bloods. In 1868 they moved to the Neosho Indian Territory, now Oklahoma, where the small remnant has been absorbed.

WEAK ENDING, also called FEMININE ENDING, in poetry, a verse ending with an unstressed syllable such as a preposition. A light ending is one in which the line ends with a pronoun or auxiliary verb.

WEAKFISH, or **SQUETEAGUE,** a spiny-rayed fish of the genus *Cynoscion* and family Otolithidae. It has no teeth on the vomer or palate bones, but numerous ones in the jaws, which are weak in structure; the air-bladder

has a horn on each side projecting forward. The genus is chiefly American, with about 15 North American species. The common weakfish (*C. regalis*) is one to two and one half feet long, brownish blue above, with irregular brownish spots, and tinged with greenish and banded in the young; the sides silvery, abdomen white, and iris yellow; lower fins orange; a single row of very small teeth in the upper jaw and a double series in the lower; dorsals separated, and the second, with the caudal and anal, mostly covered with scales. This is one of the most abundant fishes along the entire Atlantic Coast from Cape Cod to Florida, but there have been times when the invasions of bluefish have driven them from parts of the coast. The name originated from the little resistance it makes when taken, and from the ease with which the delicate structure of the mouth enables it to break away. This is the name most employed on the New Jersey Coast, while in New England the Indian name "squeteague" is usual, and in the South, sea trout is applied to this and to the spotted *Cynoscion*. On the New Jersey Coast it appears early in the spring, being most abundant toward the end of July, and disappears late in the autumn; it is a greedy biter, and is easily taken by any soft white bait, affording great sport for about an hour on the flood tide; it swims in shoals near the surface and requires a line slightly if at all leaded. In summer it is abundant about the mouths of rivers, where the water is brackish, and sometimes ascends far up, having been taken in the Hudson 50 miles above New York; it is taken by seines and poundnets in large quantities; when caught it makes a croaking sound, also heard when the fish is at the bottom.

WEALDEN, wēl'dĕn, certain delta deposits of the Cretaceous system, from their great development in the weald of Sussex, England. Weald means in Old English a wood or forest, and the name is applied to a tract of country lying between the north and south downs of Kent and Sussex. The recognized geological name of this subdivision of the Cretaceous system is the Neocomian, from the old Latin name of Neuchâtel in Switzerland. This stage in the south of England, and thence eastward across Hanover, consists of a mass of sand and clay, sometimes 1,800 feet thick, representing the delta of a river. Only a portion of this delta remains, but as it extends in an eastern and western direction for a distance of at least 200, and from north to south less than 100 miles, its total area may have been 20,000 square miles, indicating a very large river flowing from a continent. See GEOLOGY.

WEALTH. Wealth comprises all material things owned by individual human beings or their associations or other agencies. The reason for ownership lies in two general characteristics of wealth: its capacity to satisfy the wants of the possessor, directly or indirectly, currently or in the future, and its scarcity. No effort is made to own material things having no known or suspected capacity to satisfy wants; and such things are not wealth. Not all material things capable of satisfying wants, however, are wealth; for, unless they are scarce in comparison with the aggregate of wants which they help to satisfy, no purpose is served by owning them. Thus, some things which nature provides freely exist in such abundance that all human beings can enjoy all they want of such things and their services. But most things provided by nature are not thus abundant, and they are therefore appropriated and owned so that the owners may enjoy their benefits exclusively. Thus land, and the various natural resources which lie upon or beneath land, are not sufficiently abundant to meet all the wants of all people; and they are therefore appropriated and become wealth. Under the above definition, a human being is wealth; but, for various practical reasons, in speaking of the wealth of a nation or of an individual or group of individuals, this literal implication of the definition is disregarded, and human beings are not counted as wealth.

The word material in the definition is significant, for it excludes from wealth a long and important list of things which are called services and do meet wants but are used up as soon as they are created. The material things which constitute wealth fall into two broad but somewhat ill-defined categories. Items in the first category are capable of satisfying human wants directly, and are generally called consumption goods. Items in the second category are, with some reservations, capable of satisfying wants only indirectly, and are generally called production, or producers' goods because they must be subjected to or play a part in one or more productive operations before they are available for direct consumption.

Nearly all items of wealth—the most important exceptions are unimproved land and undeveloped natural resources—are in some degree the result of production, the process which adapts their location or form or other qualities to human use either in direct consumption or in the production of still other goods. The stock of production goods is combined with human labor in a vast number and immense variety of activities which together make up the total system of production. The output of this system consists entirely of services which are used up either in consumption or in further production as they are produced, and of material things which are in truth new items of wealth although some of them may survive as wealth for only a brief interval before they are used up in direct consumption or in further production.

In all modern societies most production is carried on by groups of individuals, some of whom provide labor, ranging from the lowest grade of unskilled physical exertion to the highest type of leadership activities, and some of whom provide wealth in the form of production goods. How these various participants shall share in the services and wealth created by their joint activities is a question of the greatest difficulty and the highest importance to all citizens who shape or seek to shape social policy. The issues posed by this question are greatly aggravated by the fact that possession of wealth, and thereby control over production goods, is much less widely and less evenly spread among men than is the capacity to perform all labor except that requiring exceptional skills and especially, that of planning and managing. The issues are further aggravated by the institutional arrangements which have largely obscured or rendered impersonal the participation in production by the owners of wealth, especially the very numerous owners possessing only small amounts of wealth. Among these arrangements we must note par-

ticularly those which tend to conceal the very nature of the wealth which individuals possess. In fact, the definition of wealth given above by no means describes the word wealth as it is commonly used in speaking of the possessions of an individual. Progress in the organization of the production process, aiming toward a greater or more efficient production of new wealth through the use of available labor and production goods, has been aided greatly by the willingness of individual owners of the material things which constitute real wealth to transfer physical possession and partial or temporary control over the use of such wealth, to other individuals or to corporate groups of individuals, in return for claims represented by paper evidences of ownership or of the obligations of debtors. These paper claims, some of which are in forms and most of which can be exchanged by trades among their several owners, which pass as money then become part and in some cases nearly all of what is called the wealth of such individuals. Their real wealth has been transferred to others; and the corresponding claims in the form of money or property rights, which they possess have little power to convince the ignorant that these owners of wealth do in fact contribute vitally to production.

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WEALTH, National. The wealth of a nation is the stock of economic goods owned by its inhabitants either in their capacity as individuals or as member of the national group. Defined in this way wealth consists of the aggregation of substantive things called economic goods. The definition may be broadened or narrowed by modifying the content of economic goods. The wealth of a nation as distinguished from its income is, then, the stock of economic goods owned as of a specific date by those domiciled within a nation; while the nation's income is the economic goods consumed during the income period, by those domiciled there, plus the net additions to their wealth resulting from the income-producing process. Thus wealth is a *stock* while income is a *flow* of economic goods.

Economic goods defined most broadly include all sources of satisfaction which are scarce and therefore able to command a price. They include not only objects external to individuals but individuals themselves, or, at least, their useful capacities. Generally, however, wealth is restricted to those economic goods which are external to the owner so that individuals and their capacities are excluded. Furthermore, only material economic goods external to the owner are ordinarily included. Such things as the reproductive power of seeds; the "good will" of a firm, or the acumen of its management; the life supporting qualities of sunshine; the efficiency of organized institutions; are excluded except in so far as they are reflected in material objects.

Irving Fisher's definition of wealth as, "material objects owned by human beings and external to the owner" is the general connotation given the term in economics. For many interpretations of national productiveness, however, the concept of the resources of a nation (its wealth, broadly speaking) must be extended to include the number and capacities of its population, the efficiencies of its functioning institutions, and the life promoting and sustaining power of its climate.

This view of wealth, in either its narrow or broader aspects, places emphasis on the substantive items which compose it. The ownership rights in such items which govern the use, enjoyment, and disposal of their services are often spoken of as "claims" on wealth. A share of stock, a bond, a bank deposit, or paper money are tangible instruments which give "rights" to wealth. Individuals often speak of them as wealth *per se*. The right to use a public park or library is also a claim on wealth. Since all wealth must be owned by individuals either as individuals or collectively as members of a social group it is perfectly sound, for some purposes, to speak of ownership claims as if they were wealth. In order not to count the same things twice we would then have to exclude the substantive items themselves. It has seemed preferable to economists to think of the substantive items as the wealth and the "rights" to the use and disposal of the services of these items as claims on wealth. It must be recognized, however, that the arrangements by which wealth is owned and its uses facilitated are in themselves part of the institutional framework within which the economy of a nation functions and that these arrangements have pertinence and usefulness in themselves.

Measurement Difficulties.—The measurement of wealth, like the measurement of income, requires that the heterogeneous content of substantive items be valued in common terms so that they may be added to form a single comprehensive total. This is usually accomplished by estimating their money values. Such estimates, even for a single year, are difficult. The value of an item of wealth may be viewed in two ways. First it can be thought of as the price which can be received for the use of the item for a restricted period of time, say a year, the item to be returned intact; or, second, as the purchase price which gives the buyer the right to use or otherwise dispose of the services of the item for the entire period of its usefulness. These two values are not distinct but are closely related. The purchase price, which is what is usually meant by the value of an item of wealth, is, excluding sentimental factors, nothing more than a present value assigned to an estimate of the use value of the item for the period of its usefulness. Any present value of future services involves discounting these anticipated services at a current interest rate. Sales values of wealth are thus seen to be reflections of anticipated service values, that is, of expected income.

If each item of wealth was sold currently the prices (market values) thus established could be taken as appropriate values. This seldom happens. It becomes necessary, therefore, to assign to the stock not sold the prices secured for the units that were recently transferred. For some items of wealth such as public roads, parks, or even many factory buildings, no representative items are transferred, so that some appraised or book value must be assigned. Book values are usually original purchase price values and these may be quite different from either the current costs of producing a similar item or the price at which the item could be bought or sold. Where marketable instruments such as stocks and bonds exist as ownership claims against the property, the market values of such instruments constitute still another basis for valuing wealth and generally are quite different values.

Current practice in wealth estimating is to se-

cure, as nearly as possible, current market value. Even if these are obtained the task is only half over if time comparisons are to have any significance. Since the value of money changes, wealth measured in money values would not tell us whether the total of substantive wealth (useful resources) had increased or decreased in quantity. To answer this question we would have to express the totals in dollars of constant purchasing power. For this reason most of the historical estimates of wealth have only limited usefulness since they do not provide the information by which they can be made comparable.

Two major categories of substantive wealth, reproducible and non-reproducible wealth, present somewhat different aspects and difficulties for the estimating of money values. Reproducible wealth, which is generally destructible as well, is composed of things which man has made and which he can make again—or he can make closely similar things. The market value of this type of wealth tends, under competition, to equal its cost of reproduction. At any given time the market values of reproducible wealth may deviate widely from reproduction costs. But competition, by increasing or decreasing the quantity of such items, tends to bring their market values into equality with reproduction costs. To secure a measure of the changing quantity of reproducible wealth over time we can select (1) their reproduction costs, (2) their market values, or (3) their original costs, adjusting each to a given base year of costs for comparability over time.

Thus, for reproducible wealth it is clearly permissible to talk of an increasing or decreasing quantity of substantive wealth irrespective of how difficult it may be to measure such changes in the composite of all such items. For non-reproducible wealth it is equally clear that we cannot properly speak of an increase in the quantity of such wealth since by definition it cannot be produced. Land is the major item in such wealth and if, as is customary, we include under land all natural resources, it encompasses the total of non-reproducibles with the minor exception of produced works of genius which are unique and therefore not replaceable.

Ricardo spoke of land as the "original and indestructible properties of the soil" but our definition of land as all natural resources certainly includes things which are destructible. The various minerals and other ingredients available in nature, while not produced, are certainly destroyed, at least in form, by use. While their quantity may not be increased, it can be decreased. The measurement of such resources for quantification over time presents almost insuperable obstacles. While strictly speaking the quantity of such resources in existence may not be increased, they may be discovered from time to time or, if known, may be brought into use gradually with the expansion of the economy. These considerations raise the questions whether such discoveries and inclusions in productive uses should be considered additions to the stock of wealth and whether the depletion of known resources should be subtracted.

For many purposes the addition of newly discovered national resources are important considerations as are the exhaustion of known minerals and the expansion of useful areas. Such resources are in part substitutes for reproducible wealth and certainly increase the output of the economy. Their measurement in terms of money values is so difficult, however, that they should generally be treated separately from the measurement of reproducible wealth.

The measurement of wealth is subsidiary to the measurement of income. The national income is a much more direct index of the success and efficiency of an economy and also of the basis upon which its wealth, broadly or narrowly defined, is really evaluated. The value of wealth is nothing more than the reflection of its income contributing power, and no item can meaningfully be included in the category of wealth.

Measurement.—A presentation of the national wealth of Great Britain, 1932–1934, was arranged by Professors Hicks and Hart in their book entitled *The Social Framework of the American Economy,* to bring out the major categories of wealth, their market values, their relationship to wealth claims and how double counting is avoided. Their tabulation, including the note prepared by Hicks and Hart, is shown as Table 2.

In addition to indicating the wealth of Great Britain as totaling something like 18,700 million pounds it shows the main categories of which the wealth was composed. Claim items (bonds, government debt, mortgages) are shown to cancel out. The assets which are cancelled by corresponding liabilities are indexed by the small letters a, b, c. The national wealth is thus seen to be either, (1) the total value of all material assets (all those assets not preceded by a small letter) plus the net foreign investment, or (2) the sum of the net assets of private persons and government. These two concepts are clearly equivalent since all tangible property is owned by the members of the economy and constitute, after adding net foreign claims, their net assets.

Two additional points require comment. First, wealth owned directly by the government is seen, in this instance, to be less than government debt. This can only mean that the deficit is a lien upon the net assets of the individuals taken collectively. It is cared for by subtraction in the net assets column. Second, money (except gold and silver) and bank deposits are not included among the accounts because such items are merely claims which must, in total, cancel each other. If individuals have money on hand, it appears in their assets column, but the government, (or the government and the banks) must have liabilities in equal amount. Similarly, bank deposits which are assets to individuals are liabilities to banks and cancel out.

A preliminary estimate of reproducible wealth for the United States for 1946 (unpublished manuscript by Marvin Hoffenberger prepared for the Conference on Research in Income and Wealth, National Bureau of Economic Research, New York) is shown in Table 1.

Table 1.—REPRODUCIBLE WEALTH OF THE UNITED STATES, 1946
(millions of dollars)

Residential Buildings	$ 56,000
Other structures including equipment, roads and other government property	320,000
Inventory	76,000
Livestock	12,000
Consumers' goods	80,000
Monetary gold and silver	23,000
Total	$567,000

More significant, since it deals with the growth of wealth in terms of constant prices, is an estimate of reproducible wealth, other than

Table 2.—THE NATIONAL WEALTH OF GREAT BRITAIN, 1932–1934 (millions of £'s)

	Assets		Liabilities		Net assets
Private persons, including farmers	Houses	3,500	[a] Due to building societies, etc.	500	———
	Other durable-use consumers' goods	700			
	Agricultural land	600			
	Farm equipment	400			
	Foreign investments	1,500			
	[c] Government Debt	2,500			
	[b] Shares, bonds, and other obligations of British firms	14,000			
Total property of private persons		23,200		500	22,700
Firms	Buildings and land	1,000	[b] Shares, bonds and other obligations	14,000	
	Railways	750			
	Other industrial and commercial equipment	8,000			
	Gold	250			
	[c] Government Debt	3,500			
	[a] Mortgages on house property, etc.	500			
Total property of firms		14,000		14,000	0
Government and other public bodies	Land and buildings	600	[c] National Debt	6,000	
	Other equipment	1,400			
Total public property		2,000		6,000	—4,000
Total national wealth					18,700

Note to preceding table: The figures in this table are based on H. Campion, *Public and Private Property* (Oxford University Press, 1939), particularly pp. 65 and 84. In order to fit Mr. Campion's figures into the accounting form suitable for our purposes, I have had to make some extra guesses, which do not claim to be more than guesses, though I think they are reasonable. (1) Mr. Campion gives £4,600 millions for the total of private houses and buildings used for business purposes taken together. I have divided this, with an eye on the valuations for taxes. (2) The Colwyn Committee estimated that holdings of the national debt were divided between firms and private persons in about equal shares; holdings by firms were probably larger in 1932 than in 1927, so I have made an adjustment to allow for this.

The following points should also be noted: (1) Armaments and roads are not allowed for in Mr. Campion's estimate of public property. The reader is at liberty to make an addition to the national capital to allow for these, if he so chooses. (2) The foreign investments included among the national assets are net obligations due from outsiders. Material property owned by British firms in other countries (branches, subsidiary companies, etc.) is included among the material assets of firms. (3) The external debt of £1,000 millions or so to the American government was not being paid after 1931, so it is neglected. An American would be within his rights if he deducted £1,000 millions from our estimate of the national capital on account of this debt. (4) Gold in the Exchange Fund has been added to gold in the Bank of England; but that makes it all the more of a question whether both of these institutions should not be reckoned among *public bodies*, rather than among *firms*. It should be noted that these stocks of gold were largely increased during the years 1933–1938. (5) Holdings of national debt by public bodies are cancelled out, so they do not appear in the table.

Source: Hicks, J. R., and Hart, A. G., *Social Framework of the American Economy*, Oxford University Press, New York 1945, p. 135.

household, for years at decade intervals from 1879 to 1939, inclusive. This estimate (presented in Table 3) was prepared by Simon Kuznets and is based on capital formation data tied to several direct estimates by the Bureau of the Census and the Federal Trade Commission. All values are expressed in 1929 prices.

Table 3.—REPRODUCIBLE WEALTH OF THE UNITED STATES, OTHER THAN HOUSEHOLD, 1879–1939, 1929 PRICES

(millions of dollars)

Beginning of year	Real estate improvements and equipment	Inventories	Balance of foreign claims	Total reproducible wealth
1879	$ 29,968	10,554	—1,700	38,822
1889	51,157	16,188	—4,700	62,645
1899	86,511	20,073	—5,500	101,084
1909	132,064	26,063	—5,700	152,427
1919	177,299	35,201	2,400	214,900
1929	227,744	47,211	8,000	282,955
1939	236,454	46,528	4,600	287,582

Source: Simon Kuznets, *National Product Since 1869*, National Bureau of Economic Research, New York 1946; Table IV 10, Part B, page 228.

Reproducible wealth in the sixty-year period covered by Table 3 (exclusive of household wealth such as furniture, clothing, jewelry, and personal automobiles; and probably with only incomplete coverage of public wealth) increased almost seven and one-half times. The percentage rise in each decade varied, but was considerably greater in the early decades than in the later ones. Decade by decade the percentage increases were 61, 61, 51, 41, 32, and 2. The last decade shows the severity of the depression during the 1930's. If changes are measured over 20-year spans retardation in the rate of increase is equally obvious. The rise 1879–1899 was 160 per cent, 1899–1919 was 113 per cent, and 1919–1939 was 34 per cent.

The measures of wealth given are estimates subject to considerable error but they probably give fairly accurate indications of the growth of the wealth totals over the period surveyed. It is informative to compare these United States wealth measures with those for the growth of population. For the census decades 1880 to 1940 the percentage increases over the preceding census were as follows: 25.5, 20.7, 21.0, 14.9, 16.1, 7.2. It is clear then that wealth per capita, except for the last decade, must have shown significant increase. Reproducible wealth, in prices of 1929, increased from $750 per capita in 1879 to $2200 per capita in 1939, or approximately a three-fold increase. Since the portion of the population in the labor force did not change significantly over this period, each available worker in 1939 had about three times as much wealth as a worker in 1879 to aid him in the production of the national income. This estimate agrees substantially with the findings of Paul Douglas (*The Theory of Wages*), namely, that each man-hour of manufacturing employment in 1922 had 2.7 times as much fixed manufacturing capital (wealth) combined with it as had been true in 1890.

Information in Colin Clark's, *Condition of*

Economic Progress, allows some international comparisons of wealth and income per member of the working population in 1913. Table 4 summarizes this information and shows the relationship between wealth and income. The last two columns of Table 4 express the per worker wealth and income of each country as a percentage of that for the United States. That wealth and income are related is clearly shown, although there are significant discrepancies. The content of the income and wealth figures would require close inspection and analysis to separate the apparent disparities from the real ones, and cannot be entered into here. The conclusion that a larger income per worker implies a larger amount of wealth per worker is clearly indicated.

Table 4.—INCOME AND REPRODUCIBLE WEALTH PER HEAD OF THE WORKING POPULATION FOR SELECTED COUNTRIES IN 1913 IN I.U.'S

Country	Reproducible wealth per head of working population	Real income per head of working population per 48 hour week	Percentage of wealth per head in each country to U.S.A.	Percentage of income per head in each country to U.S.A.
U.S.A.	$5,160	$1,191	100.0	100.0
Canada	4,590	1,061	88.9	89.1
Australia	4,100	742	79.5	62.3
Britain	3,590	966	69.6	81.1
Germany	3,130	704	60.6	59.1
France	3,060	629	59.3	52.8
Sweden	2,680	474	51.9	39.8
Belgium	2,190	470	42.4	39.4
Austria	1,580	452	30.6	37.9
Japan	460	128	8.9	10.7
Japan, 1930	980	301	19.0	25.3

Source: Colin Clark, The Conditions of Economic Progress, Macmillan, London, 1940, p. 389. For definition of I.U.'s see article on National Income.

The accumulation of reproducible wealth results from the consumption of less than each year's full national product (national income). The difference between national income and consumption is called net capital formation. Gross capital formation includes net capital formation plus the replacement of productive facilities worn out during the income period. In the United States during the period 1869–1939, net capital formation in constant prices is shown by Kuznets (*National Income: A Summary of Findings*) to have ranged from about 16 per cent to 1.4 on the basis of average annual amounts for decades overlapped by five years. The 1.4 per cent rate applies to the decade 1929–1938 and shows the severity of the depressed conditions during that decade. If the period 1869–1928, which excludes the depressed 30's, is divided into three periods of roughly 20 years each, Kuznets finds that the percentage of net capital formation is 15.0, 15.7, and 12.2, respectively. This indicates a modest decline in the rate of capital accumulation exclusive of the influences of the 30's.

A saving of 12 to 15 per cent of national income in the United States during the period between the Civil War and World War I appears to be a modest amount, particularly in the light of the expansion of national income by almost eight times during that same period while population expanded three times. It is significant that between 85 and 87 per cent of the national income was used for the purpose of satisfying consumers' wants, indicating the better maintenance of the people who make up the nation. Furthermore, the expansion of national income seems to imply that it may have had production influences as well. As noted earlier, the wealth of a nation in its broadest sense includes the people of the nation and their capacities. A better provided for, better educated population is an addition to wealth in even a larger sense than the growth of a stock of material goods. Also during this period the United States benefited by the development of its natural resources and by the growth of its population not only by reproduction but by the addition of immigrants from abroad who came here mainly at the beginning of their working years.

These latter points concerning the wealth of a nation in its broadest sense are well summarized by Kuznets in *National Income: A Summary of Findings.* He writes, ". . . two important factors, not directly reflected in the percentages net capital formation constitutes of national income, should be noted. First, through most of the period the country profited from large immigration. The capitalized value of this addition to the country's productive population was estimated to be more than $10 billion per year in the periods of largest immigration (1881–1890 and 1901–1914), and through the period 1860–1930 at roughly $6 to $7 billion per year, at prices of the 1920's (see calculation by Dr. Agostino de Vita, supplementing the article by Corrado Gini, Europa und Amerika: Zwei Welten, *Weltwirtschaftliches Archiv,* July 1940, v. 52, pp. 31-35). Second, through a substantial part of the period the country profited from availability of land for extensive expansion within its own boundaries." (Simon Kuznets, *National Income: A Summary of Findings,* National Bureau of Economic Research, New York, 1946, f.n. p. 52.)

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WEALTH OF NATIONS. "In the year 1776, Adam Smith published his *Wealth of Nations;* which, looking at its ultimate results, is probably the most important book which has ever been written." Thus states Henry Thomas Buckle concerning the great work of the leader of English "Classical Economists." Since Smith deals with both political philosophy and economic theory, it may increase the clarity of an

analysis to treat these two phases of his doctrines separately, though always remaining conscious that in Smith's mind they formed a single unified and coherent body of thought.

In his political theory Smith followed the teachings of Locke, Montesquieu and Hume, combined with the doctrines of the Physiocrats regarding the proper scope of state activity. It is his concern with the latter which is of the greatest importance in this analysis, as he here exerted his greatest influence. Accepting the doctrine which the Physiocrats had taken over from contemporary scientists and *philosophes,* namely, that there is a natural and beneficent order which pervades the universe and of necessity extends to the domain of social, economic and political phenomena — an order which man cannot and therefore should not attempt to alter — Smith launched a violent attack upon the restrictive state activity which had been advocated by the Mercantilist writers who had dominated political and economic theory and practice for more than a century prior to 1776. It was his fundamental thesis that human happiness and the «wealth of nations» can be most rapidly and effectively increased by bringing about complete industrial and commercial liberty, and it was at this point that his political philosophy merged with his economic theory and made possible a unified and coherent body of doctrine, though it prevented Smith from separating politics from economics as effectively as he had divorced ethics from economics. Smith enumerates the three classes of duties which it falls to a state to perform, or to guarantee the execution thereof and beyond which it should not proceed. These are (1) the protection of the citizens against foreign states; (2) the administration of law and justice; (3) the establishment and maintenance of public works and the provision of education, academic and religious. But he would have even the last two types of functions exercised as far as possible by the citizens acting voluntarily according to self-interest, and the state should only intervene in these fields when voluntary activity fails to function in an effective manner. It is needless to add that he vigorously urged the immediate abolition of all restrictive state regulation of industry and commerce and the immediate initiation of that régime of unhindered competition which would allow economic affairs to harmonize with the beneficent order of nature and bring the full measure of happiness and prosperity to the human race. These *laissez-faire* theories were adopted and re-emphasized by Smith's disciples and were the leading factor in securing that abolition of industrial and commercial restrictions which constituted that era of «economic liberalism» and «political individualism,» which was the most fundamental characteristic of the economic and political history of Europe during the first half of the 19th century, and which still prevailed a century after the publication of the 'Wealth of Nations.'

In his strictly economic doctrines Adam Smith has had as wide an influence as through his political theories. Though not the founder of modern political economy, he was its first great systematizer, and the 'Wealth of Nations' stands toward modern economics in much the same way that Comte's 'Positive Philosophy' does to present day sociology.

The most conspicuous element in Smith's system of economic doctrines was his emphasis on the factor of *labor,* which he conceived to be the ultimate source of all wealth and the true measure of value. In his theory regarding the production of wealth his emphasis upon the importance of the division of labor has been most influential in the history of economic thought. Smith's treatment of this subject was the first extensive analysis it had received since the appearance of the 'Republic' of Plato, and in many respects it has never been improved upon. Smith's analysis of value and exchange centred about the well-known labor theory of value, and he maintained that the actual measure of value was the quantity of labor which a given commodity would command in exchange. His theory of distribution initiated the conventional discussion of wages, profits, interest and rent. Wages are the return to labor and are determined by the demand for, and the supply of, labor. Profits are the return to capital and are determined by the amount of capital stock invested, varying inversely in proportion to the amount of the stock. Interest is that part of profits which is derived from the lending of capital. Finally, rent, and here in part he anticipated Ricardo, is the return to the landowner and may exist as soon as all free land is occupied. It normally equals the residue from the gross income of the renter after he has deducted profits and wages. Though these specific phases of economic analysis in the 'Wealth of Nations' were of great importance for the subsequent development of economic theory, they have scarcely stood the test of more refined and scientific analysis, and they have done far less than his more general contributions to secure for Adam Smith the pontifical position which he still occupies in the history of economic thought. This position has been attained by his epoch-making attack upon Mercantilism; the accompanying advocacy of the initiation of the régime of *laissez-faire* and unhampered industrial competition; and his production of the first great systematic treatise on political economy. The significance of the 'Wealth of Nations' for posterity has been thus expressed by Walter Bagehot, «The life of almost every one in England — perhaps of every one — is different and better in consequence of it. No other form of political philosophy has ever had one-thousandth part of the influence on us.» Consult Gide and Rist, 'History of Economic Doctrines' (Chap. II); Haney, L. H., 'History of Economic Thought' (Chap. X); Bonar, 'Philosophy and Political Economy' (pp. 146–183). The relation of the 'Wealth of Nations' to sociology is presented in A. W. Small's 'Adam Smith and Modern Sociology.'

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WEANING, the accustoming of an infant to food other than its mother's milk, or the disengaging of a child from the habit of nursing. In normal cases it is now deemed desirable to continue nursing for nine or 10 months after birth Very careful mothers extend the period to cover the second summer. With

children who are healthy, and cut their teeth early, weaning may begin earlier than with weak, sickly children. It should never be attempted during sickness, nor, unless absolutely necessary, in hot weather. It is best for both mother and child to bring it about gradually. By so doing the secretion of milk in the former is slowly diminished, and those complaints which arise from sudden weaning are prevented; while the child is gradually accustomed to other kinds of sustenance, and the restlessness and want of sleep, which are so troublesome in sudden weaning, are avoided. Both during the weaning and for some time after it no food should be given to the child except what is very easy of digestion, and more fluid than solid, and in particular what has no stimulating qualities, nor any that will tend to create acidity, or produce other marked changes in the organic function. See INFANCY.

WEARE, wār, **Meshech,** American colonial leader: b. Hampton Falls, N.H., June 16, 1713; d. there, Jan. 14, 1786. He was graduated at Harvard in 1735; studied theology and entered the ministry, which he gave up for the practice of law; was repeatedly sent to the legislature, and in 1782 was speaker. His later appointments included that of commissioner to the Albany Congress (q.v.) in 1774, justice and (1777) chief justice of the Superior Court of Judicature. He was also colonel of a militia regiment, and when the Revolution opened was appointed chairman of the Committee of Public Safety. Upon the reorganization of the state judiciary he was placed at its head. He raised troops for defense against Burgoyne, whose invasion he materially aided in repelling. In 1776, under the temporary constitution, he was elected president of the state, and was annually re-elected until 1784. Under the new constitution he was again elected president, but resigned before the expiration of his term.

WEASEL (*Putorius noveboracensis*), a fur-bearing mammal (q.v.), typical of the family Mustelidae. The body is elongated and slender, the head long, the legs short, the muzzle rounded and the tail short and slender. The feet have each five toes and are digitigrade and unwebbed. There are 34 teeth and the sectorial or flesh-tooth lacks an internal tubercle. The anal glands are developed and secrete a strong-smelling substance. The weasel attains a length of from 12 to 15 inches, of which the tail makes nearly one third. The male is larger than the female. Above, the color is brown; below, white or pale yellow the terminal one third of the tail black. In winter the fur becomes more or less white, but this change is complete only in the north and does not affect the black of the tail; in this white phase the animal is called an ermine (q.v.). The common weasel, in one or other of its varieties, inhabits the entire eastern United States, westward to Minnesota, south to North Carolina and north to Canada; and is replaced in most other parts of North America by more or less closely related species and in Eurasia by others, of which the Siberian ermine is its nearest ally. Owing to its retiring and nocturnal habits it is unknown to most people. It is plentiful even in the vicinity of large cities, where it renders efficient service in the destruction of vermin.

The European weasel (*P. vulgaris*) is slightly smaller than its American relative, reddish brown in color, but whitish underneath. (See POLECAT). The weasel is a highly courageous animal, and makes war on rats, mice, hares and rabbits, birds and many other small animals. During the summer it devours insects, but appears never to partake of a vegetable diet. Instances are on record in which these animals have attacked horses and cows, and they sometimes exhibit an utter indifference to the proximity of man. They are especially fond of eggs, and rob hen roosts and the nest of every wild bird which they find. Their mode of killing their prey is characteristic—since they usually fasten on to the neck of their victim, and hold firmly on while they suck the blood; next they eat the brains and only then the flesh. Like most of their near relatives they often kill much more than they require for food. They hunt by scent and are tireless in pursuit. Few animals are so active, and the slimness of their bodies enables them to explore every hole and hiding place of their prey. Weasels live in holes under stone walls, rocks and trees, in burrows captured by force from ground squirrels and woodchucks, in hollow stumps, etc. A nest of dried leaves and grasses is constructed and about five young are born in a litter. Consult Coues, *Fur-bearing Animals* (Washington 1877); Merriam, *Synopsis of the Weasels of North America* (Washington 1896).

WEATHER BUREAU, a United States government agency responsible under federal law for the maintenance of the national weather service with its organized network of stations. It is a bureau of the Department of Commerce. There are similar organizations in foreign countries operating under various names, as for example the Meteorological Service of Canada, Department of Transport. These organizations cooperate in the exchange of observations and other meteorological information to their mutual benefit.

General Functions.—The Weather Bureau's present network of about 10,000 reporting stations of all kinds, as of June 1, 1947, of which 418 are first-order stations manned and maintained by full-time civil service employees, provides the basic observational data required, both surface and upper-air, in as complete detail as is practicable. The observations are collected, charted, and analyzed to make them available to the public as weather forecasts, weather maps, storm, hurricane, and flood warnings, and in the final form of climatological summaries and other publications; all for the benefit of industry, air, land and water transport, commerce, business, engineering, agriculture, and many other national interests.

Research.—The Weather Bureau is also charged with the responsibility for research in atmospheric phenomena, especially as developed by upper-air observations and the resulting air-mass analyses. Among the considerable number of investigations currently in progress, mention will be made of solar radiation measurements; studies of the physics of thunderstorms; studies of icing on aircraft; investigations of changes in the ozone present in the upper atmosphere to determine the relation of such changes to large-scale movements and frontal developments of air masses; the invention, design, and testing of new instruments and apparatus, especially for measurements of cloud height (or ceiling), visibility,

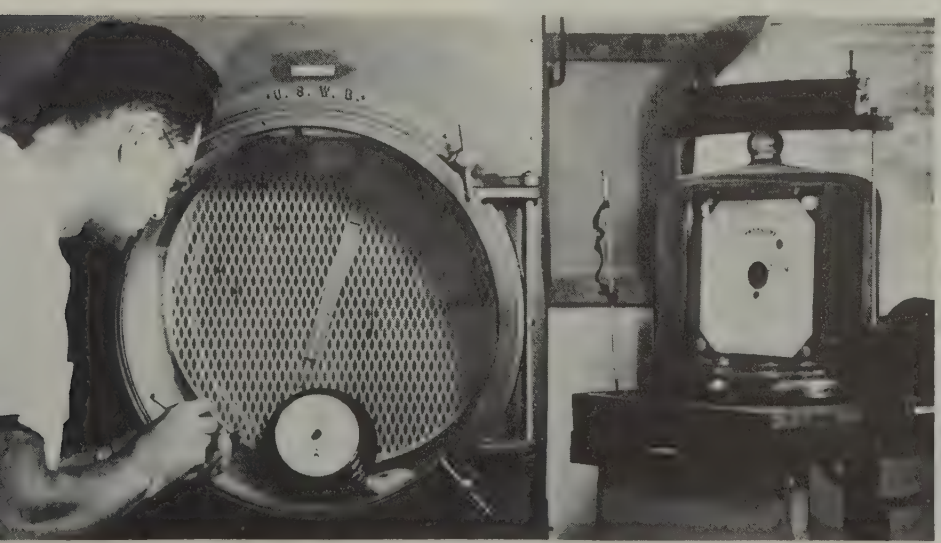
Above: The machine records climatic and atmospheric conditions transmitted from equipment on the roof of the United States Weather Bureau in Washington, D.C.

WEATHER BUREAU

Right: The instrument and storm warning tower at the Weather Bureau in New York. Wind velocities are recorded by an anemometer, the instrument on the left with four cups.

Below: The barometer testing apparatus at the Weather Bureau in New York is used for calibrating aneroid barometers on ships which serve as weather stations.

Ewing Galloway



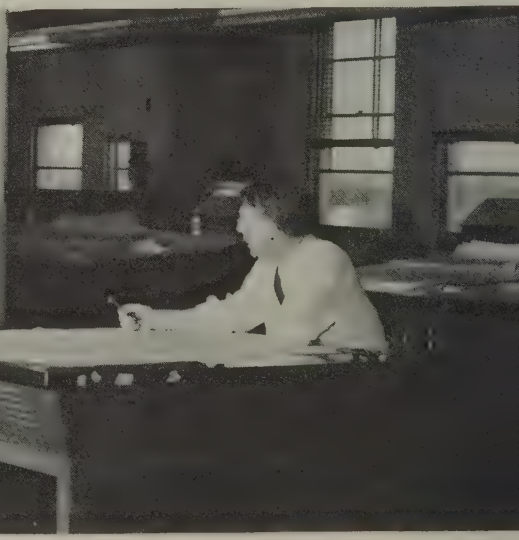
Above: The computer of the Joint Numerical Weather Project unit. Picture shows the control and input-output unit.

Far left: The Weather Bureau uses balloons to measure weather conditions in the upper atmosphere.

Left: This instrument on top of the Weather Bureau office in New York records the duration of sunshine in minutes.

(Above and below) United States Weather Bureau; (left and far left) Ewing Galloway, N.Y.

Below: Analysis of weather maps. By plotting on blank maps data from many weather stations, meteorologists chart the movements of the atmosphere at the earth's surface and up to 10 miles above.



and for upper-air soundings, also the improvement of older forms; the development of automatic weather stations for use in remote locations to transmit wind velocity, direction, relative humidity, temperature, and pressure by radio or wire to a central office; studies of precipitation intensities and their relation to runoff and flood control in selected watersheds; and numerous statistical studies in connection with storm movements, climatology, etc. These research projects have as their main objectives the improvement of forecasts for both short and long periods, largely for the benefit of rapidly-expanding and worldwide aviation, a better knowledge of the atmospheric circulation, an improved knowledge of the evolution of storms and allied phenomena, and a greater usefulness to the public of meteorological information in general.

The Weather Bureau has very broad authority of law for promoting the development of the science of meteorology. Research to that end has always been carried on by the bureau personnel although to a somewhat limited extent until recent years, for the bureau is essentially a service organization. Hence its activities have been directed very largely toward the development of its many services. As evidence of the valuation placed upon the work of the bureau, Dr. F. W. Reichelderfer, chief of bureau, was the recipient of the Robert W. Losey award for 1942, given because of his pioneering work and continued activity in advancing the science and practice of meteorology as applied to aeronautics, with particular recognition of the development under his direction of the network and system of upper-air soundings by radiosondes. The bureau has undertaken (1947) a project of large magnitude to study the causes and mechanisms of thunderstorms, with assistance from the military weather services and other agencies that have concern for research in this direction. The bureau is also engaging in fundamental studies of solar radiation, of the electrical influences that seem to be part of all cloud and precipitation formations, and of the use of radar for weather observing and forecasting.

History. — Keen observers and scientists knew in the 17th century that storms in our country along the Atlantic seaboard frequently moved northeastward to New England from some location in the southland, attended by strong northeast winds and heavy precipitation in advance of the storm center. But there could be no comprehensive study of such a storm with the plotting on a chart of atmospheric pressures, temperatures, etc., until suitable observations all made at the same time along the path and throughout the area covered by the storm could be secured. The value of forecasting such a storm was seen, but it was not until the invention and use of the telegraph in 1837 that such a chart and forecast even became possible. Some sporadic attempts were made before 1870 to do so, but such a development awaited the establishment of an organized government weather service covering the whole country, so that synoptic weather reports could be systematically collected and charted at forecast centers. This weather service was inaugurated by the approval on Feb. 9, 1870, of a joint resolution of Congress, and service actually started on November 1 of that year under the supervision of Gen. Albert J. Myer, as a part of the Signal Service of the army.

The plan of organization was largely due to Professor Cleveland Abbe, while the administrative functions were ably conducted by General Myer. Other civilian scientists, especially Dr. Increase Allen Lapham, gave their assistance to the undertaking. Dr. Lapham had long advocated the establishment of a government weather service, and he served at the Chicago station for a short period after the new service started. He is credited with having charted the first synoptic observations of the new service followed by a forecast.

The weather service continued as a part of the United States Army Signal Service until an act of Congress made it a part of the Department of Agriculture. The name had been changed to Signal Corps in 1880. During the period to 1891, at which time the meteorological organization of the government was named the Weather Bureau, growth was gradual and largely pioneering in character, and the issue of storm warnings and forecasts for the benefit of agriculture, shipping, and commerce were the most prominent. General Myer was succeeded by Gen. William B. Hazen who was followed by Gen. A. W. Greely, noted for his polar expeditions and other scientific achievements. The first civilian to become chief of the Weather Bureau was Professor Mark W. Harrington (1891–1895), succeeded in turn by Professor Willis L. Moore (1895–1913); by Professor Charles F. Marvin (1914–1933); Dr. Willis R. Gregg (1934–1938), and lastly by the present incumbent (1947), Dr. Francis W. Reichelderfer.

Effective June 30, 1940, the Weather Bureau was transferred to the Department of Commerce in accordance with the Fourth Plan of Government Reorganization. This change was due mostly to the need for the "better coordination of Government activities relating to aviation and to commerce generally, without in any way lessening the bureau's contribution to agriculture." (H. Doc. 692 76th Congress, 3d session.)

An index of the growth of the bureau is found in the expansion of the observational network of stations. This growth was gradual but steady until about 1930, when service for aviation began to be a dominant factor, coupled with the need for a denser network, especially those for upper-air soundings, required by the application to forecasting of the polar-front theory and its accompanying use of air-mass analysis methods.

Prior to 1930 impetus was given to the bureau's growth by the satisfying in part of the need for an adequate number of stations making observations for climatological purposes. This requirement was especially recognized in the act of Congress of Oct. 1, 1890 establishing the Weather Bureau, although considerable progress had been made in that direction during the administration of General Greely, when the opening of cooperative stations was a feature. Other factors were: (1) an increase of stations reporting precipitation and stream-gage heights, required for forecasting and hydrologic studies by the River and Flood Service; (2) stations for upper-air soundings, at first (1896–1931) by means of box kites carrying meteorographs aloft, and later by airplanes accomplishing similar results (1918–1938); by pilot balloons filled with hydrogen or helium permitted to ascend freely into the upper air, and, when observed by theodolites, providing means for determining

wind velocities and directions above the earth's surface, beneath a cloud layer if present. Pilot-balloon observations started in 1918, and there has been an increasing number of stations since, and in 1944 there were 160.

A considerable number of stations were opened about 1918 for observations of evaporation, and the additional requirements made on the bureau because of World War I left lasting impressions. When radio became useful as a means of communication in 1905 it became possible to make weather observations on ships at sea and to transmit reports to land stations, and thus augment, for the benefit of forecasting especially, the synoptic reports received from land stations. This resulted in the establishment of the Marine Meteorological Service of the bureau. Radio has also provided a means of securing through exchange or otherwise observations made in foreign countries, so that northern hemisphere weather maps could be prepared.

Since 1930 the outstanding development from the observational standpoint has been the advent of the radiosonde for upper-air soundings. Experimental flights started in 1936 and 1937, followed by the initial establishment of six regularly reporting stations in 1938, steadily developing to a total of 57 land stations by 1944, supplemented by a considerable but variable number of vessel stations. The radiosonde proper is essentially a low-powered, light-weight radio transmitter. It is carried aloft by a rubber balloon filled with helium. The device has the great advantage over other means of upper-air soundings, of providing quickly and without interruption because of weather, a record of the upper-air temperature, pressure and relative humidity. Soundings are made to heights as great as 60 to 70,000 feet above sea level. Radio impulses transmitted by the radiosonde are intercepted and recorded by a short-wave radio receiver and connected ground equipment. The values of the recorded frequencies are readily interpreted in terms of the meteorological elements named.

Measurements aloft provide information by which to determine the characteristics of air masses; the stability or instability of the atmosphere; the development of thunderstorms, and areas and levels at which icing of aircraft will occur. All of these data are vital to the safety and efficiency of flying operations, as well as for weather advices to business, industry, and the general public.

Another factor involved in expanding service has been the inauguration (1939) of six-hourly synoptic observations and reports from selected land stations, the observations in 1944 being made at 1:30 and 7:30 EST, A.M. and P.M. Such reporting was required for better forecasting, especially because of the needs of aviation. Route and terminal forecasts for airplanes began as early as 1930. Many stations, both first-order and substation, are now operating on a 24-hour schedule, which is especially true of airport offices and airway and district forecast centers.

Also important has been the development of the cooperative project of the War Department (Engineers) and the bureau, which started in 1939, having flood control as its principal objective. The project has required the establishment of many hydrologic stations provided with gages for measuring and/or recording precipitation in selected watersheds.

Organization.—The Weather Bureau is an organization comprised of a network of primary or first-order stations located at or near cities in the United States and its territories, with numerous substations for observations and service operations. Their joint activities are correlated and directed by the central office at Washington, D. C., with the help and closer supervision of eight regional offices, seven of them covering the continental United States, while region 8 comprises Alaska. The names of the cities where the regional offices are located, with their respective members, are (1) New York, N.Y.; (2) Atlanta, Ga.; (3) Chicago, Ill.; (4) Fort Worth, Texas; (5) Kansas City, Mo.; (6) Los Angeles, Calif.; (7) Seattle, Wash.; (8) Anchorage, Alaska.

Stations other than regional offices are classified and defined as follows: *First-order stations* are those at which public offices are maintained and manned by full-time civil service personnel. Such offices conduct the principal activities of the bureau program, including upper-air observations, and are located at so-called city offices, or at airports; in important cities there may be offices at both locations. The airport stations necessarily center on service to aviation; those at city offices care for the broader aspects of bureau work and contact with the public. At a number of places the airport station functions in both fields of work.

Substations are those where local weather observations are taken or storm warnings displayed, or other services performed by local personnel who are not full-time civil service employees. Substations furnishing synoptic or on-call observations are designated second-order stations; all others are termed third-order stations. *Second-order stations* for example are those along airways reporting at intervals of one hour, and those off-airway stations reporting every 3 or 6 hours. Hurricane stations reporting daily or oftener to district centers are also second-order. *Third-order stations* include the following: the cooperative stations making observations of weather, temperature, and precipitation daily for climatological purposes but without compensation to the observers; also the following where local employees usually receive nominal pay for part-time services: corn and wheat, cotton-region, and sugar and rice stations reporting to Weather Bureau collection centers daily during the growing season; storm warning and hurricane display stations maintained for the dissemination of warnings for the benefit of navigation, and the coastal regions and cities which may be endangered; flood-warning stations which distribute forecasts and warnings of floods for the benefit of river navigation and the protection of life and property in areas affected by floods; fruit-frost and other stations which observe and report when needed the weather factors involved; hydrologic stations where precipitation records are maintained for hydrologic studies conducted by the Weather Bureau and cooperating agencies; river and rainfall stations which make observations of precipitation and/or river stages for transmission to district centers for use in making river-stage forecasts; snowfall stations reporting snowfall and depth of snow mainly for irrigation and water-power interests; other snowfall stations reporting for the benefit of winter sports; and fire-weather stations for transmitting reports to district centers for use in forecasts to protect forests from fire damage, and assisting in the dissemination of such warnings.

CENTRAL OFFICE ORGANIZATION AND FUNCTIONS

Broadly speaking the central office organization is divided into three parts: (1) Administrative; (2) Technical, and (3) Scientific. The chief of bureau directs, supervises, and coordinates the activities of the bureau.

Administration.—Administrative activities, under an assistant chief of bureau for administration, are divided between a division of personnel management, a budget office, and a division of administrative services. The eight regional offices of the bureau also have important administrative responsibilities. The activities of this branch of the bureau, however, are in no way peculiar to the weather service, but are similar to the same sort of functions conducted generally throughout the government. The recruitment, training, and placement of personnel; the preparation of budget estimates; allotment of appropriations and accounting for expenditures; and the procurement of services, supplies, and property are the concern of these administrative groups. Questions on organizational form and coordination of management plans are also cleared through the office of assistant chief for administration.

Technical Services Organization.—*Assistant Chief Technical Services.*—The technical field operations of the bureau are organized under an assistant chief of bureau, with the following central management and planning divisions.

Division of Station Operations.—This division administers, with the assistance of regional offices, the basic meteorological observational networks, including planning, organization, and routine observations at duly authorized stations of all kinds; prepares instructions and procedures as to observations and meteorological records; supervises operation and installment of equipment for all types of upper-air stations; initiates recommendations on staffing of stations for action of personnel division; recommends on observational networks; and, in cooperation with the division of synoptic reports and forecasts, coordinates daily weather service.

Division of Climatic and Hydrologic Services.—This division has supervision of and responsibility for checking, compiling, and publishing of meteorological and climatological data (including land-surface, marine, and upper-air) for the United States and possessions, excepting such work as is delegated to state section centers; assembly of climatic data for such services and investigations as pertain to the needs of industry, agriculture, commerce, and transportation; preparation of special reports on climates of oceans and foreign areas; determination of effects of weather on crops; and the preparation of certificates for admiralty and other litigation.

This division also directs all hydrologic work of the bureau, including specialized studies of storm precipitation and maximum possible runoff, and provides general advisory supervision for all hydrologic, hydrometeorological, and hydroclimatic work carried on at the field stations and in the regional offices, including those for river and flood forecasts and warnings, mountain snowfall and hydroclimatic substation networks, and evaporation studies.

Division of Synoptic Reports and Forecasts.—Has general supervision and administration of weather forecasting services, from transmission of basic reports to final public distribution of all types of reports, forecasts and warning by bulletins, press, telephone, radio, and other means; coordination of daily weather service in cooperation with the division of station operations; supervision of communication schedules and the maintenance of open channels for domestic, foreign and maritime communications; preparation of transmission codes; and maintenance of operating relations with communications agencies. The division also maintains the international exchanges of weather reports and information.

Instrument Division.—Has general administration of matters pertaining to meteorological equipment, including determination of requirements as to type and quantity, preparation of specifications, initiation of procurement action, testing, installations, inspections, repairs, instrumental research, building plans, exhibits, and records. The work is carried on with the aid of a corps of engineers and physicists, a laboratory equipped especially for electronics, an instrument shop, and a section devoted entirely to the radiosonde program.

Scientific Services Organization.—*Assistant Chief for Scientific Services.*—Provides advisory service in scientific and professional matters pertaining to meteorology, climatology, and statistics, including climatological and meteorological statistics and research studies for essential economic activities; supervision of authorized research projects including forecasting for the improvement of the service; general direction of approved scientific and professional training activities.

Division of Special Scientific Services.—This division is responsible for basic work in improving methods of forecasting; the preparation and verification of advisory extended forecasts for forecasters of the bureau; investigations in the physical and dynamic aspects of atmospheric problems; coordination of bureau research in forecasting and related special research projects. It also directs, plans and supervises special statistical studies of specific weather behavior.

Division of Physical Research.—A new division to engage in fundamental physical investigations, with special reference to the processes of formation and precipitation of condensed moisture, is being organized in 1947. This division will also deal with problems involving the use and application of modern electronic principles in the detection and measurement of atmospheric phenomena and their variations.

REGIONAL ORGANIZATION AND FUNCTIONS

The eight regions into which the United States and possessions are divided for the more efficient administration of the activities of the bureau, are each manned by a regional director, an executive assistant, a regional operations official, hydrologic engineer, property clerk, and a number of other assistants, all assigned to the regional office.

The regional director is the administrative representative of the central office, and his office coordinates all types of service in the region, subject to the policies and regulations of the central office. The regional office has general field supervision of all the substation activities and networks in the region excepting those delegated to certain first-order stations for more efficient handling, and the operations officer is required to assist the regional director in coordinating all station inspections. He also supervises the inspec-

tion staffs and personally inspects first-order stations in collaboration with district forecasters when required. The hydrologic service is administered by regional directors with the active assistance of the hydrologic engineers. Regional fiscal, personnel and property transactions are also handled by a specialized administrative staff in the regional offices.

District Forecast Centers.—Each of the twelve centers in continental United States (also one in Alaska) is primarily responsible for all forecasts for its district and for their distribution. Each center also operates as a first-order station and is subject to the general administration of the regional office having jurisdiction.

Washington National Airport Station is an example of the organization required for district and airway forecasting, and for taking surface and upper-air observations required in whole or in part of all synoptic-reporting stations. In addition a flight watch is maintained especially for the benefit of aviation. A meteorologist is responsible as official in charge for the general administration of the station. Continuous service is necessary, and forecast charts are prepared at least four times during each 24 hours to utilize the many observations received mostly by teletype and a few by telegraph. There are many hourly observations received also by teletype from stations along the several airways centering at Washington.

Weather forecasting and general services require four groups of forecasters under a leading forecaster: one group of four for district forecasts, covering the states of New York, Pennsylvania. New Jersey, Delaware, Maryland, Virginia, West Virginia, Kentucky, and Tennessee; another of five for airway forecasts; five for the flight watch, and nine for trans-Atlantic flight forecasting and pilot briefing.

The preparation of maps and charts requires the services of twenty-four men and women. Weather observing services require nine observers, three for the twice-daily radiosonde ascensions and six for surface and pilot-balloon observations. Another activity requiring considerable personnel cares for the analysis and verification of records and forms received from Weather Bureau radiosonde stations in the field.

Climatological Section Centers.—These are first-order stations where the climatological work of a state or a group of states is carried on. There are 43 of them: one for New England, one for Maryland and Delaware, and one for each of the other states and for Alaska, the Hawaiian Islands, and Puerto Rico, including the West Indies. Each section center selects and instructs the cooperative observers and the weather-crop correspondents, and prepares climatological publications and reports for the section. Inspections of such stations are regularly a function of the regional office where substation inspections of all kinds are centered, but joint inspections with section center personnel are made when necessary.

Under a new item of appropriations for fiscal year 1948, it is expected that the processing of climatological records will be done by modern machine-card methods.

River District Centers; River and Flood Service.—Such centers are responsible for and have the direct management of the substation network in their respective districts, from which daily reports of river stages and precipitation are received and form the basis for the flood warnings and forecasts issued from the district center.

The appropriate regional office coordinates all flood reports and clears all recommendations relative to substation changes. Regional office hydrologic engineers, acting under the general supervision of the hydrologic director in the central office, assist the river district centers in matters concerning changes and developments of river and flood forecasting procedures, and assist in flood emergencies.

SERVICES

The public requires weather information and service along three principal lines which are interdependent and closely related: (1) the forecasting of the weather, usually rated as the most important; (2) the reporting of current or very recent weather conditions and elements, such as are found on weather maps and bulletins, or which are made public by telephone or radio; and (3) the records of past weather, as given by averages or normals of the meteorological elements, or the departures therefrom, such as are published in climatological and monthly meterological summaries, in the *Weekly Weather and Crop Bulletin,* the *United States Meteorological Yearbook,* the *Monthly Weather Review* and others; all of which include interesting comparisons of current weather with the normals. It has been estimated that services required and rendered by the Weather Bureau increased by 200 per cent from 1935 to 1944.

The observation-station networks provide basic data in all three of the above categories; hence the far-reaching importance of accurate instruments and of accurate reading and reporting, toward which competence the in-service training of new observer employees is directed. Speed and timing are also important, especially where forecasting is the main objective, in order that forecasts may reach waiting users quickly for prompt application to operations in commerce, agriculture, aviation, and many other activities.

The many synoptic reports, both surface and upper-air, are promptly charted and analyzed at forecast centers, and soon the forecasts are in evidence on the radio, in the newspapers, on the automatic telephone, and often by telegraph messages sent direct to important users.

Operating Functions of the Weather Bureau.—These are shown in picture form in Fig. 1, the sources of weather reports appearing on the left hand, the operations of forecast and other centers, where the material is charted, analyzed, or processed for use, are shown in the center, followed on the right by the several ways and means of effectually reaching the public. The systematic and efficient handling by teletype, telegraph, and radio of all of these reports through the several "collection centers and selective distribution headquarters," is in itself a work of major importance, involving the use of number codes and the most intensive planning and execution. This work is administered by the division of synoptic reports and forecasts of the central office with the cooperating field stations. Full use is made of the teletype and other communication facilities provided by the Civil Aeronautics Administration.

General Weather Service.—This is the service best known to the public, which provides the current weather reports and frequent forecasts, usually for short periods of time. State fore-

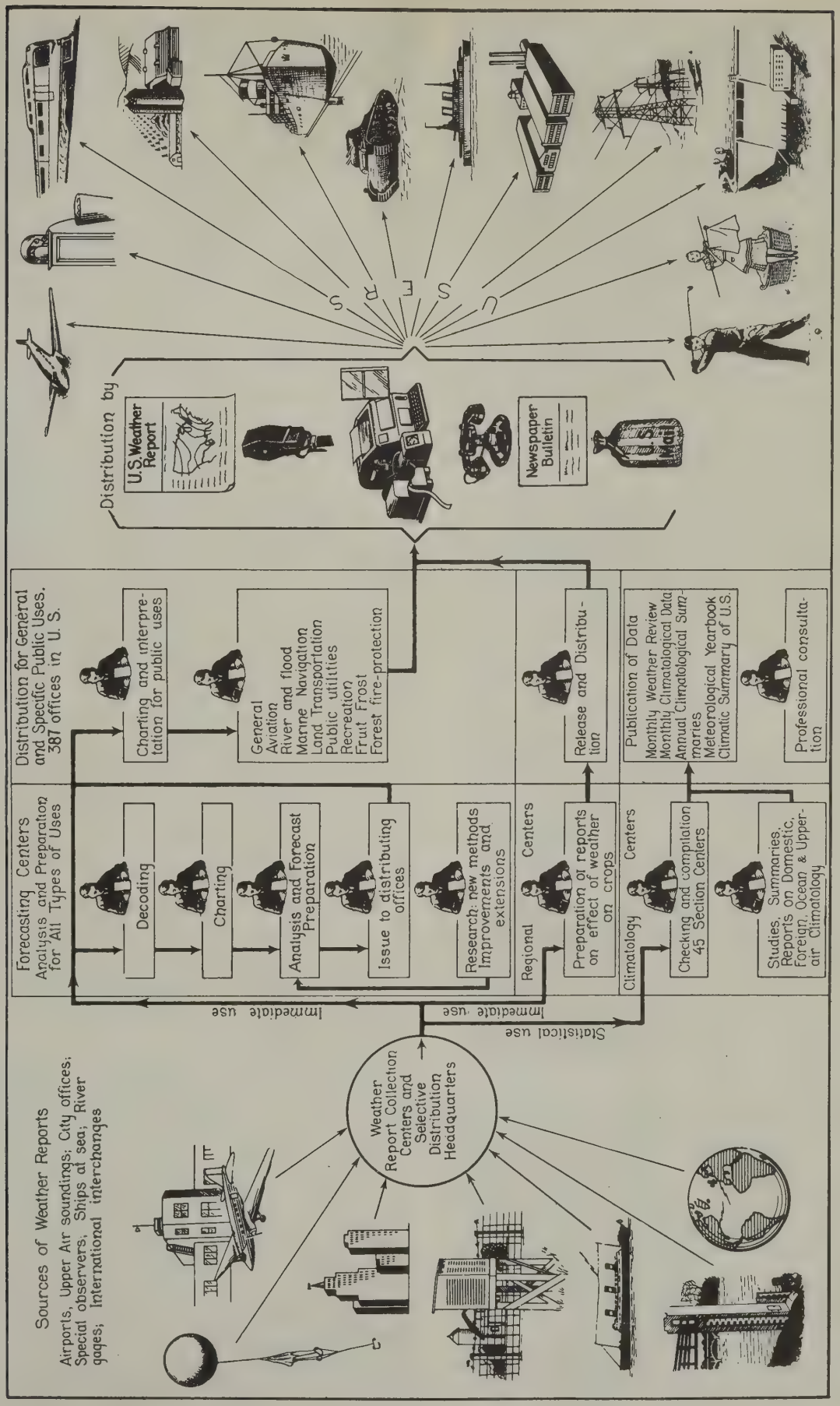


FIG. 1. How the Weather Bureau works.

casts are issued by the district forecast centers, and local forecasts by the several Weather Bureau offices authorized to prepare and issue the same. The local forecasts are modifications of the state forecasts which take into account the peculiarities of weather in and near the cities where the local forecasts originate. Distribution is made effective mostly through the radio and the newspapers, especially the former which reaches far and wide, even to vessels at sea. The distribution of printed bulletins and maps by the Weather Bureau, usually by mail, is also important, although not so expeditious as radio and telephone. The teletype linking airway and airport stations with drops to nearby city offices of the bureau, is also a valuable and practically indispensable factor in the communications system, both for the collection of reports and the means for ready access to many Weather Bureau offices and others, thereby bringing them the forecasts, warnings, and other important information direct for quick redistribution, or such usage as is necessary. Much information reaches the public through personal telephone inquiries made to Weather Bureau offices, and in times of emergencies such service reaches large proportions.

Summarizing, district forecast centers issue state, coastal, marine, and general forecasts; also warnings of storm, whole gale, hurricane, cold waves, blizzards, frost and freezing temperatures, glaze or freezing rain, heavy rains and other special warnings and services for areas and particular interests within their respective districts, such as those for fire-weather, fruit spray, or winter sports. There is also a service for reporting severe local storms such as tornadoes, thunderstorms, hail storms, and the high winds usually experienced under such conditions. Reports are gathered at collecting centers, and forecasts and warnings issued when possible of individual local storms or groups of storms. The direction of movement and future intensity of such storms can be estimated with a considerable degree of accuracy for several hours in advance and warnings can be issued which will protect life and property. This service is in effect in the Gulf states, and the interior valleys and Great Plains states.

Aviation Weather Service.—This important and growing service was authorized by the Air Commerce Act of 1926 and given its present form by the Civil Aeronautics Act of 1938. These acts place the responsibility upon the Weather Bureau of providing an adequate meteorological service for the benefit of aviation and thus "to promote the safety and efficiency of air navigation in the United States and above the high seas."

The needs of this service require the taking of land-surface and upper-air observations, every hour at least for the former at stations along the airways, and at intervals of three to six hours at off-airway stations. On-call stations make reports when requested. The upper-air pilot-balloon stations report every six hours, and the radiosonde stations twice daily as a rule. There are nearly 600 airway substations, mostly on the airways, and the airway observation network includes the Weather Bureau first-order stations which add regular land-surface observations in addition to the upper-air.

Reports are assembled promptly at airway forecasting centers and airway terminals. Forecasts are made currently available for aircraft in flight and the observational data also to others needing complete information. Such data are also summarized in a form suitable for analysis and publication; all in all the service is organized and operates especially as a direct aid to air navigation.

Forecasts are issued for all civil airways, specified regions, and individual terminals for a period usually not exceeding 12 hours. Airway forecasters also make use of the state forecasts issued by the district forecast centers. Trip or route forecasts which are based upon the general forecasts but which are supplemented by any more recent reports from points en route are issued for individual flights upon request. Service is also made available upon request to off-airway airports.

Flight Advisory Weather Service.—This new service was organized and established in the latter part of 1943 at Civil Aeronautics Administration traffic control centers. It provides current weather information, and similar prospective information for the immediate future, for transmission to pilots in flight or for control of air traffic. The object is to provide a greater degree of safety in flight, the information being based on weather trends or short-period forecasts, and current weather reports, both from land stations and conditions aloft as reported by airplanes in flight or determined by upper-air observations with pilot-balloon and radiosondes.

The service is made fully efficient and dependable by the active and close collaboration of Weather Bureau forecasters, observers, and other station personnel, with officials and employees of the airway traffic control and airway communications stations.

Hurricane and Storm-warning Service.—Hurricane warnings, advisories, and preliminary hurricane alerts are issued from the forecast centers at Miami, New Orleans, San Juan (Puerto Rico), Washington, Boston, Los Angeles, and San Francisco. Alerts are ordered to cover a period of uncertainty during which winds of hurricane force may endanger a locality or area within 24 to 36 hours when conditions do not as yet warrant a definite warning.

When a hurricane or other tropical disturbance, developing or in progress, is at such a distance as not to warrant the issue of an alert or a hurricane warning for any land area, an advisory warning, if required, will be issued. This is done so that communities in the probable path of the storm may be placed on guard well in advance of the storm and be kept informed as to its movement and development.

Storm and small craft warnings are issued for the aid of marine shipping and other interests on the Great Lakes and the seacoasts of the United States and its possessions, and, when required, for vessels plying the sea lanes leading thereto. Hurricane warnings are usually confined to the Gulf and South Atlantic coasts, but sometimes are required for the Middle and North Atlantic coasts and the South Pacific coast as well.

Distribution of warnings is made in the usual way on the Great Lakes and most of the seacoasts, but during the hurricane season, June to October, inclusive, use is made of a special teletype system along the Gulf and South Atlantic coasts, reaching inland also to such cities as Atlanta, New Orleans, Houston, and San Antonio. This teletype aids greatly in quickly reaching the connected Weather Bureau stations and other in-

terests when these usually destructive storms are imminent. It serves also in disseminating the very essential reports received from the special hurricane observing stations and from vessels located in the West Indies and contiguous areas where these storms often have their origin. Such observations, particularly needed by forecast centers, are received by radio and wire at collection centers and placed on the teletype, so that they are quickly available at forecast offices.

Storm and hurricane warnings also reach the public by display of flags and electric lanterns, mostly where steel towers have been erected by the bureau especially for the purpose. There are nearly 500 of such special display stations, located as a rule where passing vessels can readily see the flags and lanterns.

River and Flood Forecasting Service.—This important service is maintained in the public interest for the primary purpose of preparing and issuing forecasts and warnings of damaging floods, and of providing forecasts and other information for those interests concerned in the normal or low-river stages. Most of the navigable rivers are covered by this service.

The continental United States is divided at this time (1947) into 86 river districts each with its forecast center, and there are nearly 2,500 substations reporting rainfall and/or river stages, snowfall, and evaporation. Specialized river forecast centers are maintained at Cincinnati (for the Ohio Basin), and at Kansas City (for the Missouri Basin). These centers prepare general river and flood forecasts, using the most modern hydrologic techniques, which are communicated to the local river district centers for their guidance and detailed application to their respective areas of responsibility. Several more such centers are contemplated.

Forecasts are based upon the observational data coupled with a thorough knowledge of watershed runoff and other factors governing the expected water stages and the time of the occurrence. Such forecasts have a high degree of accuracy, and the protection and savings of life and property resulting from their use is very large.

Services of this activity include also the determination of available water supply for irrigation, hydroelectric power-plant usage, etc. resulting from the melting of snow in the spring and early summer which has accumulated in natural storage in the mountain regions of the west.

Hydrometeorological Service.—Specialized services for flood control and reclamation engineering are maintained. Techniques are developed for estimating the maximum possible precipitation and available runoff from certain watersheds under investigation to determine the meteorological factors bearing upon flood-control and reclamation projects. Such investigations require dense networks of precipitation-measuring stations, using both recording and non-recording gages. The results of such studies will be found ultimately in the comparative freedom from damaging floods of watersheds where flood-control measures and works are introduced and built under the direction of the War Department engineers.

Climatological and Crop-Weather Services.—The main objective of these services may be summarized as follows: To determine the climatic characteristics of the United States and its possessions, requiring the publication of climatic data in such form as to be readily understood by the public; to make necessary studies of the climates of foreign lands; to supervise the collection and publication of reports showing the effect of weather on crops; and in general to analyze statistically the observational data involved.

Land-surface observations are made mostly by the many so-called cooperative observers serving without pay, of which there are now (1947) more than 5,600. These are supplemented by numerous observations from other land stations, for example the airway stations, and all first-order stations make observations for climatological purposes, often both surface and upper-air. The continued processing of such data over long periods of time results in the determination of the normals, extremes, departures from normals, of the several meteorological elements, which when combined constitute the climatology of a city, a state, or a region. Climatology, briefly, is based upon regular, daily observations of weather, temperature, wind, precipitation, and other elements from a widespread network of stations.

A featured service of long standing is the issue of weekly bulletins showing the relation of crop production to current weather. The principal publication, called the *Weekly Weather and Crop Bulletin,* is issued from the central office at Washington, D. C. It contains a summary of weather conditions for the past week for the entire United States, accompanied by statistics giving the precipitation and mean temperature for the week and their departures from normal. This material is supplemented by a general summary of crop conditions and work as affected by the current weather followed by individual reports from the various states.

Other similar bulletins are issued by field stations; one from New Orleans covering the valuable cotton crop, and also sugar and rice; and other bulletins are issued by state section centers in regions where corn and wheat production is of major importance.

The tabulation and analysis of climatological records by modern machine-card processes is being instituted. New climatological facts, of great importance to the national economy, but hitherto not available by hand methods of analysis and computation, will be readily available by use of this new and modern technique of processing the voluminous records from many years of observations.

Marine Meteorological Service.—The purpose of this important service is to obtain surface and upper-air weather reports from vessels at sea, preferably synoptic reports to supplement those obtained from land stations. In turn the Weather Bureau furnishes vessels at sea as needed with forecasts, storm and hurricane warnings, and other useful information. The service fosters improvement in the accuracy standards both of the instruments employed and the observing technique, especially as regards the barometers, the readings of which are used in charting pressure areas and locating storms. The meteorological reports of whatever kind are all valuable in the compilation of ocean weather summaries and for studies of marine climate, storms at sea, and weather conditions affecting transoceanic aviation.

Every effort is made to encourage the cooperation of vessels at sea, especially those of American registry, in furnishing reports, and also

to transmitting these reports by radio to foreign meteorological services. Under normal conditions broadcasts by radio of "major weather bulletins" are made over the several naval radio stations, so that vessels at sea may receive sufficient reports to prepare weather maps, thus contributing to the safety of life and property at sea. Such broadcasts also describe fully the weather prevailing between southern North America and northern South America and from the Bahamas to the mid-Pacific.

The accumulated observational data has been used during the past several years especially in improving the pilot charts issued by the Hydrographic Office of the United States Navy. These charts provide special wind data, fog and gale frequencies, and average wind and weather conditions at sea.

The radio-reporting service for the North Atlantic is supervised by the Weather Bureau Office at New York City, that for the Gulf of Mexico and the Caribbean by New Orleans, the Pacific Ocean by San Francisco, and the Great Lakes by Cleveland. The work is further divided among the rather numerous port stations where bureau offices are located. Such stations collect marine weather reports, make personal contacts with ships' officers and shipping companies, keep the observers furnished with supplies and forms and make careful inspections and comparisons with standards of the meteorological instruments aboard ship.

Special Forecast and Warning Services.—District forecast centers assisted by local Weather Bureau offices prepare and issue special forecasts and warnings affecting public utilities, important industrial organizations, manufacturing establishments, military and naval authorities, hydroelectric flood control projects, and construction jobs. Other special forecasts enable the farmer to plan his harvesting, the spraying of fruit and vegetables and other operations. Livestock and poultry interests also receive warning of conditions affecting them, such as blizzards, cold waves, heavy snows, low temperatures, floods, or cold rains with strong winds.

Highway Forecasts.—Close cooperation exists between the bureau and state highway patrols and maintenance departments and current weather information is made available promptly to the public in the interest of safety. Warnings of heavy snows, cold waves, freezing rain, floods, and such factors as endanger motor traffic and other interests, are of particular value. Such forecasts are often confined to local areas of 100 miles or so radius about the issuing station.

Winter Sports.—Places where winter sports are important receive special forecasts during the winter season each Thursday or Friday or oftener. Special bulletins are issued by local Weather Bureau offices and given distribution by press, radio, mail, and other means.

Special Forecasts and Warnings for Horticulture.—Under this heading the special forecasts and warnings issued by the fruit-frost forecast centers stand foremost. Knowledge of expected minimum temperatures and accompanying weather conditions enables the orchardists and others to protect fruit crops from damage usually by heating the orchards above the critical minimum. Forecasts are based on the general synoptic weather conditions coupled with current reports, especially of temperature, received from numerous stations located in or near the areas affected. Such service is particularly valuable in the protection of the citrus fruits and winter vegetables of California, Florida, and the lower Rio Grande Valley. It has been in operation in California since 1913. Other fruits are also protected from frost damage by suitable means, not only deciduous tree fruits but small fruits such as strawberries or cranberries. Shippers receive separate temperature forecasts which enable them to counteract expected low or high temperatures, especially the former, to be experienced by perishable products in shipment en route.

Fire-Weather Forecast and Warning Service.—This important service involves forecasting in its relation to the protection of our valuable forests from fires which are started by lightning or accidentally, when weather and other conditions are favorable. Protection is made possible through an accurate knowledge of current weather, relative humidity, moisture, temperature, wind direction and velocity, and visibility, taken together with forecasts of changes affecting the degree of hazard from fire. Forecasts of wind, precipitation, and thunderstorms accompanied by lightning from cloud to earth, are especially valuable, as they affect the starting, progress, and control of forest fires. The Forest Service of the Department of Agriculture and the Weather Bureau have long collaborated in this important work of protecting and conserving our forests. Other cooperating agencies render valuable assistance such as the National Park Service, the Indian Service, the Grazing Service, together with state, county and private forest protection agencies.

W. F. McDonald,
United States Weather Bureau.

WEATHER MAPS. See Meteorology.

WEATHER SIGNALS. See Signals and Signaling.

WEATHERFORD, wĕth'ĕr-fĕrd, **William,** (known also as Red Eagle), American Creek Indian chief: b. Creek Settlement, Ala., about 1780; d. Monroe County, Ala., Mar. 9, 1824. At the outbreak of the Creek War he led the attack on Fort Mims, Aug. 30, 1813, and the massacre of some 500 victims—men, women, and children. Also he was one of the leaders of the Creek Indians at Horseshoe Bend, Jan. 27, 1814, and was defeated by Andrew Jackson, after which he surrendered. He lived at peace thereafter on a plantation among the white people of Monroe County.

WEATHERFORD, city, Oklahoma, in Custer County, altitude 1,644 feet, served by the Chicago, Rock Island and Pacific Railroad, is situated 14 miles east of Clinton. It is the trade center of a wheat and cotton area; its industries are: cotton ginning, and the manufacture of wood products. Weatherford is the seat of the Southwestern Institute of Technology; nearby is an Indian hospital. The city was founded in 1893. Pop. (1950) 3,529.

WEATHERFORD, city, Texas, seat of Parker County, altitude 864 feet, is served by the Texas and Pacific; and the Gulf, Colorado and Santa Fe railroads. It is located 27 miles west of Fort Worth, and is the trading center for a rich agricultural region, and the market center for its products: melons, cotton, grains, pecans, peanuts, and cattle. The local industries

are: cottonseed and peanut oil milling, pecan shelling, and grain milling; the manufactures are: oil-field equipment and clothing. There are limestone and clay deposits in the locality. The city has a junior college (state; coeducational), a Carnegie library, a high school and a hospital. First settled in 1850, and incorporated in 1856, the city's charter dates from 1858. Its water, electric lighting, and gas systems are city owned and operated. Government is by a mayor and council. Pop. (1940) 5,924; (1950) 8,093.

WEATHERING, wĕth'ĕr-ĭng, a geological term which describes the gradual action of the atmosphere upon rock material. See also GEOLOGY—*Petrography and Petrology;* METAMORPHIC ROCKS.

The term is also used in architecture to describe outward sloping at cornices, window sills, etc., to throw off rain.

WEATHERLY, wĕth'ĕr-lĭ, **Frederic Edward,** English lawyer, and writer of popular songs: b. Portshead, Somerset, Eng., Oct. 4, 1848; d. Bathwick, England, Sept. 7, 1929. He was graduated from Oxford University in 1871, and called to the bar of the Inner Temple, London, in 1887. Among his many popular songs are: *Nancy Lee, Darby and Joan, London Bridge, Danny Boy,* and *Roses of Picardy.* He was also the author of various books of verse and other volumes of academic interest.

WEAVER, wē'vĕr, **Aaron Ward,** American naval officer: b. District of Columbia, July 1, 1832; d. Oct. 2, 1919. He was graduated from the United States Naval Academy in 1854, and became lieutenant in 1855. In 1858–1859 he cruised along the African coast in the sloop *Marion,* and returned in command of the prize slaver *Ardennes.* Having served in the Union Army with distinction through the Civil War, he was made commander in 1866, captain in 1876, and rear admiral in 1893, in September of which year he retired.

WEAVER, Emily Poynton, Canadian author: b. near Manchester, Eng., in 1865; d. Toronto, Ont., Can., March 11, 1943. She removed with her parents to Canada in 1880, and subsequently lived in Oxford County, Ontario, and in Halifax, Nova Scotia, and Toronto. She became known as a writer of short fiction, historical essays for magazines, and author of several books, among them *My Lady Nell* (1889); *The Rainproof Invention* (1896); *Builders of the Dominion* (1907); *The Trouble Man* (1911); *Canada and the British Immigrant* (1914); and *The Book of Canada* (1928).

WEAVER, James Baird, American lawyer and politician: b. Dayton, Ohio, June 12, 1833; d. Des Moines, Iowa, Feb. 6, 1912. He was graduated from Ohio University Law School, 1854, and began practice at Bloomfield, Iowa. In 1861 he entered the Union Army, was promoted colonel in 1862, and brevetted brigadier general in March 1864. In 1866–1870 he was district attorney, second judicial district of Iowa, and in 1867–1873 assessor of internal revenue first Iowa district. For some time he was editor of the Iowa *Tribune,* published at Des Moines. He took an active part in the organization of the Greenback Party and was elected to Congress on its ticket in 1879, serving one term. In 1880 he was the Greenback candidate for president, receiving over 300,000 popular votes. Later he was affiliated with the People's Party and was a delegate to the National Convention in 1892 and again nominated for the presidency when he won 22 electoral votes and a popular vote of 1,041,021. After 1895 he lived in Colfax, Iowa, and was mayor of that city from 1903–1906. He wrote *A Call to Action* (1892), and *Past and Present of Jasper County, Iowa* (1912).

WEAVER, Jonathan, American clergyman, bishop of the United Brethren in Christ: b. Carroll County, Ohio, Feb. 23, 1824; d. Dayton, Ohio, Feb. 6, 1901. Educated in the common schools and the Hagerston Academy, Ohio, he began to preach in 1845 but did not join a conference until 1847. After serving several appointments he became presiding elder in 1852 and was agent for Otterbein University, Westerville, Ohio, from 1857 to 1865 when he was elected bishop. In 1893 he became bishop emeritus. He was one of the greatest leaders of his church and was the author of a number of books on theological subjects.

WEAVERBIRD or **WEAVER,** a bird of the Ploceidae family remarkable for their nests many of which are marvelously woven. The family ranges almost throughout the Old World and includes the Old World sparrows (e.g., the house sparrow, *Passer domesticus*). The weavers themselves number well over 200 species. They range the tropics and southward to South Africa and Tasmania and include the Java sparrow (*Padda oryzivora*) and the Australian finches. They run from 3 to 10 inches in length, besides long-tailed kinds up to 20 inches, and closely resemble true finches (Fringillidae), having the finch types of bill, moderate wings with the outer primary quill better developed, short to very long tail and even more varied coloring often with great differences due to sex, age and—less often—season.

Weavers are extremely social and many breed in colonies. All nests are domed, the entrance—often tubular—at the side or bottom. There is no more beautifully woven nest than that of the bayas (*Ploceus*) of tropic Asia (but not the Philippines) of grass and strips of palm leaf, retort-shaped with an entrance tube of some inches, even up to three feet, at the bottom and hung by a short rope of the same material from the tip of a tree branch, often over water, sometimes from a building, and usually secure from climbing enemies. Both sexes work on it, and when finished the male commonly builds others, for which he may get other mates, and an unfinished one, a dome over a woven perch, serves as a sheltered roost for himself. Some weavers nest in bushes, some in tall grass; some use twigs, sometimes thorny ones, and the white-headed weaver (*Dinemellia dinemelli*) strews the branches of its nest-tree with thorny twigs which may deter small climbers. The nests of one species of weaverbird, the sociable grosbeak (*Philhetaerus socius*), of Africa, composed solely of grass, are built cooperatively. They are joined together in aggregated masses, sometimes as many as 100 to 200, or more, and all are entered from the bottom of the mass. They have the appearance of a huge mushroom, at a distance sometimes mistaken for a native hut.

The black and yellow weaver (*Textor cucullatus*) nests in conspicuous colonies in trees usu-

ally among houses, and has been introduced and established in Hispaniola as have two other smaller African species in Puerto Rico. Well-known groups are the tiny waxbills and mannikins, the black and flame-colored (yellow to red) bishops and the long-tailed widowbirds or whydahs. Females, young and winter males of bishops and whydahs are sparrow-like.

Consult Bartlett, *Monograph of the Weaverbirds* (Maidstone 1888).

WEAVERS, The. The misery of the Silesian weavers of the second quarter of the 19th century, which inspired Heine to a moving ballad, is the theme of Gerhart Hauptmann's best known play. Hauptmann derived his intimate feeling for it chiefly from the lips of his grandfather, one of the actual sufferers; and in his work *Die Weber* (*The Weavers* 1892) he has given to industrial revolution a stronger sanction than can be found in any other dramatic work whatever. *Die Weber* is rather a series of five one-act dramas than a drama in five acts. Different groups of persons appear in five different places. But the persons belong to the same community, they pass to and fro, and the five acts, each a unit with skilful exposition and a theatrical conclusion, constitute a greater whole, in which rebellion is carried to temporary success, but which is mainly impressive for the presentation of conditions that cry out for a remedy. There is no hero; every person is an integral character, every one a reality, and to the tragedy of starvation as the only reward for toil is added the pathos of vicarious atonement: an old weaver who refuses to leave his loom in order to join his fellows in rebellion is shot by a stray bullet. Hauptmann's method is unqualifiedly naturalistic. The play was first written in the harsh Silesian dialect, and the revised form in general circulation is only approximated to the literary language. It smacks of the soil. Its power resides in its apparent artlessness, in the impressiveness of truth naked and unadorned. There is, however, in a treatment of squalor which arouses unmixed sympathy a high degree of art, as there is also a preachment the more eloquent for being left to be inferred. Its text is the simple precept, give them their daily bread.

WILLIAM G. HOWARD.

WEAVING, Hand Loomed. Weaving is the crosswise interlacing of at least two sets of parallel fibers or threads of any kind. These may be the whole leaves, bark or other parts of natural plants; the prepared plant fibers such as cotton thread or paper; animal fibers such as silk or wool, or leather strips; wire or flat strips made from metals such as gold or silver; spun yarns from minerals such as asbestos or glass; or various man-made, chemically prepared fibers such as rayon and nylon. The purpose of weaving is to lock the separate fibers or strands into a connected, orderly expanse or web of desired size.

The first set of threads, which extended lengthwise in front of the weaver provides the foundation for the cloth, is called the warp. The cut ends of warp threads are called warp ends. The second set, interlaced in an alternate under and over sequence to fill the spaces across the width of the warp, is called the weft or woof. The sequence and spacing in which the two sets of fibers are interlaced determines the kind of weave which will be produced.

The interlacing may be done entirely by hand without the use of any frame or mechanical device, particularly if reeds, grasses, leaves or other relatively stiff, short fibers are to be woven as in the case of some types of grass mats. This is achieved by laying the warp in parallel rows on the ground or on lap boards, such as those used in the Marshall Islands, and guiding the weft fibers alternately over and under the warp strands, thus locking the two groups together.

The method is not, however, practical for weaving long lengths of cloth and hand loom weaving is, therefore, done on a frame to which the warp threads are attached and held at a suitable tension to keep them in an even, parallel position. In this way the weft may more easily and quickly be guided into place either with the fingers alone or with the aid of a shuttle. The shuttle, which may be merely a twig or thin stick, holds the supply of weft thread. Each passage of the weft across the alternate warp threads is called a shot or pick, the work generally, but not always, starting at the end nearest the weaver and progressing toward the distant end of the warp.

Shuttles.—The implement around which the weft supply is wound and passed across the warp to form a web is called a shuttle. It is designed in many variations which may be divided into two main categories—those from which the weft must be unwound by hand and those constructed with a revolving bobbin or quill to unwind automatically when being used. They are chosen according to the preference and convenience of the weaver. In some cases shuttles are not used at all, the weft simply being used in short, stiff lengths or wound into a ball that can be passed between the warp layers when needed.

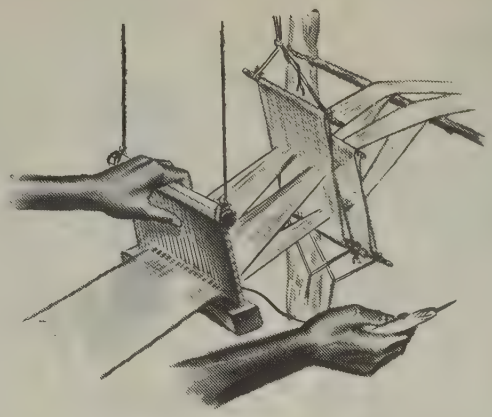
Weaver's Comb or Reed.—The woven rows of stiff grasses and reeds, when a special implement is lacking, can be pressed together compactly by the pressure of the weaver's fingers, but when soft, flexible fibers in the form of cord or yarn are used a better, less tiring method is necessary. The need was at first filled by a notched or forked twig or a piece of bone, which later was developed into a short handled comb known as a weaver's comb. Still later the need for an improvement was filled by the reed or sley, a device that was developed for another purpose and which was actually made of reeds that grew near the weaver's dwelling. Thus used it represents the third of the earliest major loom improvements in hand loom weaving.

Looms.—Most hand looms are equipped with rollers at the back and front of the frame, for storing the supply of warp to be woven and for the finished cloth. They have, in addition, a simple automatic method of raising or lowering the alternating groups of warp threads as they are needed, in conjunction with which they are also equipped with either hand or foot levers.

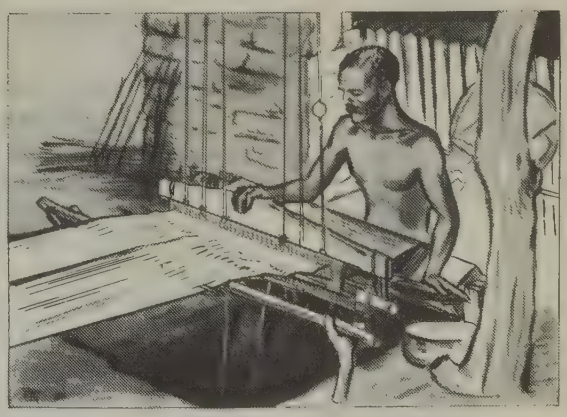
The frames used for all types of weaving are called looms.

The most intricate forms of weaving can be, and sometimes are, done on the simplest of looms, but the work, especially where complex patterns are desired, is arduous and exceedingly slow; therefore, over many centuries ingenious minds have devised many loom improvements to accelerate and lighten the task. These improved looms, while adding immeasurably to the speed at which the weaving may progress, have in no way changed the fundamental principle of interlacing the fibers or threads.

WEAVING, HAND LOOM

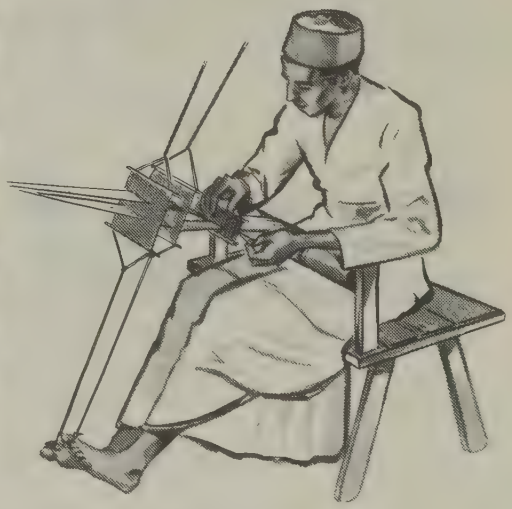


Details of an Eastern loom.

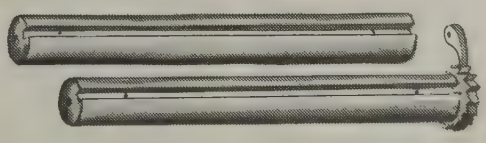


A simple pit loom of the Far East.

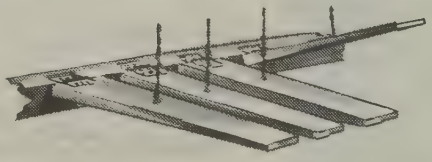
A Montaña Indian weaver of Peru. The long fabric lengths are started from both ends on these backstrap looms. The last few center rows are woven in with a needle.



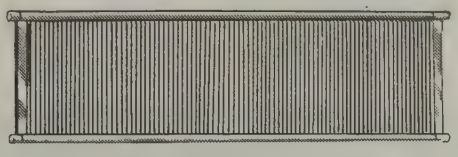
One method of weaving in Hyderabad, or Haidarabad.



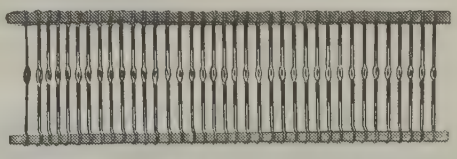
Warp and cloth rollers with locking device.



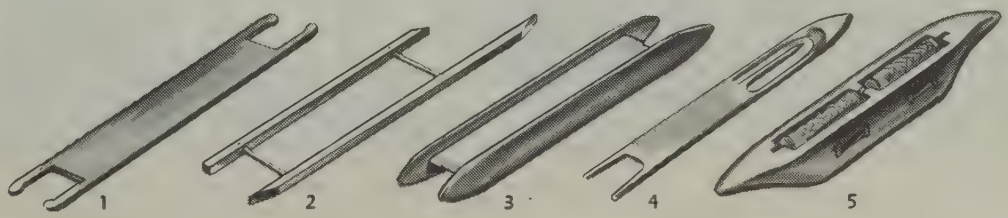
Treadle action of a floor loom.



Modern metal reed.

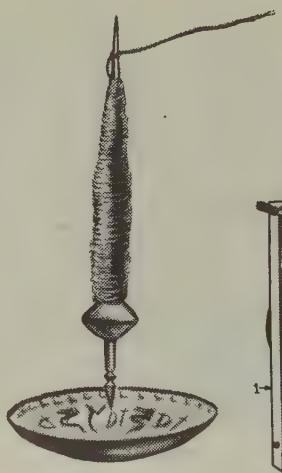


Heddles, headles or healds, mounted on bars.

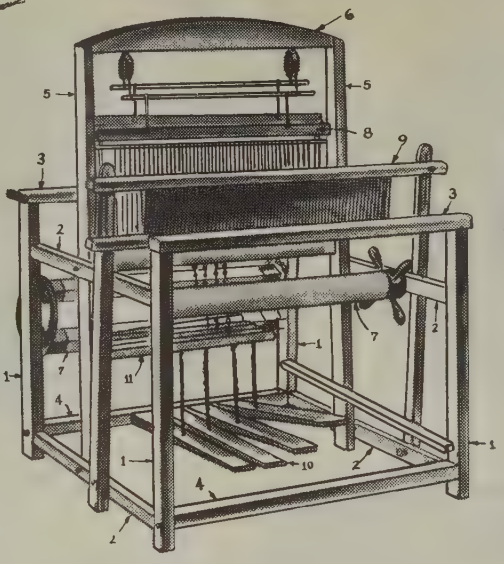


(1) Flat shuttle. (2-3) Rag or rug shuttles. (4) Pick-up shuttle. (5) Boat or throw shuttle.

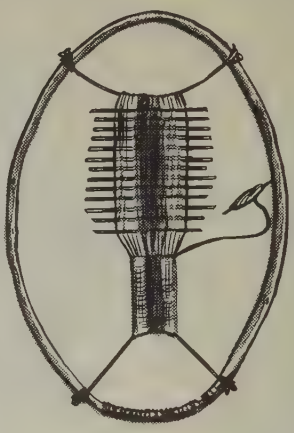
WEAVING, HAND LOOM



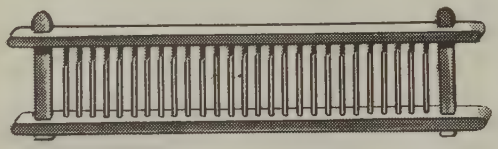
A Montana Indian spindle, with earthen dish. Others vary from delicate seven- or eight-inch Eastern types to the huge four-foot style of certain northwestern Salish tribes.



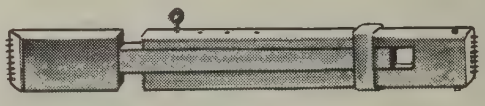
A modern floor loom, developed over many centuries. Numbered parts are identified in the text. In principle, all looms are the same.



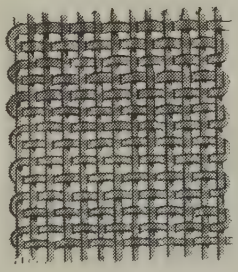
An O or oval loom, of the Pancan and Arawak tribes of Peru. Thin reeds are inserted to set the sheds before weaving begins. Two cords fastened to the frame hold the warp securely in place.



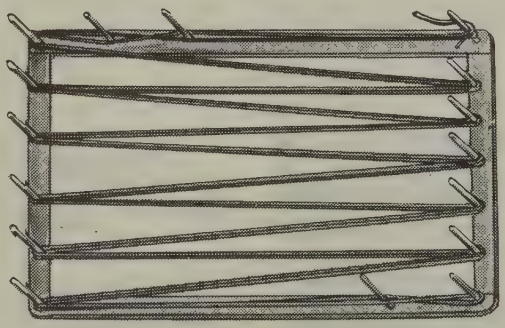
A raddle, used to spread the warp evenly while it is being wound on the warp roller or beam, is similar to a very coarse reed in appearance. It is temporarily secured to the upper back or front beam and removed when the warp is wound.



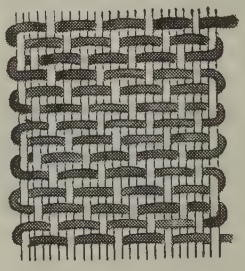
A temple or tenterhook for keeping the width of the finished cloth stretched evenly before being rolled on cloth roller. The pronged ends of the temple are set into the selvedges of the cloth, being moved when necessary as weaving progresses.



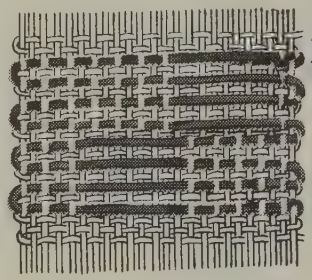
Tabby or plain cloth. The most widely used of the three major fabrics.



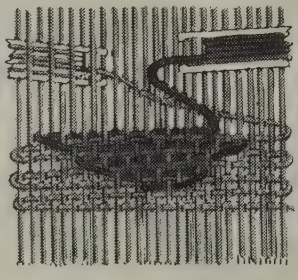
A pegged warping frame for measuring the length of the warp and keeping threads in order.



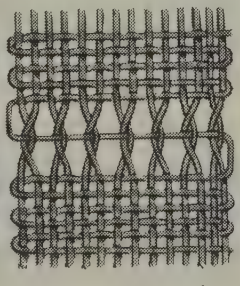
Twill, recognized by its diagonal weft lines, is second major weave.



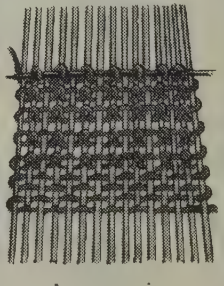
Overshot weaving



Laid-in weaving



Leno or gauze weaving



Loop weaving

The horizontal type of loom with which we are most familiar is of an open boxlike construction which is made of: (1) corner capes or posts; (2) upper and lower side beams; (3) upper front and back beams, known respectively as breast beam and whip beam or slabstock; (4) lower front and back stretcher beams; (5) vertical side beams at the center of the frame, called castle capes; (6) the crosswise beam attached to the top of the castle capes. called the top castle.

This framework is securely fastened together to support the movable parts of the loom, namely, (7) the warp and cloth rollers below the back and breast beams; (8) the heddle bars or frames suspended from the top castle, to provide for the raising or lowering of alternate warp threads; (9) the swinging beater or frame that holds the reed in place midway between the castle capes and the front of the loom.

Depending upon the construction of the loom the beater may swing from an overhead bar or from the lower side beams of the loom by means of additional upright supports called swords; (10) treadles attached to either the front or back stretcher beams; or hand levers usually attached to the castle capes; (11) lams—for greater variation in the tie-up of the treadles to the heddle frames another set of bars, stretching across the width of the loom half way between the treadles and the heddle frames, is often used. These are known as lams.

The reed is threaded or sleyed according to the desired closeness or looseness of the weave as well as the spacing of the spaces, called dents, contained in it. A coarse reed can be sleyed with two or more threads to a dent, but a fine reed very obviously cannot be used for coarse yarn.

Such looms, although widely distributed on all continents, are by no means the only kind on which hand weaving is done.

Nearly every type of loom ever devised, from the crudest to the most elaborate, can be seen in daily use in some part of the world. These may consist of merely a single length of wood, cut from the limb of a tree or sturdy bush, around which one end of each warp thread is attached, all of them together forming a horizontal row. All the ends of the opposite side are tied together in one group to the trunk of a nearby tree or to a stake set in the ground for the purpose. A loop of cord or a belt is then tied to one end of the wood, which is placed horizonitally in front of the weaver, and the cord extended around the back of his waist and tied in place to the other end of the log or branch. By sitting on the ground with his single bar loom strapped around him the weaver can adjust the warp to the required tension as he slides along the ground with the progression of the weaving. Looms of this type, whether only a front bar or a bar at both ends of the warp is used, are called back strap looms.

When only a very short length of warp is needed for small bags, mats, or belts, a thin, pliable bough of a tree or bush may simply be cut and bent in the form of the letter O or U for a frame on which to stretch the warp. By stretching and tying two cords across the upper and lower extremes of the O or U the warp can be fastened to the cord in a single, continuous thread or in separate short strands, in parallel rows

A somewhat more advanced form of loom is one made of 4 logs or beams securely fastened together, similar to a picture frame. Such looms may be used in either a horizontal or vertical position and are used extensively in many areas for tapestry and rug weaving. The starting end of the thread or cord used for the warp is often fastened to one of the end beams and then wound in a continuous length across the frame from the front to the back beam, or from bottom to top according to the position in which the frame is held, instead of each strand being cut to the required length and all the cut ends tied at the required tension to the front and back beams.

The even spacing of the warp is obtained in some locations by simply twisting a separate length of string around each warp thread. With the length of string doubled, one half to extend underneath the width of the warp and the other half on top, the looped end is placed at the outer edge of the first warp thread and the two cut ends crossed as they are passed between successive pairs of warp threads, in much the same way that a shoe is laced. If the threads are to be closely spaced a fine string is used and a single twist or cross made between each warp thread; for a widely spaced warp a heavier string is used and two or more twists made between the pairs of threads.

It was for this purpose of spacing the warp that the framed comb or reed was originally developed. With the use of the reed it became necessary to cut the ends of the warp in order to draw each alternate warp thread through the dents, thus necessarily eliminating the custom of making selvedges at the ends of the cloth as well as at the sides.

Selvedges.—A word derived from self edges, selvedges are the woven edges of the cloth that are held in place by the loops formed in reversing the direction of the warp and weft for each successive row. When the warp is wound in a continuous, uncut length across the front and back beams of looms not equipped with a built-in reed and harnesses, as in the case of most vertical looms, the looped ends can be closely woven to their full extent after the main part of the web has been completed and removed from the loom, to make a perfect selvedge at each lengthwise end of the cloth.

The last warp thread at each side of the web guides the evenness of the side selvedges as the weft is looped around them when passed from side to side across the warp.

Only side selvedges can be made when the ends of the warp are cut for the purpose of threading the loom.

Roller Beams.—Horizontal looms seem to have been favored in Asia and from the improvements made on them during many centuries have come those with which we are familiar today. To the first simple frames mounted on a stand made of four posts or stones were added, at a very early date, back and front beams that could be turned at will for rolling on them the supply of warp, and the cloth as it was woven. This appears to have been the first of the four important advances in loom construction, but is still not used by all groups.

Heddles.—Since the action of interlacing is that of drawing one group of alternate warp strands away from the other to produce an opening or shed between the two layers, through which to pass a crosswise weft or binding strand, it became important to effect a method that would permit all of one layer of alternating threads to be raised at one time. Thus much previously wasted effort could be saved by a single, mechani-

cal motion when fabrics requiring many warp threads were needed. This was accomplished in several ways. One was by the use of two twigs or rods that were somewhat longer than the width of the loom. The first rod was passed across the width of the warp, over and under each alternate thread, to form and maintain a shed opening between the two layers of warp threads. On vertical looms this rod was held in place by braces attached to the side beams of the loom. The second rod was laid across the top of the upper warp layer and a separate cord of the proper length loosely looped under each warp thread of the lower layer and fastened as well to the rod above the warp. In this way the loosely looped warp threads could be pulled to the required distance above their normal level by pulling the rod upward, to form a second shed of the warp. By alternating the sequence of the shed openings for each row, the weft could be locked in place. It is the method used today for the rugs woven by the American Indians and for other forms of tapestry done on vertical looms. The rod is called a heddle or heald rod, and the loose loops are heddles. This was the second major improvement in loom construction.

In some areas the demand for cloth led to still other solutions of the problem of time and labor saving that through experiment resulted in the use of a separate, permanently suspended threading arrangement for each of the two layers of warp threads. These threading arrangements were comprised of a series of heddles, mounted individually on bars or frames across the center of the width of the loom, through each of which a single warp end was threaded. For special purposes several warp ends may be threaded through each heddle.

As has been indicated, heddles were originally merely loose string loops, laced under alternating warp threads and around a wooden rod to enable the weaver to separate the warp into two layers. From this process heddles have more commonly become separate loops, each containing three openings—two for mounting it on the heddle rods and one for holding the warp thread in place.

They are usually made of string or cord of linen, silk or cotton; or of either flat steel or twisted wire.

Those of string are tied by hand on a pegged gauge made for the purpose. The two long, end loops used for mounting are known as doups and the short center loop is called the eye. Those of metal are generally made by special commercial machines. In this case the two end openings are called slots, the center opening of all heddles is called an eye.

Some heddles, used extensively for silk weaving, are made of two cord doups with a detachable glass or porcelain eye in the center. Until 1812 when John and Patrick Clark of Paisley, Scotland, perfected a method of making a suitable cotton cord, silk and linen were the fibers most generally used for heddle cord.

Harnesses.—The separate bars on which the heddles are mounted across the width of the loom are called heddle bars. When narrow, joined frames are used for the purpose they are referred to as heddle frames In the United States two bars, for the upper and lower heddle loops, or a single heddle frame constitute a harness when supported in position on the loom. A two harness loom, therefore, has two sets of heddle bars or two frames; while a four harness loom consists of four sets of bars or four frames and so on, all looms being designated by the number of harnesses provided.

This differs from the British meaning of a harness for which two sets of heddle bars or two frames comprise a harness. A two harness loom in Britain, therefore, generally means one having four sets of heddle bars or frames. The equivalent of the American two harness loom being designated as a two shaft or two way loom.

Heddle-Reed Combination.—Among some groups the principals of the rod for separating the warp into layers and the framed comb were combined into one by burning or drilling a small hole through the center of each tooth of the reed to form a straight row across its width. Starting at one side of the reed the cut ends of the warp were passed in successive order through a slit between the teeth and then through the hole burned into the tooth, for the width of the warp. By raising or lowering the threaded reed by hand the shed separation between the alternating threads could be made. In this way three important details could be dispatched by the use of one implement: the even spacing of the warp, the separating of the alternate warp threads and, by a sharp forward and back motion of the reed, the beating together of the woven weft rows.

Sword Beater.—When it was found that an entire row of alternate warp threads could be raised at one time, the manner of beating the woven rows together changed, in some sections, from the use of a forked stick or comb to a flat, pointed, thin edged, wooden stick rather than a framed comb or reed. This was passed through the shed opening to beat the weft into place. Such sticks vary in size and design in different localities, but since they were often made to resemble hunting knives or swords they became known as swords.

Treadles.—In the course of time treadles or foot levers were added to the constant improvements being made, to further simplify the raising or lowering of the heddle bars or frames and to provide the fourth important advancement in loom construction.

The combined use of hand and foot power has always been more widely practiced in the East than in the West, and there are many interesting examples of how foot as well as hand motions were applied to the details of this craft in Asia where treadles have been used for thousands of years. One resourceful system, still to be found occasionally, requires the use of only two strings, one end of which is tied to each of the two suspended heddle bars while the other end is tied at the required distance to the large toe of each of the weaver's feet, enabling him to pull the heddle bars down at will.

In India the treadle development included a shallow pit dug into the ground beneath the loom to accommodate the treadles which were placed in the pit. The dark ground patches shown in illustrations of some Indian, African and Chinese looms generally indicate the use of these pits.

The manner in which the action of the treadles or hand levers causes the layers of warp to separate identifies the loom as one of two types; the *counter balanced* loom in which both layers pull away from each other equally in opposite directions from a central level; and the *counter march* loom in which only one of the layers is pulled away from a central level.

The treadles of most floor looms cause the

harnesses to be pulled downward; the hand lever action of most table looms, those which can be placed on a table for weaving, causes the harnesses to be raised. Floor looms in which the construction causes the harnesses to raise when the treadles are depressed are known as *jack looms.*

Each improvement necessitated a change or addition to the framework of the loom and in some areas the single rod or flat square frame became a large, sturdy, boxlike frame (already described) to accommodate the harnesses and treadles. But even today there are looms being used that are no more than a few rods or sticks held together only by several lengths of knotted string and on these the skill of an occasional weaver produces fabrics of outstanding quality and design.

Patterned Fabrics.—The formation of a pattern is made possible by the raising or lowering of certain separate warp strands or groups according to a predetermined plan. This is the basis for all weaving. Thus the early division of the warp into two layers soon led to more divisions as designs were introduced into fabrics. A method of doing this was to pick up as many threads across the warp as were needed for a particular part of a pattern and keep these in order at the back of the loom by inserting another rod between them and the remaining warp threads. By moving the rod forward when it was needed a temporary pattern shed could be formed in the warp to simplify the passage of the weft. As many as 20 or 30 such rods could thus be used for the various parts of a pattern, all remaining at the back of the loom when not in use. Each time a certain portion of a pattern was needed the warp threads that formed that portion had, heretofore, to be raised individually and other ways were therefore evolved. It was evident that by threading these warp threads through a different group of heddle loops the pattern could more readily be woven. In this way the use of many rows of loops was developed, with a corresponding number of foot pedals or hand levers to expedite their operation.

Some of the intricate designs in many colors required the raising or lowering of more groups of warp threads than even the additional rows of heddles permitted. This is apparent in the samples of magnificent ancient Persian, Indian and Chinese fabrics that have been preserved for our inspection in numerous museums. For these patterns the many rows of heddles were used in conjunction with various systems of extra cords attached to special individual warp threads.

In China, after silk weaving was introduced on an organized basis about 4,000 years ago, a loom was developed that made it possible to raise each delicate silk warp thread separately or groups of them together. This was done by attaching additional weighted silken threads to each warp thread by a series of extra heddle loops and extending them vertically from the bottom of the loom to the framework at the top. These additional threads or cords were drawn into position by an assistant who was called a draw-boy and the loom was known as a draw-loom. The resultant effect was very complex in appearance but produced beautiful fabrics of intricate patterns when operated by skilled weavers.

Vertical Looms.—These were used to a marked degree in Egypt, Greece, Rome, Scandinavia and England during the early periods of European history.

In Egypt and Rome both ends of the warp were attached to the lower and upper beams of the vertical looms just as they are in many places today and the weaving done from the bottom upward.

In Greece and some of the northern European areas, however, the weaving was done from the top downward. The upper end of each warp thread was secured to the upper beam, but the lower end was left unattached, the proper tension being obtained by the use of clay or stone weights fastened to each separate warp thread or to a number of them tied together in a weighted group.

Just how this latter detail was managed in the case of long warps such as those needed for the many yards of cloth from which the costumes of the era were made is not clear. Since the only examples of Greek looms are a few pictured on bowls and vases and these indicate long lengths of finished weaving rolled on the upper beam, there must have been a similar method of rolling the warp supply on the lower end of the loom as well, or fastening it in some other way, but the method used has not yet been determined satisfactorily. Nor does it seem probable that sufficiently heavy weights could be attached to fine threads to keep them at the tension required to obtain an even beat without breaking them. In Greece particularly, vertical looms reached a high state of development. Both in Iceland and in northern Alaska warp weighted looms were used until very recently and may even now be found in isolated areas.

Today vertical looms are used principally for tapestry weaving. In this technique the warp is entirely covered by the closely beaten weft. The figures and scenes depicted in tapestries such as those from the celebrated weaving centers of Europe must be woven in a sideward direction, across the width of the cloth, not in an upright direction as the finished work appears to the observer. Examination of some of the famous museum pieces will ascertain this point, the direction of the ridges made by the warp threads being clearly visible in them. A great deal of tapestry weaving is now done on two harness horizontal looms.

Fibers.—Of the almost endless list of natural fibers that have been experimented with since looms were first set up, linen, wool, cotton and silk seem to have supplied the greater part of the need for weaving yarns. And, as far as there is any record, the use of these evidently originated in the East; linen in Egypt; wool in Mesopotamia; cotton in India; and silk in China. It does not prove conclusively, however, that they were not also known elsewhere. Cotton garments, for example, found in Utah and other western states, are believed to antedate the Christian era.

The bark, roots, leaves and stems of scores of trees and plants were and still are prepared in both spun and unspun forms for weaving in many areas. Notable among them is bamboo which is adequate not only for weaving but often supplies almost every need of daily living in Asia. The advantages of asbestos as a fabric were long ago known in China and Egypt. In China, among its other purposes asbestos was sometimes woven into cloth for lining the cuffs of the Chinese wide sleeved jackets and coats—such linings when removed could readily be cleansed in a fire and replaced, clean but unharmed, when needed.

Metals were not a neglected element in weaving either, although their earliest use was of much

more recent date compared to plant and animal fibers. Gold and silver that had been drawn into wire or hammered and cut into narrow, thin strips are said to have been introduced into weaving by a ruler of central Asia about 1200 B.C., and these combined with the beauty of silk gave rise to one of the most fabulous industries in history. Much fine weaving, however, had been done before sericulture or silk production was organized in China by the emperor Huang-Ti about 2700 B.C.

Not only was the step from unspun to spun fibers dependent upon the intellectual levels of the various groups, but was dependent as well on the available source of supply within each area, and on accepted rites and customs. It is doubtful that there are any remote tribes who do not know how to spin. It has been found, however, that among certain of the more primitive people, weaving in any form is unknown.

In hand weaving are involved the spinning and measuring of the yarn and the preparation of the loom. Many fibers are, of course, used in their natural form, unspun. But where long lengths of thread or yarn are needed the spinning in most cases is done commercially. Sometimes, however, all the attendant steps must be done by hand.

In order to spin, the natural fibers must first be prepared by removal from the plant or animal and by cleaning. There is considerable variation in the way in which these details of the work are undertaken not only for different fibers but for similar fibers among the groups who use them. Sheep's wool is generally cut; camel and kashmir goat hair are never cut but collected during the moulting season when the hair falls from the animals in chunks. Angora rabbit's fur may be plucked out by hand or cut.

Cotton is part of the seed pod of the plant and is usually pulled by hand although machines do part of the work. Flax of the finest type is nearly always pulled by hand and the delicate roots pulled with the stems to add to the length of the fibers.

Silk must be freed from the silkworms' cocoons by soaking them in hot water.

The second step in spinning is that of cleaning the fibers. Among some groups, fibers such as wool or cotton may simply be picked clean by pulling the dirt particles off by hand. Among other groups more elaborate methods of washing and combing are customary.

Linen, ramie, jute, hemp and other similar fibers taken from the stems of plants are known as bast fibers and these require the soaking of the stems in water to loosen them from the core and outer bark of the plants.

Spinning.—The spinning itself is a matter of twisting the fibers together to make as continuous a length of the required fineness or thickness of yarn as possible. As in all the steps connected with weaving every method that has been devised, from the simplest to the most complex, is being used today—all involve pulling successive groups of matted fibers out to the required fineness or thickness and twisting them into a continuous strand of yarn or thread. (See article SPINNING for complete process.)

The basic principal of a spindle is a thin rod or twig which, when attached to one end of an extended fiber and suspended in mid-air, will revolve, thus causing the length of fiber to wind around itself. The extremely fine thread used for the famed Dacca muslins of India was spun on the most delicate of these hand spindles, never on the more advanced spinning wheels. Indeed, so finely spun was the thread that it was necessary to rest the lower end of the spindle in a shallow shell or disk to prevent the weight of the spindle from breaking the thread. This simple device, transcending through many changes including the addition of a disk near the lower end of the spindle, has become familiar in the spinning wheel, which seems to have made its first appearance in India. The modern, low, treadle wheel, used particularly for flax, was developed in Nuremburg in 1533 * and is known as the Saxony wheel. The high wheel used in colonial days mainly for wool, is called the Jersey wheel.

Winding the Warp.—With the yarn at hand the weaver must approximate and measure the amount needed for the cloth to be woven. This is referred to as winding the warp and is the second part of the process called dressing the loom, the first being any necessary adjustment to the loom itself. The size and type of loom used as well as the fineness or thickness of the yarn determine the amount of warp that can be accommodated at one time. The greatest length is usually dependent upon the distance from the front and back upper beams to the top of the rollers or winding beams. The width is determined by the width of either the reed or the heddle frame, whichever is the narrower.

As has been pointed out the number of warp threads contained within the limitations of the width to be woven may vary according to the spacing of the warp in the reed, thereby resulting in a closely or widely woven fabric.

The number of threads thus contained in the width multiplied by their length equals the entire length of yarn needed. From this amount each warp thread of the desired length must be measured equally, and for the purpose a gauge of some sort must be used. The gauge may be two pegs or stakes set apart in the ground at the necessary distance; it may be a frame or board around the sides of which a row of pegs has been set by means of holes drilled into the wood; or it may be an upright revolving frame or cylinder called a reel, around the circumference of which the yarn is wound. During the process of winding, the alternating threads are crossed at an angle as they pass each other, to facilitate the threading or drawing-in of the loom later. Sometimes the warp is crossed at two points; the first near the first peg of the warping frame, is known as the porrey cross; the second, near the last peg used is known as the portee cross. For convenience in counting the number of threads needed, a string is generally tied around each group of 25 or 50 threads until the required number have been wound.

When the warp has been entirely wound, the cross, called a leash, is tied in place with a temporary string which is later replaced by two sticks, called leash sticks. The two extreme ends of the warp where they loop around the first and last pegs are also temporarily tied with a string to accurately cut the strands for the threading process. The entire group of measured threads in this form of warping are fashioned into a loose, easily retractable chain to prevent it from entangling until it has been drawn in on the loom.

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* Some authorities say 1530.

Another form of warping is done by the use of large frames or stands that have been constructed with bars or racks containing removable spools. These spool racks are called creels. Each spool is carefully wound with the appropriate amount of thread and the threads from as many of them as are needed at one time, wound on what is called a sectional warp beam, that is, a warp beam or roller that has been constructed in a number of even, movable sections which are mounted horizontally on a central axle. Each of these sections is revolved the same number of times to assure an even length of the entire warp, the cut ends being held in place with Scotch tape, or other adhesive binder, until they are ready to be threaded. The process is called sectional beaming or sectional warping. All color changes and patterns to be woven must be considered before the warping begins.

Drawing-In.—The threading or drawing-in of the loom is the last part of dressing the loom and is done according to a predetermined plan. If only two rows of heddles are to be used, as for a plain cloth, the threading of the heddles is simply a matter of evenly alternating the two rows —the first thread in row 1, the second thread in row 2, and so on. If the pattern is complex, involving the use of many rows of heddles and often thousands of threads, great care must be taken in threading the heddles according to the design. Such designs are generally sketched out in draft form on graph paper to avoid the possibility of making threading errors which even the most skilled weavers are subject to. To make a draft is to darken certain squares of the graph paper, or notate in some other understandable manner the lines and spaces that represent the weft and warp threads. This enables the weaver to raise or lower the heddles in the sequence required for continuity of the pattern.

Among some groups sketched patterns are not used at all, the design simply following the imagination of the weaver. This fancy-free method while sometimes resulting in designs of unusual interest and excellence more often results in fabrics that would have been considerably improved by an adjustment made on a paper sketch.

The threading, if the chain method of warping has been used, may be done from either the front or back of the loom. The object is to wind the warp around the warp roller or beam; therefore the warp must be secured to the warp roller or beam by a rod or other device that is connected to it and can be turned with it. With the warp evenly wound on the warp roller and the threaded, cut front ends extending to the upper front beam the winding ceases, to permit the even tieing of the front ends to the rod, stick or cloth attached to the cloth roller over the top of the breast beam.

When the sectional warping method is used the loom is drawn in and sleyed from the back and then tied to the front roller in the same way as the chain method.

Various extra appliances such as a raddle, which is temporarily attached to the back beam, for evenly spreading and maintaining the warp at the required width of the fabric while the threads are being wound and drawn-in; and a gauge, known as a temple, to keep the width of the woven cloth stretched at the desired tension in front of the reed as the weaving progresses, are also used by many weavers to aid them in producing accurately proportioned webs.

Woven Cloth.—Although the ever increasing exchange of ideas and techniques has long since brought about a very broad similarity in the weaving of all nations and each copies the designs of others, there still remains that individual difference of fiber preparation, pattern, style and workmanship that lends distinction to the textiles of each and labels them, in effect, to the informed observer, as its own. We associate certain fabrics with the nations in which they originated or were produced to a notable degree. For example; plaid designs have been used since early antiquity in many areas, but the particular way in which they were patterned and woven in the Scottish Highlands has come to identify certain plaids everywhere as Scotch plaids or tartans.

In a like manner, the fabrics of India, China and Guatemala, to mention a few others, clearly indicate and identify some of the variations of artistic preference and general characteristics of each nation.

There are three main categories into which woven cloth is divided. These are (1) plain or tabby weaves; (2) twill weaves; (3) satin weaves. Within these three come an infinite variety of plain and patterned fabrics from the plainest muslin such as that used for sheeting or in finer qualities for sheer handkerchiefs to the most elaborate brocades or other ornamented textiles.

Tabby or Plain Cloth.—Tabby weaves are recognized by the even under 1, over 1 interlacing of alternate, single warp and weft threads which requires only two shed separations. This even alternation makes tabby the most easily woven of the three main types of cloth.

It is more widely used in all parts of the world than any other form of weaving and includes, in addition to sleeping mats, floor coverings, blankets, saddle bags, boat sails, etc., fabrics for wear and decoration such as gingham, cretonne, chintz, flannel, cheesecloth, broadcloth, seersucker, taffeta, chiffon, pongee, Shantung, homespun and some tweeds, to illustrate a portion of its uses.

When two or more colors or types of yarn are combined in a tabby fabric, designs in stripes, checks and plaids may be arranged, the elaborateness of which may be as varied as the needs of their users.

Another variation of plain tabby is achieved by the use of two or more sizes of yarn to obtain a ribbed or corded fabric such as seen in poplin, piqué or grosgrain ribbon.

Basket weaves, also, are a form of tabby for which two or more warp and weft threads, rather than single threads, are alternately interlaced.

Plain tabby is the basis for the majority of special pattern techniques, adding firmness and strength to the cloth. It is woven as part of the pattern in techniques similar to "laid-in," or between the pattern rows in those similar to the "overshot" designs of colonial coverlets and the various forms of brocade in which the weft spans or floats across several adjacent warp threads. The primary difference between "overshot" and "brocade" techniques is that overshot designs are planned on the overlapping by one thread of adjoining blocks or squares, while brocade may take any formation or placement desired.

In addition, overshot patterns are woven with the right side toward the weaver. Brocades, which provide us with some of the most beautiful fabrics made, are woven with the wrong side toward the weaver, the right side of the pattern

appearing on the under side of the web. This is due to the fact that it is simpler, in this case, to skip over the top of warp threads for a pattern than under them as would be necessary to weave the pattern right side up. Also, the fewer threads raised the less wearing it is on the warp.

Twill Weaves.—These may generally be identified by the clearly visible diagonal lines of the fabric. The overlapping of the weft in successive rows makes twill stronger than tabby when both are evenly spaced.

The weave is based on the alternation of at least three adjacent warp threads in which the weft passes under 2, and over 1 or vice versa according to the effect desired.

A four harness twill produces a diagonal or angle of the most equal proportions and is used for the majority of twilled fabrics, as, for example, the well known and popular Scotch plaids or tartans.

By raising or lowering the heddles, as the weaving proceeds, to rearrange or reverse the even sequence in which these units are threaded, a great variety of herringbone, diamond and other novel effects may be produced in either a widthwise or lengthwise direction. For example, instead of a consecutive 1, 2, 3, 1, 2, 3 order, a 1, 2, 3, 2, 1, 2, 3 sequence will result in a broken or herringbone pattern. Serge is produced by a diagonal sequence of under 2, over 2, and so on. Other twill fabrics are denim, gabardine and foulard.

Satin Weaves.—Basically a twill weave although the twill pattern is not visible, at least five harnesses are required in weaving satin and as many as twenty-four may be used. Of Chinese origin, it is a very close weave based on an even rotation of as many harnesses as have been threaded.

The weft is passed over 1 warp thread and under the remaining number in each pattern unit. This results in floated or loose warp threads throughout the surface of the fabric to create the nearly unbroken line that gives satin its appearance of a smooth, uninterrupted surface. Like brocade satin is woven face downward.

Loop and Knot Weaves.—These two other important techniques are familiar in pile fabrics —those having a raised surface.

In the loop weave a tabby shot is made, the thread for this shot then being looped, between the warp threads, around a thin rod or gauge which is glided across the top of the warp for that purpose. There are many uses for loop weaving, perhaps the best known among them being bedspreads and rugs. The loops may either be left as they are woven or the top edges cut off to create an appearance of softness and depth as in velvet or chenille.

The knot weaves are usually identified with Oriental rugs but are also used by some weavers for decorating special fabrics such as those made for draperies and upholstery. The two knots used principally in this form of pile weaving are the Ghiordes or Turkish knot and the Sehna or Persian knot, each being the name of the respective weaving centers. They are woven, in the Orient, on vertical looms.

Each knot is made separately by twisting the weft thread around the proper warp threads to knot it in place, the loose weft end then being cut to the required length before the next knot is made, and one or more rows of plain tabby or twill woven between the knotted rows.

Besides these, there are many other methods of weaving rugs or carpets by hand.

Lace or Gauze Weaves.—These weaves are generally achieved, in their simplest form, by twisting the threads of the lower tabby layer over those of the top layer by means of a thin, flat, pointed stick or similar device and pulling one or more rows of weft through the twisted threads. The process is repeated as often as necessary or combined with plain or twilled weaving, to produce the length of gauze required. These weaves can also be made on multiple harness looms by a special threading arrangement.

HISTORY

Hand weaving is one of man's most ancient and fundamental skills. Exactly where it started or how it came about can only be conjectured since no fragment of history is old enough to provide positive assurance on these points. If there was a single place of origin for the art of weaving the evidence at hand would suggest that Asia was that place. Certainly most of the progress in the craft has evolved from there. But there seems little doubt that the need for cloth was recognized almost simultaneously in widely separated areas and that the solution to so basic a problem could not have deviated greatly, except in the relatively minor details of mechanical execution.

As is to be expected, many of these details were more quickly and ably bridged by some groups than by others. In fact some groups seem never to have acquired the desire or ability to weave at all as, for example, throughout much of Polynesia and Melanesia where cloth is made by the beating of bark and plants.

If man needed an example of the principle of interlacing there were many such examples in nature to choose from. Vines will become entwined and interlaced as they grow. Many animals, birds and insects instinctively form their nests by a method of locking together or weaving the twigs and strands of grass, straw, feathers and other fibers they gather. And who is not aware of the skill of the spider in the construction of his web.

The oldest fabric samples known have been unearthed in the excavations made during the 19th and 20th centuries in Europe, particularly from the dry lake bed regions of Switzerland, the Nile Valley in Egypt, Peru, and from the oak tree coffins of northern Europe. They are variously dated from as far back as 12,000 years to the Stone Age to about 2000 B.C.

Excavations made in the Nile Valley in Egypt have provided us with samples of linen, some of which are believed to be about 6,000 years old. One of these is said to be of tan thread so fine and closely woven that it contains more than 250 double warp threads to the inch. Wool and other fibers were also used in Egypt.

From the oak tree coffins of northern Europe, dated to the 2d millennium B.C. we have evidence of the use of wool as well as linen. This does not mean that wool was lacking or unknown elsewhere in Europe, simply that prevailing conditions were not conducive to its preservation in all areas or that circumstances have not brought it to our attention.

In the Western Hemisphere an antiquity of weaving almost equal to that of Egypt has also been authoritatively established by archaeologists. Peru is the principal site in this half of the

world and from the profusion of textiles found we have firsthand knowledge of the unusual skill of ancient Peruvian spinners and weavers. There, as in some European and Asiatic areas, nearly every form and technique of weaving seems to have been known. The earliest of these pieces, made of cotton to which maguay or a similar fiber has been added, is believed to be about 4,500 years old and is the oldest sample of cotton weaving known. Ancient as well as present-day Peruvian spinners were familiar with at least six distinct colors in which cotton grew. These ranged from tan to reddish brown and gray.

Remnants of cotton in North America have also been found. One of the most ancient of these is a piece of tapestry thought to have been woven prior to the Christian era in what is now the State of Utah. It was found in a dry cave in Grand Gulch. Skeins of cotton and woven articles discovered during explorations of the cliff dwellings of the southwestern United States indicate the knowledge of weaving in that section also. Only from rare discoveries such as these and their relation to other known prehistorical facts can scientists determine the approximate antiquity of man's ability and progression.

Trade is, of course, the major incentive in progress of any kind. But conquest and subjugation have also had an important share in the strides made in the art of hand weaving. The outstanding skill of certain individuals is admired and appreciated among all groups, whatever their fields may be; thus it was not long before a trade was established in some areas to supply the demands for the products of such individuals. Often neighboring tribes not concerning themselves with trade would simply overpower a weaker neighbor and take by force the workers and articles they wanted. As the need for cloth grew greater both trade and conquest continued.

Each country, each province had something different to offer in the quality and beauty of its fabrics. Each guarded its techniques with care while trying to wrest the secrets from the others.

Many centuries before the advent of Christianity a thriving if hazardous business was being conducted between Egypt, the various provinces of India, Arabia, Syria, Byzantium, China and other Asiatic areas, and parts of Europe, particularly along the Mediterranean.

Every weaving technique known from the plainest to the most unusual combinations was used and others evolved and improved. Loom improvements or changes were an important part of the advances made in perfecting the textiles. Without these changes it would not have been possible to produce the endless yards of cloth increasingly demanded.

One of the most unique achievements in loom construction was the Chinese draw loom perfected, according to available records, about 1300 B.C. Made for weaving the dainty, beautifully patterned silks of China, it is the forerunner of the European draw looms on which so many magnificent fabrics were made during the 9th to 18th centuries.

In Asia and Egypt rigidly controlled factory systems developed that caused many of the harassed and ill treated weavers, as well as those who sought adventure, to search for safety and freedom elsewhere. With no overland route open to them except toward the west, Europe and North Africa were their inevitable goals.

The most notable fabrics of early Europe were those of Greece and the surrounding areas. Both wool and linen were woven in Greece by ladies of all classes and nearly every household. To a lesser degree weaving was also a home occupation in Rome, but in both these countries the textile demands for luxury at home and by the armies abroad were supplied chiefly by the factory systems that so often brought misery to the enslaved workers, and in addition by imports from Egypt and the East.

During the 6th century A.D. silk culture was introduced into Europe by the successful mission to Asia of two Nestorian monks of Mt. Athos. Constantinople is said to be the city in which sericulture became a new enterprise for the western world.

Linen, wool and cotton were all in constant demand for many types of fabrics, but it was silk, more than any other fiber, that brought about the incredible volume of trade that arose wherever its elegance was known. For a time, among those who could afford its luxury, there was scarcely any purpose for which silk was not used, whether for personal adornment, household items, banners or horse caparisons.

When the exploits of Mongolian marauders closed the Eastern sources of supply to Europe in the 13th century, much of the power of Arab trade was lost. Italy, then a wealthy trading center, was able to meet the requests of her neighbors and others for silk. By the 17th century, when first place in this field went to France, Italian silks were as highly prized as those from the Orient. Both Italy and France still make some of the finest textiles woven.

The extravagance of royalty and its followers as well as the church in nearly all of the European countries during these and the following centuries is well known and this extravagance was strongly evidenced in the magnificence of the textiles used, just as it was in Eastern lands.

From time to time laws regulating the making and use of these costly fabrics were proclaimed, but were soon ignored by those of wealth who were indifferent to the plight of the general populace.

The weaving guilds during the rise of the weaving industry in Europe had become highly organized, rigidly controlling each minute detail of cloth production by its members whether the work was done at home or in one of the many large shops of the period. The type and quality, and washing and dyeing of the fibers; the width of the cloth; the number of shots to the inch; the finishing, and the pressing and weight of each piece were even more completely inspected than the best fabrics today, and woe be the worker whose work was not up to standard. Only in his few spare hours after the long day's toil was over could a weaver make the cloth he and his family needed.

A great deal of excellent weaving was, of course, being done throughout the entire Western Hemisphere by various groups of native Indians and Spanish settlers. The extent of its trade, however, seems to have been almost negligible compared to that of other continents, especially in North America.

It is a point of interest to note that not only in their spinning, weaving and implements of general use, but also in appearance, so closely did some of these Western people resemble the inhabitants of far distant lands as to strongly suggest a mutual origin. This is evident, for instance, in the case

of the ancient Peruvians who bear close resemblance in all the named points to the early Egyptians. The route by which they and others may have come seeming quite logically to be via the southern Pacific expanse that takes in some of the South Sea Islands. A number of books and theories have been written on this subject.

The early North American colonists do not seem to have been familiar with the weaving techniques of our western Indians or of Central and South Americans, the samples of their work that remain all being similar to that of northern Europe. And, understandably, they had very little time for weaving experiments when coping with the problems of a new frontier. At a later date some very excellent fabrics, including many of silk, were woven by those colonists who were skilled in the art.

More than a century after the first colonists arrived in North America the use of power machinery to replace the hand looms became an established fact. Many experiments had been made in this direction throughout the long history of weaving, and there is evidence, though scant, that power machinery of some kind was known in the Mediterranean area prior to the Christian era. This knowledge seems, unfortunately, to have been forgotten, and the point must await adequate scientific research for definite proof.

Because it was a household occupation in Europe, most of the American colonists were familiar with spinning and many with the weaving of cloth so necessary to their well being in the new world. It was not long, therefore, before looms were set up. Those looms were large cumbersome affairs that would be unsuited to most of our dwellings today, although they are still used occasionally in country homes.

Sheep and flax were raised and small amounts of cotton were grown from seeds brought from Europe. The various fibers were hand spun and hand woven into the blankets, sheets, pillow tickings, suit cloth, and so on, needed for home and personal use.

In an effort to foster and protect her home industries and products England demanded the weaving of cloth by the early settlers. Toward this end importations of both the raw materials and finished fabrics from other European nations were prohibited. Even a silk industry was begun. At that time the culture of silk was considered a more important industry than cotton growing. Grants of land and other special compensations were extended to those southern planters who were interested, while in some cases fines were imposed on those who did not grow 10 mulberry trees on each 100 acres of land for the feeding of silkworms.

Today many of the best textile mills find it expedient to employ hand weavers to work out the designs they are considering before the power machines are set up. In this way much uncertainty is forestalled and time and money saved.

Hand weaving alone cannot supply the vast amounts of cloth necessary for the world's daily use, although in many places it is still the major source available. Machinery, on the other hand, is efficient only on a quantity basis, a requirement that does not gratify man's creative instincts or sense of beauty. These things must be satisfied by individual vision and effort. In fabrics they can be achieved only by the weaver's creative touch on the thread of his hand-operated loom.

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WEBB, Beatrice Potter, English economist: b. England, Jan. 22, 1858; d. Liphook, Eng., April 30, 1943; was educated privately and later engaged in investigating social conditions. In 1892 she was married to Sidney Webb (q.v.), with whom she

collaborated in preparing many works on economics. She served on the royal poor law commission in 1905–1909 and was joint author of the minority report. During World War I she served on the Committee in Aid of Distress; Statutory War Pensions; on Reconstruction; National Registration; on Machinery of Government; the War Cabinet Committee on Women in Industry; the Lord Chancellor's Advisory Committee for Women Justices. She wrote *The Co-operative Movement in Great Britain* (1891); *Men's and Women's Wages* (1919); *My Apprenticeship,* 2 vols. (1926; 1938).

WEBB, Charles Henry (pseudonym JOHN PAUL), American journalist and humorist: b. Rouse's Point, N. Y., Jan. 24, 1834; d. New York City, May 24, 1905. He was on the staff of the New York *Times* (1860–1863); founded and edited the *Californian,* San Francisco (1863–1866); later contributed to the New York *Tribune* humorous articles signed "John Paul." He invented an adding machine, but was better known by his burlesque dramas, among which are *Liffith Lank* (1867); *Saint Twel' Mo* (1868). He also wrote *John Paul's Book* (1874); *Parodies, Prose and Verse* (1876); *Vagrom Verse; More Vagrom Verse* (1901).

WEBB, James Watson, American journalist and author: b. Claverack, N. Y., Feb. 8, 1802; d. New York, June 7, 1884. He entered the United States Army as second lieutenant and became adjutant in 1825; served in the West under General Winfield Scott, and resigned from the army in 1827. In that year he became editor of the *Morning Courier* in New York; this was united with the *Enquirer* as the *Courier and Enquirer,* which he edited until 1861, when it was merged in the New York *World.* At first he supported Jackson but later as vigorously opposed Jackson's measures, and made the *Courier and Enquirer* one of the leading Whig papers. In 1851 he was appointed engineer in chief of New York State and given the rank of major general. After refusing an appointment as minister to Turkey, he was appointed minister to Brazil in 1861, which office he held until 1869. In 1865 when he was in France for a time, he negotiated a secret treaty with the emperor providing for the removal of the French troops from Mexico. He wrote *Altowan, or Incidents of Life and Adventure in the Rocky Mountains* (1846); *Slavery and Its Tendencies* (1856), and *National Currency* (1875).

WEBB, Sidney, 1ST BARON PASSFIELD, English economist: b. London, July 13, 1859; d. Liphook, Eng., Oct. 13, 1947. He was educated in Switzerland and at the City of London College, and in 1878 entered the civil service, holding several different positions, chiefly in the colonial office, and resigned from the service in 1891. He was admitted to the bar in 1885. He was one of the founders of the Fabian Society (q.v.), and in 1891 was elected to the London County Council as a candidate endorsed by the Fabian Socialists. He was lecturer on political economy at the London School of Economics and Political Science and was professor of Public Administration at the University of London.

He wrote *Socialism in England* (1890); *The London Programme* (1892); *Labor in the Longest Reign* (1897); *Grants in Aid* (1911); *Toward Social Democracy* (1916); *The Works Manager of To-day* (1917). He edited *How to Pay for the War* (1916); *Story of the Durham Miners* (1921); *Fabian Essays* (1920); and many works in conjunction with his wife, Beatrice Potter Webb (q.v.), among them *The History of Trade-Unionism* (1894); *Industrial Democracy* (1897); *English Local Government* (1906); *English Poor Law Policy* (1910); *The Consumers' Co-operative Movement in Great Britain* (1921); *The Decay of Capitalistic Civilization* (1921); *Soviet Communism* (1935). He was created Baron Passfield in 1929. In 1929–1930 he was secretary of state for dominion affairs and for the colonies in 1929–1931.

WEBB, Thomas, British soldier and Methodist pioneer in America: b. England, c.1724; d. Bristol, England, Dec. 19, 1796. He was an officer of the Royal American Army and saw service at Braddock's Defeat in 1755; at the storming of Louisburg, Nova Scotia, in 1758 and with Wolfe at the Battle of the Heights of Abraham in 1759. He was converted to Methodism by the preaching of John Wesley at Bristol, England, and was afterward licensed to preach. He returned to America on military duty and after 1767 preached in New York in alternation with Philip Embury. After his retirement from the army with rank of captain he devoted himself to the preaching of Methodism. He founded the first Methodist Society at Philadelphia and also established societies in New Jersey, Delaware and Maryland. After the outbreak of the Revolutionary War he returned to England and spent the remainder of his life as a preacher at Bristol.

WEBB, William Henry, American shipbuilder: b. New York, June 19, 1816; d. Oct. 30, 1890. He was educated in the grammar school of Columbia College, New York; learned the trade of shipbuilding in his father's yard; became manager of his father's business in 1843. Under Webb's management were built many ships of war for the United States and foreign governments, as the *General Admiral,* steam-frigate for Russia, two steam-frigates for Italy, the *Dunderberg,* ironclad ram for the United States government. In 1890 were erected buildings at Fordham, N. Y., for an "academy and home for shipbuilders," founded by Webb. The objects of the academy and home are:

(1) Relief of "aged, indigent and unfortunate men" who have been engaged in any department of shipbuilding in the United States; relief also of their widows. (2) Providing for American young men of good character gratuitous education in the profession of shipbuilding and machine-engine building, together with free maintenance.

WEBB CITY, city, Missouri, in Jasper County; altitude 1,003 feet; 6 miles northeast of Joplin; on the St. Louis-San Francisco, and the Missouri Pacific railroads. The region in which it is located was originally predominantly agricultural, and still has many fine farms; but when lead and zinc were discovered in a field embracing sections of Missouri, Kansas, and Oklahoma, and came increasingly into demand for commercial uses, Jasper County turned to mining. In the years of the first World War, Webb City and Carterville, its next-door neighbor—the two are known locally as the Twin Cities—experienced a considerable boom. After the war Webb City

developed new activities mostly centering on agriculture. Clothing, shoes, and explosives are produced; gravel for road building is made from the chats of the old mines. There is a Carnegie library. The town was settled and named for John C. Webb, on whose land the site was platted in 1875. It has a mayor and council. Pop. (1950) 6,919.

WEBB-KENYON ACT, was passed in March 1913, over the veto of President Taft. It prohibited the transportation from one state into another of intoxicating liquor intended to be used in any manner violating the state laws. Thus the federal protection which liquor enjoyed as an article of interstate commerce was removed and state prohibition was stimulated. By a decision of the Supreme Court of the United States of Jan. 8, 1917 the act was declared constitutional, thus ending a long controversy on the subject.

WEBBER, wĕb'ĕr, **Charles Wilkins,** American author and naturalist: b. Russelville, Ky., May 29, 1819; d. Nicaragua, April 11, 1856. In early youth he passed several years of adventurous life on the Texan frontier and in 1844 settled in New York as a journalist; for two years he was editor and co-owner of the *American Review* and a prolific contributor to several other magazines. He was a friend of Audubon, whose influence is noted in much of Webber's work. The first volume of his projected series *Hunter-Naturalist* was published in 1851 and the second and last in 1854 under the title *Wild Scenes and Song Birds.* His first story, *Old Hicks the Guide* (1848), was followed by the sequel *The Gold Mines of the Gila* (1849) and other tales of backwoods life and adventure.

WEBBER, Herbert John, American plant physiologist: b. Lawton, Mich., Dec. 27, 1865; d. Riverside, Calif., Jan. 18, 1946. He received the B.S. degree in 1889 and the master in 1890 from the University of Nebraska, and the Ph.D. from the University of Washington in 1901. From 1893 to 1907 he did research work for the Department of Agriculture on orange diseases and plant breeding; the latter subject he then taught at Cornell University and New York State College of Agriculture until 1912, when his association with the University of California began, which was to last until his death. He held there the posts of professor of plant breeding, of tropical horticulture, and of director of the agricultural and of the citrus experimental stations. He had become professor emeritus at the time of his death.

WEBER, vā'bĕr, **Albrecht,** German Indologist: b. Breslau, Germany, Feb. 17, 1825; d. Berlin, Nov. 30, 1901. He graduated from the University of Breslau in 1845, and in 1856 he became professor of Sanskrit language and literature at the University of Berlin, a post he held until his death. Weber was one of the greatest scholars on India of the 19th century, his studies covering the language, religion, philosophy, and science, as well as the interrelationship of the Indian and Semitic cultural worlds. He was chief editor and contributor of *Indische Studien,* 18 vols. (1856–1898), a collection of critical studies of Sanskrit texts edited and annotated by him. His *Akademische Vorlesungen über Indische Literaturgeschichte* (1852) was translated into French and English and is still one of the most authoritative publications on the subject.

WEBER, Ernst Heinrich, German physiologist and anatomist: b. Wittenberg, Germany, June 24, 1795; d. Leipzig, Jan. 26, 1878. He was educated in Wittenberg and Leipzig, and appointed professor of comparative anatomy there in 1818, of human anatomy in 1821, and of physiology in 1840. He originated the formula known as Weber's Law (q.v.) and a special compass to measure the intensity of the sense of touch. All his research works were collected in the *Annotationes anatomicae et physiologicae: programmata collecta* (1851).

WEBER, Georg, German historian: b. Bergzabern, Rhenisch Palatinate, Feb. 10, 1808; d. near Heidelberg, Aug. 10, 1888. He spent his life teaching at Heidelberg, first as a tutor, later as head master and from 1848 director of the local high school. He wrote three histories of the world which were very popular at the time: *Das Lehrbuch der Weltgeschichte* (1846, reedited in 23rd ed. by Baldamus, 1921–1929); *Weltgeschichte in Übersichtlicher Darstellung* (1851); and *Allgemeine Weltgeschichte mit besonderer Berücksichtigung des Geistes- und Kulturlebens der Völker,* 15 vols. (1857–1880; 3rd ed., vols. 1-4, 1919–1922).

WEBER, wĕb'ĕr, **Joseph,** American comedian and theatrical manager: b. New York, N. Y., Aug. 11, 1867; d. Los Angeles, May 10, 1942. He started his career at a very early age appearing with Lew Fields in juvenile "Dutch" sketches at small variety theaters. The two formed in 1885 a company of their own, which lasted until 1894; their plays, interspersed with dialect jokes and slapstick antics, became extremely popular. From 1895 to 1904 Weber and Fields owned and managed the Broadway Music Hall, where they continued to produce and act burlesque comedies and presented some of the music-hall stars of the day. *Helter-Skelter, Hurly-Burly,* and *Higgledy Piggledy* are the titles of some of their productions. They quarreled and separated in 1904, but in 1912 they resumed their partnership in vaudeville and revues; Weber later retired from the stage. See also Fields, Lewis Maurice.

WEBER, Baron **Karl Maria Friedrich Ernst von,** German composer, opera conductor, and pianist: b. Eutin, Holstein, Germany, Dec. 18, 1786; d. London, England, June 5, 1826. He was a pupil of J. P. Heuschkel of Hildburghausen, attaining great skill as a pianoforte virtuoso and much proficiency in the technique of composition; and continued his studies with Michael Haydn at Salzburg, and at Munich with Kalcher (harmony and composition) and Valesi (singing). His opera *Das Waldmädchen* (1800) was produced with but moderate success at Freiberg, though more fortunate at Chemnitz and (in 1805) at Vienna. A second opera, *Peter Schmoll und seine Nachbarn,* first presented at Augsburg (1803) met with no particular approval. Early in 1803 he went to Vienna, and there that curious genius the Abbé Vogler was for a year his instructor. By Vogler's aid, he secured the post of *kapellmeister* of the opera at Breslau (1804). He displayed great ability as an organizer and director, but resigned in 1806, and became musical

director to Prince Eugene of Würtemberg at Karlsruhe, Silesia. In 1807 he entered the service of Duke Louis of Würtemberg at Stuttgart as private secretary, and in 1808–10 was working on his first large opera, 'Silvana,' the libretto of which was to a large extent based on that of his earlier 'Waldmädchen.' He was falsely charged with fraud, and despite all lack of evidence against him, was perpetually banished from Würtemberg 26 Feb 1810. Then he went to Mannheim, where his first symphony was most favorably received, and his piano-playing was also very successful; and thence to Darmstadt, where he once more became a pupil of Volger. His comic operetta, 'Abu Hassan,' was completed in 1810 and given at Munich, and 'Silvana,' with additions, gained adequate recognition at Berlin in 1812. It was not, however, until 1813 that Weber held an important appointment; in that year he was made kapellmeister of the Prague opera, and there proved himself the first of the Great German musicians to be conspicuous also as a conductor. His administration of marked success was brought to a close by his giving it up in 1816. His chief compositions of this period were settings of Körner's songs, and the cantata 'Kampf und Sieg,' founded on the battle of Waterloo. In 1816 he went to Dresden, where previously Italian opera had held undisputed sway, to organize the new venture of German opera; and soon he had attained, except among a few partisans, an unqualified victory. The appointment was confirmed for life, and he was frequently summoned to direct the music of the chapel royal. He became widely known with the presentation of his opera, 'Der Freischütz,' at Berlin, 18 June 1821, which was quickly echoed elsewhere, being simultaneously given in London in three different places. Few operatic works, it is said, have equaled it in immediate triumph. 'Euryanthe' did not meet similar approval at Vienna (1823), though appreciation was duly encountered in Dresden, Leipzig and Berlin. On the commission of Charles Kemble of Covent Garden, London, he wrote 'Oberon' to an English libretto by J. R. Planché, himself learning English to be able to work to better effect. He conducted the first 12 performances, and after a reception which almost surpassed that of the 'Freischütz,' played at numerous concerts. With the 'Freischütz,' which struck a distinctively national note, Weber became the founder of what is known as the romantic school of German opera. He has been claimed as a predecessor of Wagner in adapting his music to the dramatic requirements, and the use of leading motives. In his operatic works he apparently preferred legendary and supernatural elements, which he could make musically effective. Though his operas are the best known of his writings, he did musicianly and even brilliant work in the direction of Lieder and pianoforte compositions. Consult Jähns, 'C. M. von Weber: Eine Lebensskizze' (1873); the biographies by Rau (1865); Benedict (1881); Reissmann (1882); Gehrmann (1899), and his son Max Maria von Weber (Leipzig, new ed., 1912); also Benedict, 'Musiciens du Temps Passé' (1893), and the article by Spitta in Grove's 'Dictionary' (Vol. IV, 1889).

WEBER, Wilhelm Eduard, German physicist, brother of E. H. Weber (q.v.): b. Wittenberg, 24 Oct. 1804; d. Göttingen, 23 June 1891. He was educated at Halle, was professor of physics at Göttingen in 1831–37 and occupied that chair at Leipzig in 1842–49, after which he resumed his chair at Göttingen. He was associated with his brothers and with Gauss in various publications concerning physics, and made valuable researches in the fields of electricity and magnetism. He also published a series of essays, 'Elektrodynamische Massbestimmungen' (1846–67). Consult Heinrich Weber, 'Wilhelm Weber' (1893).

WEBER, wē'bėr, a river of Utah, whose headwaters are on the west slope of the Uinta Mountains. It flows northwest through fertile lands and through a series of cañons; and after a course of nearly 200 miles it enters Great Salt Lake. The famous Weber Cañon is the gorge made by this river where it breaks through the Wasatch Mountains. The Union Pacific Railroad passes through this gorge. The descent in places is most rapid, and the consequent water-power is extensive. At Ogden, the mean volume of water is about 2,000 cubic feet a second. The Weber is much used for irrigation. The river has built up at Ogden a large delta which extends into ancient Lake Bonneville.

WEBER'S LAW. In the 30's of the last century E. H. Weber (q.v.) made the discovery that a subject who could barely distinguish between lifted weights of 29 and of 30 ounces could also barely distinguish between weights of 29 and 30 drachms. Similar results were obtained in the case of cutaneous pressure and in the visual measurement of short lines. That is, it appeared in each case that the just noticeable increment of a stimulus was not a constant, but bore instead a constant ratio to the strength of the stimulus itself. This generalization, which is Weber's law, is a precise statement of the fact which is familiar to us in such cases as that of the ticking of a watch, quite inaudible on the noisy street though it may be very loud in the silence of the bedroom. The ratio of the barely observable increment or difference limen to the stimulus is dependent on the kind of stimulus used. For pressures on the tip of the finger it is nearly 0.05, for noise loudnesses it is about 0.33, for lifted weights, 0.033, and for brightness, 0.01. Weber's law is only an approximation at best. It is badly in error for very great or very small stimuli; even for those of moderate intensity it presupposes a complete adaptation of the percipient organ. It is not in general valid for other attributes of sense than intensity, although it seems to hold good for visual extension. In the pitch of tones, for instance, the just noticeable increment is about .75 vibrations per second for a considerable range of the scale. In so far as we are able to equate easily noticeable intervals in different parts of an intensity scale, it appears that these obey the same law as just noticeable intervals; that equal-appearing intervals between stimuli are proportional to the intensity of the stimuli evoking the lower terms of the intervals, and are made up of an equal number of just noticeable intervals. This assemblage of facts was raised by G. T. Fechner (q.v.) to the dignity of a necessary law expressing the relationship of mind and matter. He represented the fact that a constant increment of a sensation is

produced by a fixed proportional change in the stimulus by the formula $s_1 - s_2 = f\left(\frac{i_1}{i_2}\right)$, where i_2 is the stimulus inducing the sensation s_1. We obtain from this at once

$$s_1 - s_2 = f\left(e^{\log \frac{i_1}{i_2}}\right) = f,$$

$$\left(e^{\log i_1 - \log i_2}\right) = \phi, \ (\log i_1 - \log i_2).$$

As i_1 depends only on s_1, and i_2 depends only on s_2 in the same way, we get $s_1 = \phi$, $(\log i_1 - c)$, and $s_2 = {}_k\phi$ $(\log i_2 - c)$, where c is the value of $\log i_k$ for $s_1 = 0$. Therefore ϕ $(\log i_1 - c) - \phi$ $(\log i_2 - c) = \phi$ $(\log i_1 - \log i_2)$, so that ϕ satisfies the functional equation ϕ $(x) - \phi$ $(y) = \phi$ $(x - y)$.

Differentiating with respect to x, ϕ^1 $(x) = \phi^1$ $(x - y)$, which is only possible for all values of x and y if ϕ^1 (x) is some constant such as K_1, or if ϕ (x) is of the form $K_1 x + K_2$. It is easily seen that $K_2 = 0$. We thus get $s_1 - s_2 = K_1 (\log i_1 - \log i_2)$. By the proper choice of units this becomes $s_1 = K \log i_1$. Fechner's law is, then, that the sensation varies as the logarithm of the stimulus.

There are several serious objections to Fechner's treatment of the law. In the first place, it is more than probable that the basis of the phenomena observed lies rather in the make-up of the nervous system than in the transition from the physical phenomena of the nervous system to the percipient mind. Even Wundt's explanation of the facts by apperception is vitiated by the appearance of the same logarithmic formula in the reactions of the nervous system of a decerebrized frog. Secondly, what is being determined in the mind of the subject of an experiment on discrimination is not the difference between two mental states, but the *awareness* of that difference, which is altogether another thing. The existence of limina is in itself enough to refute Fechner's opinion that it is actually the difference between two mental states which is reported, for things identical with the same thing are identical with one another, whereas a weight of 61 drachms is sensibly equal to the discriminable weights of 60 and 62 drachms. In the third place, while measurement of sensations is a conceivable thing, it is most assuredly not done directly, so that the whole interpretation of Fechner's law remains indeterminate until a thorough logical analysis is made of the processes involved in our actual measurement of the intensity of sensation.

The general types of method used in experiments and investigations on Weber's law are that of just noticeable differences, where two stimuli are gradually separated or approximated until their difference appears or disappears; that of average error, in which the average error of the observer in selecting a variable stimulus equal to a given fixed stimulus is taken as the index of the just noticeable difference or limen; that of equivalents, which differs from that of average error only in that the stimuli are applied simultaneously to different parts of the body rather than successively to the same part; that of mean gradations, in which a supraliminal interval is bisected; and that of right and wrong cases, in which the mean position of the initial stimulus limen or the difference limen is determined by ascertaining throughout a series of trials for each intensity of stimulus or magnitude of stimulus difference the proportion of cases in which its presence or absence is rightly judged. (See LIMINA; PSYCHOPHYSICS). Consult Delboeuf, J. R. L., 'Examen critique de la loi psychophysique' (Paris 1883); Fechner, G. T., 'Elemente der Psychophysik' (Leipzig 1889); Fullertan and Cattell, 'On the Perception of Small Differences' (Philadelphia 1892); Külpe, O., 'Outlines of Psychology' (tr. New York 1909); Meinong, A. (in *Zeitschrift für Psychologie*, Vol. XI, 1896); Muller, 'Grundlegung der Psychophysik' (Berlin 1878); Myers, C. S., 'Text-Book of Experimental Psychology' (2d ed., Cambridge 1911); Titchener, 'Experimental Psychology' (New York 1905); Wundt, W., 'Grundzüge der physiologischen Psychologie' (Leipzig 1908–11); Ziehen, T., 'Leitfaden der physiologischen Psychologie' (10th ed., Jena 1914).

WEBSTER, Arthur Gordon, American physicist: b. Brookline, Mass., 28 Nov. 1863; d. Worcester, Mass., 15 May 1923. He was graduated at Harvard University in 1885, later studied at Paris and Stockholm, and in 1890 took his Ph.D., at Berlin. He received in 1895 the Thompson prize, Paris, of 5,000 francs for experimental research on the period of electrical oscillation. He was assistant professor of physics at Harvard in 1892–1900; and from 1900 he was professor and director of physics at Clark University. He was appointed to the Naval Consulting Board in 1915; and to the National Research Council in 1917. He was an authority on sound and the inventor of several instruments of value in this connection. Author of 'A Mathematical Treatise on the Theory of Electricity and Magnetism' (1897); 'Dynamics of Particles of Rigid, Elastic and Fluid Bodies' (1903); 'Harrison Lectures on Sound, University of Pennsylvania' (1911), etc.

WEBSTER, Daniel, American statesman: b. Salisbury (now Franklin), N. H., 18 Jan. 1782; d. Marshfield, Mass., 24 Oct. 1852. He was the son of a New Hampshire judge and farmer and brother to a large family of boys and girls, all of whom worked and sacrificed in favor of Daniel whose health was apparently not robust. After rather meagre preparation he attended Exeter Academy a year. Thence he went to Dartmouth College where he was graduated in 1801 with good if not distinguished standing. He loved to study English and classical literature; he liked self-indulgence; and he was already an orator for Fourth of July occasions. More than once he had shown a disregard to that rigid honesty in little money matters which was later to become such a distressing trait of his character.

From Dartmouth to the farm of the hard-pressed father was not a congenial move for a young man so filled with ambition to play a rôle in the great world outside; but the road to the goal he vaguely set himself was not easy to find. He studied law a while in the office of a friendly lawyer nearby but inclined rather to general reading and to fishing than to rigid self-discipline. Next he turned to teaching school in the town of Fryeburg, Me., in the hope of winning ready money, so much needed in the Webster family, now that another son was sent to Dartmouth. After one session at Fryeburg, he returned to his native town of Salisbury and resumed the study of law in earnest. Ezekiel

the brother who had been at Dartmouth, now took a school in Boston and Daniel followed him to the New England metropolis. Here he studied law under the distinguished Christopher Gore, a little later governor of Massachusetts, and always a prince of the old New England culture. Gore was certainly not of the type of Ezekiel Webster, the farmer judge of New Hampshire, but he was the bitter enemy of that "Mr. Jefferson, the atheist Virginian" who had broken the power forever of the Federalists of New England. Webster absorbed the politics of localism and provincial superiority which a little later threatened to ruin a great career.

Admitted to the Boston bar on the recommendation of Gore himself in March 1805, Webster, a little past his 23d birthday, returned to his native State and there, in the town of Boscawen, began the practice of his profession. He was quickly successful; but realizing that a larger sphere for the display of his talents was necessary, he removed to the important commercial town of Portsmouth in the year 1807.

Here he came into touch with real New England, with men who went down to the sea in ships and brought back rich harvests from the banks of Newfoundland, from the marts of Europe and even from the strange cities of China. He met and competed with great lawyers, like Jeremiah Mason and William Plumer, and he learned to think in generous figures, not in the niggardly shillings and pence of his boyhood. For five years he learned from these men and from renewed study of the great British law authorities. Webster received or gave himself a broad and deep training, whereas his great rival in life, Henry Clay, had little or no training. Moreover he earned large fees in those exasperating years of non-importation acts and embargoes, procured for himself a good town house and went back to his native countryside and married Miss Grace Fletcher, the daughter of the minister at Hopkinton. He spoke against the government on every suitable occasion; learned to write great orations and to move large audiences; and shaped barbed resolutions against James Madison and his inconsiderate Virginians who monopolized all the great offices of the nation. He learned rather better than history has recorded the language of resistance and secession. How could he do otherwise in a community whose people were delighted with young William Cullen Bryant's first poem, "The Embargo." Thus trained, deeply resentful at the policy of the national government in going to war with England a second time and ambitious to meet the enemy face to face, he became a candidate for a seat in the National House of Representatives, was elected on a most flattering vote and took his seat in May 1813.

From 1813 to 1817 Webster served New Hampshire in the House of Representatives. He opposed the Madison administration at every turn as every good New Englander must do. His protests against the conduct of the war, against Federal interference with New England trade and against the conscription of soldiers to fight the war were all animated by a warm and even impassioned sectionalism that reminded one of the Massachusetts secessionist, Josiah Quincy, just retired in disgust from a government which seemed destined to remain in the hands of slave-holding Southerners and ignorant frontiersmen. If Webster was more discreet, it was probably because the exasperation of Southern leadership was not quite so disturbing to him. But Webster was already a great lawyer and very much of his time, as well as the best of his talent, was during these four years spent in the Federal courts, both at Boston and in Washington where Chief Justice Marshal took pains to express his hearty admiration of a fellow partisan who could distress Mr. Madison. When the second term in the house was about to expire, Webster declined to offer himself in New Hampshire for re-election and removed to Boston, having first thought of making New York his home — for there, he said, the great decisions of the near future would be made.

In Boston, he quickly received that recognition and adulation which seems to have become necessary to his happiness and success. From 1816 to 1823, he again practised his profession with eminent success. His income from fees increased, in spite of the lean years that followed the close of the war with England, from $2,000 to $20,000 a year. The wealthy and the distinguished yielded to the son of the New Hampshire frontiersman who lived in the handsome house on Somerset street and deported himself with all the dignity of a Cabot or a Dana. With wealth abounding and social distinction undisputed, even in Boston, Webster now gave himself to the delivery of a series of commemorative orations that made his name known wherever New Englanders dwelt or New England newspapers were read. The Plymouth (1820) and the Bunker Hill (1826) addresses were the best of these, although others, like that on the Character of Washington and on the Landing at Plymouth, were reprinted in every important eastern paper. It was the day of oratory. There were few scholars and the clergy were fast losing their former mastery of the popular imagination. Public men must be learned, or appear to be so, and they must on occasion display their learning and their fine phrases in well-rounded periods. Of all Americans who essayed the rôle of classic oratory on the frontier soil of America Webster was the foremost. He had a remarkable personality; his voice and manner were both imposing and winning; and he had a memory that always served him admirably. When Webster spoke men laid down their tools or stopped their plows in the field and went to hear him. They would gladly stand in great outdoor audiences or crowd themselves into Faneuil Hall for hours at a time on hot days in order to look upon his majestic form or follow his moving imagery. Thus, before the great struggle in the country about the tariff and the powers of the Federal government, Webster was prepared as few men ever had been prepared for attack or defense.

It was an easy matter, then, in 1822 for him to procure once more a seat in the national House of Representatives. He represented Boston. He was a strict sectionalist. In 1814, when he spoke for a New Hampshire constituency, he had threatened to resist the national authority and he sympathized fully with those recalcitrant governors and judges of New England who refused to furnish troops to the national administration or who declared Federal laws inoperative in States that did not approve Federal policy. In 1820 Webster was so much

opposed to the tariff laws of the Union that he threatened secession in a notable speech. When he appeared in his place in the national legislature late in 1823 he was ready for a great struggle.

Henry Clay was the leader of the House of Representatives at that time and he was pressing with all his energies the tariff and internal improvement bills which together he christened the "American System." Webster opposed Clay in the best speech that had ever been made in Congress on the subject of the tariff. It is known as his free trade speech. It was delivered in 1824. The arguments which he then arranged and massed in consummate style have never been answered. But New England was changing. He was a New Englander. In 1825 a New Englander, John Quincy Adams, became President and half of New England changed its investments from shipping to manufactures. Before 1828 Webster was himself in a quandary. He must change his attitude or cease to play a part in public life. His position was exactly parallel to that of Calhoun who had been a strenuous protectionist but whose constituents now became free traders. Calhoun abandoned protection which South Carolina would no longer endure; and Webster abandoned free trade which Massachusetts then and henceforth condemned. Calhoun was the Vice-President and very ambitious to be President. Webster was elected to the Senate in 1827 and he too soon became possessed with the ambition to rise to the presidency.

When Webster took his seat in the Senate, Henry Clay was the Secretary of State and the director of the policy of the party with which Webster must work, the incipient Whig party, the party of protection to American industries, of wide-flung schemes of internal improvements and of expanding the powers of the national government. The New Englander quickly fell into line. In 1828 he made his first important speech in favor of the "American System," so ably condemned four years before, and Calhoun prepared to thwart that very tariff policy which he had done so much to set up in 1816. Nullification was about to be tried and Webster from opposing the national power, as he had done all his life, now prepared to champion that cause. The greatest speech of his life was delivered in February of 1830 when western influences in Congress opposed to the leadership of Henry Clay were being aligned with the southern influences and interests voiced by Calhoun and Robert Young Hayne. These leaders of the three great sections of the country were compelled to work out a national policy which it was hoped that a majority of the people might support.

Thomas H. Benton had pressed for six years his bill for a freer distribution of the public lands in the hope of building up the West at the expense of the East. Webster opposed the Benton plan. The Southerners were divided; but, after long and doubtful negotiations, they had made up their minds to support the western claims in exchange for support of their free trade policy. Jackson was made President upon this combination. Webster did not like the combination. It meant disaster for New England. But Jackson did not like the power and influence of Calhoun in the combination which lay behind his own presidency. When, therefore, Calhoun prepared to launch his nullification program, expecting that Jackson would remain quiescent, there were signs that the President would revolt. It was the primary interest of New England that Jackson and Calhoun should break, that the West and the South should not continue their coalition, or alliance.

Soloman Foot of Connecticut made the first move in his resolutions of early January 1830, in which it was proposed to withdraw the public lands from sale. Benton was quick to denounce the resolution as indicative of the selfish and provincial policy of New England. The Southerners came to the support of Benton. The great debate was begun. Hayne of South Carolina made an elaborate attack upon New England, which roused Webster's ire; but Hayne also publicly announced that the South would support the West in its land program which made him uneasy. To this Hayne also added a long and thoughtful argument against the growing powers of the Federal government. The nation was only a confederation. It was only what the Constitution provided, but not a power of original jurisdiction over the people. Webster replied. He defended New England; said nothing about the subject of the public lands; and closed in a magnificent appeal to the people of the country on behalf of the government as a government of real powers. "The Union, one and inseparable, now and forever." It was strange doctrine from New England. But New England had changed its interest and its attitude. Chief Justice Marshall and the Federal courts had long been working to the same end with New England and the East as a whole. Webster stirred in men a devotion, as yet but half-aroused anywhere, to the ideal of a great national government supreme over all States, all sections and all American citizens. It was to be one of the classics of American oratory. There can be no doubt that it proved to be a powerful influence during the next 30 years. No President, duly cognizant of the meaning of his own office, could remain deaf to an appeal like Webster's. Jackson made it known in April following that he agreed with his New England opponent. When Calhoun's friends would have had him talk of States' rights at a Jefferson dinner, he boldly announced that he drank to the Union, "it shall be preserved." If that were so the alliance of South and West was dissolved and Daniel Webster had done much to dissolve it.

From 1830 to 1850 Webster remained almost uninterruptedly in the Senate. He supported the United States Bank in the long war it made upon the President and the nation he talked of in the great oration. He played a great part in the campaign of 1840 which resulted in the election of William Henry Harrison to the presidency and was under Secretary of State. When Vice-President Tyler succeeded in May 1841 to the office made vacant by the death of Harrison and when Henry Clay undertook to manage Tyler as a modern boss generally manages a governor of his own nomination, Webster revolted against the counsels of his chief, Clay, and retained his seat in the Tyler Cabinet. As Secretary of State under Tyler, Webster negotiated a treaty with the British Minister, Lord Ashburton, which was long known by the names of the two negotiators.

But Webster retired in May 1843. Already

the nomination and election of Henry Clay seemed to be foregone conclusions. Webster, in spite of Clay's dislike of his insubordination, gave earnest support to the Clay ambition. Clay was again defeated and Webster himself now expected that his turn for the leadership of the Whig party had come. He returned to the Senate in 1845 where he renewed his opposition to the annexation of Texas in its final stages. When the war with Mexico began he was, as usual, in full sympathy with the heated and unalterable opposition of his section. But he was too much of a candidate for the presidency to voice his views very strongly. Yet he failed of the Whig nomination in 1848. A successful general and a great slave-holder, Zachary Taylor, received the nomination as a result of Abolitionist opposition to Webster and Clay. Webster declared that it was an improper and unworthy nomination; and both Webster and Clay declined to give public support. Yet Taylor was elected.

Taylor, the slave-holder, urged the admission of California as a free State. As a result civil war between the North and the South seemed imminent. Webster was still in the Senate. Calhoun was again a member in 1845, after a retirement that had been designed to be final. Clay was returned to the Senate at this critical juncture to aid in reconciling the hostile sections of the country, reconcile interests that were in violent conflict. Since Webster, Calhoun and Clay so well represented the three sections — the East, the South and the West — any agreement satisfactory to them was likely to be satisfactory to the country. Clay took the lead, as he had done all his life. Calhoun placed himself in direct and bitter opposition. The South would never consent to the admission of another free State south of the line of 36° 30′, extended to the Pacific.

Unexpectedly President Taylor maintained the position that California must be admitted as a free State. A deadlock ensued. From the opening of Congress in December 1849 till the first of March 1850 it seemed that a disruption of the Union must be the outcome. Under these circumstances Clay arranged his last great compromise. It was prepared early in January. Private meetings of senators and representatives were arranged. Old enemies sat down to dinners together and with Clay. Newspaper editors were consulted and combinations made. When Clay at last made his appeal to Congress and the country, he had Webster's consent to follow him with a similar appeal. But President Taylor would have nothing to do with the compromise. Webster and Clay had both said he was an unfit man to be President. Moreover the Southern leaders challenged Taylor, and a challenge of the President as to his powers and his independence has almost invariably been fatal to the challenging party. Taylor would send the United States army into any territory where the Southerners refused to recognize the authority of the United States. That meant immediate war.

Webster had been a nationalist since 1830. He was not in sympathy with the Administration of his own party, which was supported by the Abolitionists. He was by nature a conservative, one who liked to have great social changes made slowly or not at all. He represented the manufacturers and the stable business element of New England and not what would be called the democracy of the North. He made the only decision that he could have made. It was given to the world on 7 March 1850 in a great and eloquent appeal to the public sentiment of the country, North and South, against the disruption of the Union. This decision of Webster broke the deadlock; it ranged his great followers alongside that of Clay. The country rallied to the two old chieftains. The President resisted till 9 July, when death removed him from the scene. Vice-President Fillmore, a friend of Webster and Clay, succeeded and the country breathed freely. In every large town there was a holiday, and big guns announced the passage of the compromise. It had been Webster's decision in March that produced the result. Not even Taylor's military stubbornness could long have withstood the tide of popular demand for a settlement.

Webster entered President Fillmore's Cabinet as Secretary of State and served the ideals of the country well, particularly in the publication of the Hulsemann letter, in which American sympathy for democratic uprisings everywhere was vigorously expressed. But he was denounced for his 7th of March speech most unmercifully. His name was anathematized in 'Ichabod,' one of the widely read poems of Whittier. But the country as a whole did not think less of him, only the people did not demand him for President. When the Whig national convention met in Baltimore, June 1852, to nominate a candidate for the presidency, Webster was the logical candidate. According to all the rules of regular political procedure, the great New England statesman should have received the nomination. But the convention, under the influence of Thurlow Weed and William H. Seward, preferred another military "hero." General Scott was nominated. Webster, broken hearted, went home to Northfield. There he made known his wish that his friends would vote for the Democratic candidate, Franklin Pierce. It was a trying ordeal, the public abandonment of his party. He died before the election. Like so many other great leaders, he died despairing of the republic.

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WEBSTER, Ebenezer, American patriot, father of Daniel Webster (q.v.): b. Kingston, N. H., 1739; d. Franklin, N. H., 1806. In his youth he served under General Amherst in the "old French war," and in 1761 was one of the original settlers of that part of the town of

Salisbury now known as Franklin. He combined, as was common at the time, the occupations of farmer and innkeeper; took an active part in public affairs; and at the outbreak of the American Revolution led the Salisbury militia to Cambridge, Mass. Subsequently he fought at White Plains and Bennington and served in other campaigns until the close of the war, by which time he had attained the rank of colonel of militia. Webster served at various times in both houses of the New Hampshire legislature, and from 1791 until his death was a lay judge of the county court of common pleas.

WEBSTER, H(arold) T(ucker), American cartoonist: b. Parkersburg, W. Va., Sept. 21, 1885; d. Stamford, Conn., Sept. 22, 1952. At the age of seven he began to draw, and when he was about 12 he sold his first cartoon. After studying art in Chicago for a short time, he went to work for the Denver *Post* but soon returned to Chicago to work for the *Daily News* (1903–1905) and the *Inter-Ocean* (1905–1908). Later, from 1908 to 1910, he worked on the Cincinnati *Post*. After a trip around the world in 1911, he settled in New York and drew cartoons for the Associated Newspapers, going to work for the New York *Tribune* in 1919 and the New York *World* in 1923. In 1931 he began to draw for the New York *Herald Tribune*, and eventually his work was syndicated in over 120 North American newspapers.

In thousands of cartoons, Webster commented with acute insight on the American character and social scene. Among his popular cartoon series were "The Timid Soul," which with Caspar Milquetoast added a beloved figure to the national mythology; "Life's Darkest Moment" and "The Thrill That Comes Once in a Lifetime," which nostalgically evoked his boyhood in Wisconsin; "The Unseen Audience," satirizing radio and television, which earned him a Peabody Award in 1950; "They Don't Speak Our Language"; "Poker Portraits"; "Bridge"; and "How to Torture Your Wife (Husband)." He published collections of cartoons in *Our Boyhood Thrills and Other Cartoons* (1915); *Boys and Folks* (1917); *The Timid Soul* (1931); and *Webster Unabridged* (1945).

WEBSTER, Henry Kitchell, American novelist: b. Evanston, Ill., Sept. 7, 1875; d. there, Dec. 8, 1932. After being graduated from Hamilton College in 1897, he taught rhetoric for a year at Union College and then returned to Evanston to devote himself entirely to writing. Among his published works are *The Whispering Man* (1908); *The Ghost Girl* (1913); *The Butterfly* (1914); *The Real Adventure* (1916); *The Painted Scene* (1916); *The Thoroughbred* (1917); *An American Family* (1918); *Mary Wollaston* (1920); *Real Life* (1921); *The Innocents* (1924); and *The Sealed Trunk* (1929).

WEBSTER, Herman Arthur, American painter and etcher: b. New York, N. Y., April 6, 1878. After being graduated from Yale University in 1900, he went to Paris, where he studied art at the Académie Jullian under Jean Paul Laurens. Although he attained some reputation as a painter, he became best known as an etcher, particularly of scenes in out-of-the-way French towns. His work is represented in the Luxembourg, Paris; the Victoria and Albert Museum, London; the Library of Congress, Washington; the Boston Museum of Fine Arts; and the Art Institute, Chicago.

WEBSTER, Jean (in full ALICE JANE CHANDLER), American writer: b. Fredonia, N. Y., July 24, 1876; d. New York, N. Y., June 11, 1916. She was educated at the Lady Jane Grey School, Binghamton, N. Y., and at Vassar College, from which she received a B.A. degree in 1901. After spending a few years in Italy and traveling around the world (1906–1907), she made her home in New York. In 1915 she married Glenn Ford McKinney, a New York lawyer. Her interest in underprivileged children led her to write her most popular novel, *Daddy Long-Legs* (1912), which she successfully dramatized in 1914. A sequel, *Dear Enemy*, appeared in 1914. She was also the author of *When Patty Went to College* (1903); *The Wheat Princess* (1905); *Jerry Junior* (1907); *The Four Pools Mystery* (1908); *Much Ado About Peter;* and *Just Patty* (1911).

WEBSTER, John, English dramatist: b. about 1580; d. ?1625. Very little is known of his life, but he was probably born in London, where his father was a tailor, and he himself was a freeman of the Merchant Taylors' Company in 1604. In 1602 he began to write plays for the theater manager Philip Henslowe in collaboration with other dramatists, but he attained his full powers only when, between 1607 and 1612, he adopted independent authorship. He altered and wrote an introduction to *The Malcontent*, a play by John Marston, and was associated with Thomas Dekker in writing two vigorous prose comedies, *Westward Hoe* (produced 1604) and *Northward Hoe* (produced 1605). *The White Devil or Vittoria Corombona*, published in 1612, was his first independent work; it is now recognized as one of the best tragedies of the Jacobean period. *Appius and Virginia*, written soon afterward and published in 1654, was long attributed solely to Webster, but it was probably partly the work of Thomas Heywood. Webster's masterpiece was *The Duchess of Malfi*, which was first produced at the Blackfriars Theatre about 1614 and published in 1623. This great tragedy, which won enthusiastic praise from Charles Lamb and many later critics, was based on a Neapolitan story found in Matteo Bandello's *Novelle*. *The Devil's Law Case*, also published in 1623, appears to have been Webster's last play. Of other plays sometimes ascribed in part to Webster, only *A Cure for a Cuckold* (published in 1661) seems to contain any of his work. He also wrote prefatory verses to Heywood's *Apology for Actors* (1612) and collaborated with Heywood and Cyril Tourneur in writing *Three Elegies to the Memory of Prince Henry* (1612). In 1624 he wrote a pageant for the lord mayor of London. The best edition of Webster's works is that of Frank Laurence Lucas (4 vols., 1927).

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WEBSTER, Joseph Dana, American soldier and engineer: b. Hampton, N. H., Aug. 25, 1811; d. Chicago, Ill., March 12, 1876. After being graduated from Dartmouth College in 1832, he studied law and in 1835 entered government service as a civil engineer. Three years later he was

commissioned a second lieutenant of topographical engineers. He remained in the army, rising to the rank of captain, until 1854, when he resigned his commission and went to Chicago, where he obtained an interest in a firm manufacturing agricultural implements. As a member of the city sewage commission, he helped to solve the problems involved in constructing the Chicago sewage system, a project which involved raising the grade of a large part of the city. At the beginning of the Civil War he was charged with the construction of fortifications at Cairo, Ill. In 1862 he became colonel of the 1st Illinois Light Artillery, but shortly thereafter was appointed chief of staff to Gen. Ulysses S. Grant. Commissioned brigadier general as of November 1862, he was made military superintendent of the railroads in the area of Grant's operations. Subsequently he served as chief of staff for Gen. William T. Sherman, and retired from the army in 1865 with the rank of brevet major general of volunteers. Returning to Chicago, he served as assessor of internal revenue (1869–1872), assistant United States treasurer (1872–1875), and collector of revenue (1875–1876).

WEBSTER, Noah, American lexicographer and author: b. West Hartford, Conn., Oct. 16, 1758; d. New Haven, Conn., May 28, 1843. In 1774 he entered Yale College, but his studies were interrupted by the outbreak of the Revolutionary War, in which he served as a volunteer. After receiving his degree in 1778, he studied law and was admitted to the bar in Hartford in 1781. The unsettled state of the country prevented his obtaining a suitable opening in his profession, and for several years he taught school in various places. While at Goshen, N. Y., in 1782, he wrote an elementary spelling book, which he published in Hartford in the following year as part 1 of *A Grammatical Institute of the English Language.* Part 2, a grammar, appeared in 1784; and part 3, a reader, in 1785. The speller, known as *Webster's Spelling Book* or *Blue-Backed Speller,* was extremely popular in various editions for more than a century, and by 1890 more than 60 million copies had been printed; it had great influence in standardizing orthography and pronunciation in the United States. As an author, Webster was disturbed by the lack of federal or state copyright laws, and from 1782 to 1789 he devoted much of his time and energy to agitation for a uniform copyright law, which he came to believe could be achieved only through the establishment of a strong federal government. In 1785 he set forth his views in *Sketches of American Policy,* and two years later he published a pamphlet urging the adoption of the Constitution. In 1785–1786 he gave lectures on the English language in various cities, and these he published in 1789 as *Dissertations on the English Language.* These interests led to correspondence with Benjamin Franklin and to experiments with spelling reform. After an unsuccessful venture as editor of the *American Magazine* in New York in 1787–1788, Webster went to Hartford, where he practiced law until 1793. Returning to New York, he established two Federalist newspapers, a daily, the *Minerva* (later the *Commercial Advertiser*), and a semiweekly, the *Herald* (later the *Spectator*). He maintained his ownership of both papers until 1803, but he moved to Hartford in 1798 and thereafter devoted most of his time to writing. In 1806 he published his first lexicographical work, *A Compendious Dictionary of the English Language,* in which he included about 5,000 words not found in previous dictionaries. In 1812 he moved to Amherst, Mass., meanwhile continuing his research. He served as a member of the Massachusetts legislature in 1815 and 1819, and as trustee (1816–1821) and president (1820–1821) of Amherst Academy, and he helped to found Amherst College. In 1822 he returned to New Haven and resided there until his death.

Webster's great work was *An American Dictionary of the English Language,* the fruit of more than 20 years of study and research. In 1824, when the work was nearly completed, he went to France and England to obtain additional material, and he finished his dictionary during an eight months' residence in Cambridge, returning to the United States in 1825. A two-volume edition was published in 1828, and a revised and enlarged two-volume edition in 1840. Webster ranks as the greatest of American lexicographers. He originated most of the accepted dictionary forms and laid the groundwork for the modern comprehensive lexicon. Although he made some errors in word derivations, his definitions were excellent and his scholarship in general was of a high order. In 1843 the rights to his dictionary were sold to the firm of G. & C. Merriam, Springfield, Mass., which has continued to publish it in various editions, the latest unabridged version being *Webster's New International Dictionary of the English Language* (2d ed.).

Webster was a man of wide interests, and he published works in many fields. In addition to those previously mentioned, he was the author of a pamphlet, *The Revolution in France* (1794); 10 essays under the signature Curtius in favor of Jay's Treaty (1795); *A Brief History of Epidemic and Pestilential Diseases* (2 vols., 1799), which he wrote after an outbreak of yellow fever and which became a standard work; *Ten Letters to Dr. Joseph Priestley* (1800); *Historical Notices of the Origin and State of Banking Institutions and Insurance Offices* (1802); *A Philosophical and Practical Grammar of the English Language* (1807); *Origin, History, and the Connection of the Languages of Western Asia and of Europe* (1807); *History of the United States* (1832), long popular as a textbook; and a revision of the *Authorized Version of the Bible* (1833). *Experiments Respecting Dew* (1809) was a pioneer scientific work. In addition, Webster edited John Winthrop's *Journal* (1790).

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WEBSTER, Pelatiah, American publicist: b. Lebanon, Conn., Nov. 24, 1726; d. Philadelphia, Pa., Sept. 2, 1795. After being graduated from Yale College in 1746, he studied theology and from 1749 to 1755 was a Congregational minister in various towns. Settling in Philadelphia, he became a merchant and amassed a considerable fortune. Webster was a student of the problems of currency, finance, government, and national resources, and during the Revolutionary War he aided the American cause with his purse and pen. He was imprisoned by the British at Newport in 1777 and for several months at Philadelphia in 1778, and his property was confiscated. He wrote *Essays on Free Trade and Finance* (1785); *A Dissertation on the Political Union and Con-*

stitution of the Thirteen United States of North America (1783).

WEBSTER, Richard Everard, 1st Viscount Alverstone, British jurist: b. Dec. 22, 1842; d. Cranleigh, Surrey, Dec. 15, 1915. Educated at Cambridge University, he was called to the bar in 1868. The Conservative government selected him as attorney general in June 1885, and the next month he secured election to Parliament, a necessary prerequisite to occupying the post. He was attorney general until 1892, and again from 1895 till 1900. He was representative of Great Britain in the Bering Sea Controversy (q.v.) in 1893 and in the Venezuelan Boundary Dispute (q.v.) in 1898. Knighted in 1885, he was raised to the peerage as Baron Alverstone in 1900 on appointment to the mastership of the rolls. On becoming lord chief justice in October 1900, he received a viscountcy. During 1903, he served as a member of the Alaska Boundary Commission (q.v.). He retired in 1913.

WEBSTER, town, Massachusetts, in Worcester County, on the French River 16 miles southwest of Worcester; it is served by the New York, New Haven and Hartford, and the Boston and Albany railroads. Industries include the manufacture of textiles, paper, and shoes. The town was set off from Dudley and Oxford in 1832. Pop. (1950) 13,194.

WEBSTER-ASHBURTON TREATY, The, in United States history, a treaty signed in Washington, D.C., in August 1842. The chief negotiators were Daniel Webster and Lord Alexander Baring Ashburton (qq.v.). It settled the boundary between the state of Maine and Canada. Seven twelfths of the disputed ground was assigned to the United States; Canada's share included heights commanding the St. Lawrence which an earlier award by the king of the Netherlands had assigned to the United States. Other provisions related to suppression of the African slave trade and the mutual extradition of criminals. See United States—*38. United States Diplomacy* (Oregon Question).

WEBSTER CITY, city, Iowa, Hamilton County seat; altitude 1,040 feet; on Boone River; 71 miles northwest of Des Moines; served by the Fort Dodge, Des Moines and Southern; the Chicago and Northwestern; and the Illinois Central railroads. Industries include the manufacture of washing machines, electric football and basketball scoreboards, and farm machinery. The town was founded in 1850 by Wilson C. Brewer; government is the council-manager form. Pop. (1950) 7,611.

WEBSTER GROVES, city, Missouri, in St. Louis County; on southwestern outskirts of St. Louis, of which it is a residential suburb; served by the Missouri Pacific and St. Louis-San Francisco railroads. Webster College (part of St. Louis University, for women, founded 1915), and Eden Theological Seminary (Protestant) are located there. Webster Groves became a city in 1914, and has the commission form of government. Pop. (1950) 23,390.

WEBWORMS, various species of caterpillars or lepidopterous larvae, so named because of their habit of spinning webs of silk, enclosing leaves upon which they feed, and also serving as a shelter. As a rule neither the web-spinning nor the social habit is so highly developed as in the tent-caterpillars (q.v.), but there is no sharp distinction in the application of the two names. The species of caterpillars exhibiting such habits are quite numerous and belong to a number of genera and families of moths (q.v.). Some of them are of considerable economic importance. The fall webworm is the larva of the small white moth (*Hyphantria cunea*). As soon as they leave the egg all of the larvae hatching from a mass spin a common web enclosing several leaves. After these are eaten the caterpillars wander farther and farther in search of food, sometimes destroying the entire foliage of a tree, but always returning to the shelter of the nest to rest when not feeding. Typical of a large and quite distinct group of caterpillars is the garden webworm (*Loxostege similalis*), which is a small, nearly naked caterpillar that feeds in company on all kinds of garden vegetables. Some of the related species form large colonies. The root webworms are caterpillars of the little roll-wing moths. *Crambus vulvigagellus* is a common species, which spins a web about the stalks and roots of grass and corn to which it is sometimes very destructive. The true tent-caterpillars belong to the genus *Clisiocampa* and family Bombycidae.

WEDDELL, wĕd'ĕl, **SEA,** Antarctica, wide arm of the South Atlantic Ocean, south of the island dependencies of the Falkland Islands. The shores, which are covered with ice, remain largely unexplored; portions of them are named Coats Land, Caird Coast, and Leopold Coast. The sea was named for James Weddell (1787–1834), a British navigator who entered it in 1823 with the brig *Jane* and the cutter *Beaufoy* and reached the then record latitude of 74° 15′ S.

WEDDERBURN, wĕd'ĕr-bûrn, **Alexander,** 1st Baron Loughborough, British jurist and statesman: b. Edinburgh, Feb. 13, 1733; d. near Windsor, England, Jan. 2, 1805. He was a member of the bar of Scotland from 1754 till 1757, and thereafter of that of England. Elected to the House of Commons in 1761 as member for Ayr, he subsequently represented various constituencies and was by turn Tory and Whig as expediency suited him. He was appointed solicitor-general, 1771–1778, and attorney-general, 1778–1780, by Lord North, of whose North American policies he strongly approved. In 1780, he was created baron and made chief justice of the court of common pleas. He served on this bench until 1792, when he became lord chancellor. On retirement in 1801, he was made 1st earl of Rosslyn. As judge, he displayed great clarity of judgment; but as politician, despite considerable oratorical powers, he was widely distrusted.

WEDDERBURN, James, Scottish balladist: b. Dundee, 1495?; d. England, 1553. He was educated at the University of St. Andrews. Espousing the Reformation, he was forced to seek refuge in France from arrest in Scotland as a heretic. With his brothers, John (1500?–1556) and Robert (1510?–?1557), he composed several anti-Romanist ballads. With them, about 1548, he edited a song book long popular in Scotland entitled *Ane Compendius Buike of Godly*

and Spirituall Sangs, Collectit Out of Sundrie Partes of the Scripture, wyth Sundrie of Uther Ballates Changed Oot of Prophane Sangs, for Avoyding of Synne and Harlotrie; editions of the work were published by David Laing (1868) and Mitchell (1897). He was also credited with authorship of *The Complaynt of Scotland* (1548).

WEDDING ANNIVERSARIES, or celebrations, bear many familiar names from the sort of articles considered appropriate gifts on such occasions. They are as follows: Paper, one year; cotton, two years; leather, three years; books, four years; wooden-clocks, five years; iron, six years; copper, bronze or brass, seven years; electrical appliances, eight years; pottery, nine years; tin or aluminum, 10 years; steel, 11 years; silk or linen, 12 years; lace, 13 years; ivory, 14 years; crystal, 15 years; china, 20 years; silver, 25 years; pearl, 30 years; jade or coral, 35 years; ruby, 40 years; gold, 50 years; emerald, 55 years; and diamond, 60 years, or 75 years as is the custom in the United States.

WEDEKIND, Frank, German dramatist and pamphleteer: b. Hanover, July 24, 1864; d. Munich, May 1918. He first became a journalist, but drifted for a time into the employ of Maggi's soups, where he managed the advertising department (1886). He traveled as a performer in Herzog's Circus (1888) and settled in Munich in 1890, where he spent the rest of his life in literary and artistic work of various kinds. Wedekind's plays, of which many may be obtained in English translations, are a savage exposure of the sexual hypocrisy of our times, which imposes upon all classes a degree of restraint and concealment of this fundamental passion inevitably resulting in the most dangerous repressions and perversions. His first play treats this situation in a more pathetic and impressive manner than Wedekind subsequently succeeded in reaching in any of his more ambitious works. He presents in it (*Frühlings Erwachen,* 1891, *Spring's Awakening*) the early sex interest of children and the cowardice of parents in informing them on matters so vital to their future development. The terrible results of the misunderstood passion on the lives of the boys and girls in the play are perhaps more typical of Germany than of most other countries, owing to the more rigid course of German family life, but they are, in large measure, of universal application. Like several other plays of Wedekind's, *Frühlings Erwachen* has been played in New York, in English. *Erdgeist,* also dealing with sex phenomena (1895), is more colossal in its scope and almost crushing in the fury of its obsessions; its sequel, *Die Büchse der Pandora* (*Pandora's Box,* 1904), goes further in depicting the unsavory side of sex relations—Schnitzler's *Reigen* is probably the extreme in the more aphrodisiac, more tempting direction—than any other play in literature. *Erdgeist* and *Die Büchse der Pandora* are more generally known under the collective title of *Lulu,* the name of the man-consuming heroine. Other important plays are *Die junge Welt* (1897), *Der Liebestrank* (1899), *Der Kammersänger* (played in New York in English, as *The Tenor,* by the Washington Square Players, 1900), *Hidalla* (1904), *Die Zensur* (1908). The last named is a short but humorous dramatic attack on the censorship with which Wedekind had come in contact because of outspoken utterances in a previous play. In fact, he once fled from Germany from persecution for *lès majesté* (*Majestätsbeleidigung*), remained for a short time in Paris, returned voluntarily for trial, and served a short sentence in the fortress of Königstein (1900). After the outbreak of World War I in 1914, Wedekind seems, like many other German writers, to have been attracted to a more sympathetic view of German history and the German government, and wrote (1915) a rather overpatriotic historical play, *Bismarck,* glorifying the events leading up to the foundation of the German Empire. He is one of the most vigorous and original satirists of our time; his ironic, cynical estimate and rejection of the universe is apparent behind all his ingenious puns, and his grotesque humor, his eccentric caricatures, his burlesque distortions. As an artist he considers restrictions of form to be not binding, and produces not infrequently results that are refreshing or even childishly grotesque. His works (7 vols.) appeared at Munich in 1913, and include short stories as well as plays. Biographical works on Wedekind have appeared from the pens of Pissin, Raimund (1905); Kapp, Julius (1909); and Elsner, Richard (1909).

JACOB WITTMER HARTMANN.

WEDEMEYER, wĕd'ē-mī-ēr, **Albert Coady,** United States army officer: b. Omaha, Neb., July 9, 1897. Graduating from West Point in 1918, he was commissioned second lieutenant of infantry and rose through the grades to reach the temporary rank of lieutenant general in 1945. His service included duty in the Philippines, 1923–1925 and 1932–1934, and China, 1930–1932; study at the Command and General Staff School, 1934–1936, and the Kriegs Akademie (German General Staff School), 1936–1938. In 1940, he was assigned to Washington, D.C., in connection with the training of the greatly expanded United States Army, and the next year he was transferred to the war planning branch of the general staff. He continued to serve with the general staff after the United States entered World War II in December 1941, earning the Distinguished Service Medal in 1943 for his work as chief of the strategy section and later of the strategy and policy group of the operations division. Given the temporary promotions to brigadier general in 1942 and major general in 1943, in October of the latter year, he was appointed American deputy chief of staff of the Southeast Asia Command, at that period operating under Admiral Lord Louis Mountbatten against the Japanese in Burma. In October 1944 he was transferred to Chungking, China, to succeed Gen. Joseph Warren Stilwell (q.v.) in command of the United States Army forces in the China area and to serve as chief of staff to Chiang Kai-shek (q.v.). Promoted temporary lieutenant general in January 1945, he continued to serve in China until war's end. After termination of the conflict he remained in charge of American troops in that country until the summer of 1946.

WEDGE, something made of hard substance in the form of a V or double inclined plane, for splitting or pushing apart by being thrust between two surfaces. It is often regarded as one of the mechanical powers, but is really an amplification of the inclined plane. The blade of an axe, the head of a chisel and the woodman's wedge are familiar illustrations

of common wedges. A very thin wedge driven with a comparatively light hammer may be made to exert a high degree of splitting force, owing to the mechanical advantage obtained. See MECHANICAL MOVEMENTS, POWERS AND APPLIANCES.

WEDGWOOD, wĕj'wŭd, **Josiah,** English potter: b. Burslem, Staffordshire, 12 July 1730; d. Etruria, Staffordshire, 3 Jan. 1795. He was the son of a potter in the district and on the death of his father was employed in the pottery at nine. An incurable lameness later compelled him to give up the wheel and he removed for a time to Stoke, where he entered into partnership with other potters and where his talent for ornamental pottery was first displayed. In 1759 he returned to Burslem, and set up a small manufactory of his own, in which he made white stoneware, and developed the cream-colored ware for which he became so famous. He presently succeeded in producing a ware so hard and durable as to render works of art produced in it almost indestructible; and he also produced paintings on pottery without the artificial gloss so detrimental to the effect of superior work. In 1771 he erected potteries at Etruria, a village which he founded for his workmen. His improvements in pottery, which included form, substance and decoration, in all of which he attained an excellence rarely equaled, created the great trade of the Staffordshire potteries, which even during his lifetime acquired a remarkable expansion. He made 50 copies of the Portland vase, which were sold for 50 guineas each, a sum which it is said did not cover his expenditure in their production. (See POTTERY; WEDGWOOD WARE). Consult Jewett, 'The Wedgewoods' (1865); Meteyard, Eliza, 'Life' (1860); Rathbone, 'The Masterpieces of Old Wedgwood Ware' (1892-93); 'Life,' by Smiles (1894).

WEDGWOOD PYROMETER, in physics, a pyrometer in which temperature is ascertained by the contraction of baked clay, measured before and after its subjection to the action of heat.

WEDGWOOD WARE. England's most noted art potter was Josiah Wedgwood, born at Burslem, Staffordshire, in 1730. In 1754 he became Whieldon's partner, but started his Ivy House works in 1759, making "cream-color" ware. By 1773 Wedgwood's products were all being made at the newly-erected magnificent works called Etruria. "Jasper" ware (made first in 1775) was Wedgwood's most noted achievement. It was of colored body and decorated with Flaxman's reliefs in white. The texture of the paste was very beautiful and the ware was left unglazed (*biscuit*). It was used, not only in vases and table services, but also as cameos in medallions, plaques, brooches, shoe-buckles, earrings, snuff-boxes, etc. Jasper ground colors were dark and light blues, lavender, pink, two tones of green, black, so-called 'lilac" and yellow — the rarest and most coveted of all pieces. First it consisted of a solid colored body of a most beautiful grain, but was later made in a white body and dipped to give a surface of color upon which the delicate white reliefs were laid. A few pieces (made since 1790) are "tricolored." The medallions (Hackwood, as well as Flaxman, did many of the best) contained mythological subjects and beautifully executed portraits of Benjamin Franklin, Robert Boyle, Sir Isaac Newton, Priestly, Hamilton, etc. A fine white ware, named "pearl," was made from a variation of Wedgwood's "Queen's ware" paste (this was his cream-color patronized by Queen Charlotte) used on "shell" patterns and coated with pearl-shell lustre enamel washes. Gold, purple, yellow and silver (platinum) lustre pieces were made from 1792 to 1810 in tea-pots, coffee pots, cream jugs, candlesticks, trays, etc. The black stoneware that Wedgwood called "basalts of Egypt" was used on "Etruscan" (as Greek vases were then called) vase styles, medallions, panels, seals, plaques, busts, tea and coffee sets etc., with reliefs of mythological scenes, trees, horses, flowers. Noted are the busts in this ware of Zeno, Cicero, Plato, Chaucer, Milton, Spencer, Bacon, Lord Chatham of the larger sizes and the smaller Voltaire, Rousseau, etc. Most famous of Wedgwood's productions is the glass Barberini or Portland vase (see PORTLAND VASE) in black-polished earthenware background with applied white jasper bas-reliefs. Wares of mottled bodies and glazes were made in both Burslem and Etruria, Wedgwood learned this style through Whieldon's "tortoiseshell," granite, agate and other marbled wares. Another variety was the "rosso antico" or unglazed red stoneware, after the Elers brothers' style, used on cream jugs, milk jugs, etc. The so-called Greek "Etruscan" antique pieces were imitated by a method Wedgwood termed "encaustic" painting; they used an enamel paint process that produced a dull (*mat*) surface. As the pieces copied were of the Greek "Decadent" period they are not much admired; such ware is found in tea-cups, jugs, bowls, etc. Wedgwood's "bronze encaustics" still exist but the *bronze* (precipitated gold), adhering only through japanners' size is mostly worn off. Wedgwood produced scarcely any porcelain ware, but his nephew, Byerly (10 years after the great Josiah's death), made a real fine porcelain in small quantities, in unrefined decoration, mostly. Since 1872 porcelain has been produced again in Etruria. This great factory has been continued under the descendants of Josiah to this day.

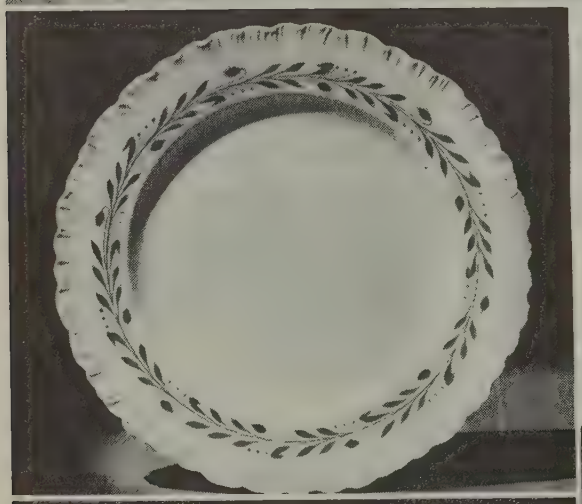
Characteristics and Marks.— True pieces having the "Wedgwood" mark and word "England" date from 1791, then the country of origin was added. "Old" Wedgwood body has been compared with a "baby's skin"; Church describes it as "ivory, neither dry and chalky-looking on the one hand, nor of waxy smoothness on the other; Yoxall says it "feels like a clay-pipe which has a film of soap-bubble over it." In Josiah's day the body had a perfect homogeneity and the workmanship showed "no ripples or stringiness" as appeared later. Marks are "Wedgwood & Bentley," "WEDGWOOD & BENTLEY," "WEDGWOOD & BENTLEY, ETRURIA," in a circle; also "W. & B." These were during the Bentley partnership, otherwise "WEDGWOOD" alone was used. The mark is always *impressed*. Much has been said of the Wedgwood forgeries, but they are so rare as to be almost considered negligible. Neither the ware nor the impressed mark are easy to closely imitate. Voyez, when dismissed by Wedgwood, made cameos in Wedgwood style and he was

WEDGWOOD WARE

Josiah Wedgwood and Sons, Inc

Top left: Marbled ware of the period of the Whieldon partnership, 1754–1759. *Top right.* Wedgwood shapes and glazes in the modern style. *Center left:* Salt glaze cornucopia produced at Burslem in 1760. *Center right:* Jasper jug of 1770 beside a modern example of the same shape in blue queen's ware. *Bottom:* three examples of modern jasper.

WEDGWOOD WARE



This cream colored pattern was given the name of queen's ware in 1765 by Queen Charlotte of England. The tableware is still in production.

Josiah Wedgwood and Sons, Inc.

Three 18th century Wedgwood designs still in production. Counterclockwise, their names are "Barley," "Husk," and "Bacchus."

a "perfect master of the antique style," but few of his cameos are known. William Adams, who worked under Josiah, made fine jasper cameos, but gave them the mark *Adams* impressed. A Herr Schmidt, at a Bayreuth factory in the 19th century, is said to have imitated Wedgwood's stoneware, using his mark.

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WEDMORE, Sir **Frederick,** English author and art critic: b. Clifton, England, July 9, 1844; d. Sevenoaks, England, Feb. 25, 1921. Educated in France, he was noted for his interpretations of French art in England. He was art critic on the London *Standard* from 1878 for nearly 30 years; lectured at Harvard and Johns Hopkins in the United States; was knighted in 1912. He edited the English edition of François-Émile Michel's *Rembrandt* (1886); wrote the *Pastorals of France* (1877); *Life of Balzac* in the Great Writers Series (1890); *Studies in English Art* (1876; 1880); *On Books and Arts* (1899); *Turner and Ruskin* (1900); *Etchings* (1911); *Memories* (1912); *Brenda Walks On* (1916).

WEDMORE, wĕd'mōr, agricultural village and parish, England, in Somerset, 7 miles northwest of Wells. It has a 15th century church. In 878 A.D. Alfred the Great, who had overthrown the Danes of East Anglia, signed here with King Guthrum the Peace of Wedmore. By this treaty the king and his chieftains agreed to withdraw into the Danelagh (q.v.), the territory in northeast England north of Watling Street, and to embrace Christianity. Guthrum changed his name to Athelstan with Alfred as his sponsor. Pop. (1931) 2,382.

WEDNESBURY, wĕnz'bĕr-ĭ, a municipal borough, England, in Staffordshire, 8 miles northwest of Birmingham, on the Tame River. It was named for the Scandinavian god Odin or Woden. A battle was fought here in 592 A.D. between the Saxons and Britons. It has a fine Perpendicular church (St. Bartholomew) and many modern buildings. As a steel center in the Black Country it manufactures railway rolling stock, steel tubing, machinery, and light metals. Pop. (1951) 34,758.

WEDNESDAY, wĕnz'dĭ, the fourth day of the week. The English name is derived from the old Scandinavian god Odin or Woden. In Anglo-Saxon, it is *Wōdnes dæg;* in Danish and Swedish, *Onsdag;* in Dutch, *Woensdag.* The Romans called it *Dies Mercurii* (Mercury's Day) and the Germans call it *Mittwoch* (midweek). See also Ash Wednesday.

WEED, Clarence Moores, American naturalist: b. Toledo, Ohio, Oct. 5, 1864; d. Lowell, Mass., July 20, 1947. After graduating from the Michigan Agricultural College in 1883, he was instructor (1904–1922), principal (1922–1932), and president (1932–1935) of the Massachusetts State Teachers College at Lowell. From 1918 to 1920 he was regional director of the United States School Garden Army. His works include *Manual of School-Supervised Gardening* (1920); *Insect Ways* (1930).

WEED, Edwin Gardner, American Protestant Episcopal bishop: b. Savannah, Ga., July 23, 1837; d. Jacksonville, Fla., Jan. 18, 1924. He was educated at the University of Georgia and at the General Theological Seminary where he graduated in 1870. He took priest's orders in the Episcopal Church in 1871 and was rector of the Church of the Good Shepherd, Summerville, Ga., from 1871 to 1886. In 1886 he was consecrated bishop of Florida.

WEED, Stephen Hinsdale, American soldier: b. New York, 1834; d. near Gettysburg, Pa., July 2, 1863. Graduated from the United States Military Academy in 1854, he served on the Texan frontier and in the Seminole wars in Florida 1855–1857; became a lieutenant in 1856; and was on duty in Kansas and in Indian wars in Utah 1858–1861. When the Civil War broke out he was promoted captain and assigned to the command of a battery in the Army of the Potomac where he became known as a "superb artillerist." He was engaged in many campaigns and at Chancellorsville received promotion to brigadier general of volunteers for his gallantry in action. Commanding a brigade of artillery at Gettysburg, he was picked off by a sharpshooter while holding Little Roundtop.

WEED, Thurlow, American journalist and political leader: b. Greene County, N. Y., Nov. 15, 1797; d. New York City, Nov. 22, 1882. At 14 he entered a printing office, but left his trade for a time to serve in the War of 1812. In 1819 he went to central New York State, where he established and edited successively *The Agriculturist* at Norwich and the Onondaga County *Republican* at Manlius. In 1822 he became editor and later proprietor of the Rochester *Telegraph,* a daily paper. During the Antimasonic excitement he stopped publication of the *Telegraph* and issued the *Anti-Masonic Enquirer.* He was twice elected to the state legislature on the Antimasonic ticket, and while in Albany became noted as a shrewd political manager. In 1830 he moved to Albany and established the Albany *Evening Journal,* which he edited until 1862. This paper was first used as a means of attacking the "Albany Regency," a body of politicians under the leadership of Martin Van Buren, and it soon became the leading journal of the Whig Party in the state. Through the influence of this paper and his political skill, Weed became the state manager of the Whig Party and later of the Republican Party. He held no public office himself, but for many years practically controlled the nominations for state officers; some of the most efficient governors of the state were elected under his management. He also took a leading part in national politics as early as 1824, and when John Quincy Adams was nominated for the presidency, he was instrumental in uniting the Clay and Adams factions. He was particularly influential in securing the nomination of William Henry Harrison in 1840, Henry Clay in 1844, and Zachary Taylor in 1848. In 1860 his first choice for the presidency was William H. Seward, but he loyally supported Lincoln after his nomination and urged his renomination in 1864. Weed had long been a personal friend of Seward and was for some time closely

associated with Seward and Greeley in what was known as «the political firm of Seward, Weed and Greeley.» In 1861 he went to Europe on a diplomatic mission to place the North in a favorable light before foreign governments and to prevent their intervention in behalf of the South. After 1865 he was for a time a member of the editorial staff of *The New York Times;* in 1867–68 was editor of the *Commercial Advertiser* in New York. His health then forced him to resign continuous journalistic work, but he continued to write occasionally for newspapers and periodicals, and though he took no active part in politics, his advice was sought by Republican leaders and had no small influence in shaping the policy of the party. He published *Letters from Europe and the West Indies* (1866), and prepared his *Autobiography,* which was published after his death (1884). Consult Barnes, *Memoir of Thurlow Weed* (1884); Alexander, *Political History of New York* (New York 1906).

WEED, Walter Harvey, American geologist: b. Saint Louis, Mo., 1 May 1862. He was graduated as mining engineer from Columbia University, School of Mines (1883) and appointed assistant geologist, United States Geological Survey in that year. In 1883–89 he was engaged in Yellowstone Park investigating hot springs and geysers, and glacial and sedimentary formation. To him is due the discovery that the brilliant coloring about hot springs and geysers are not mineral but due to living algae; and he also found and described Death Gulch. He also made the discovery that Death Gulch gave out carbon dioxide gas from an extinct hot spring, and it was this that killed wild animals that strayed there. He was occupied in general geologic exploration work in Montana, 1889–98. His most notable contribution to science was the theory of secondary enrichment of mineral deposits published in 1899, now generally accepted. This was followed by the theory of enrichment by ascending alkaline waters. He was one of the first to describe contact metamorphic ore deposits, and to interpret replacement deposits correctly. He was a member of practically all important scientific societies and was appointed special expert and commissioner on copper for Louisiana purchase exposition, 1904. In 1906 he resigned from United States Geological Survey to become chief geologist and examining engineer for General Development Company, and in 1910 went into private practice as consulting engineer and mine valuer. In later years he was an expert witness in many important mining lawsuits. His publications include *The Mines Handbook,* formerly *The Copper Handbook* (1911–25); *Nature of Mineral Deposits* (adapted from Beck's German treatise); *Geology of Butte, Montana; Geysers; Secondary Enrichment;* and many papers of the United States Geological Survey and in *Transactions* of the American Institute Mining Engineers. He died in California, 5 Sept. 1944.

WEEDEN, William Babcock, American manufacturer and economic and historical writer: b. Bristol, R.I., 1 Sept. 1834; d. 1912. He studied at Brown University, and then engaged in the manufacture of woolen goods in Providence. In 1861 he joined the Union Army as first lieutenant of artillery; was promoted captain after the first battle of Bull Run; was present during the siege of Yorktown, and took part in the engagements at Hanover Court House, Mechanicsville, Gaines' Mill and Malvern Hill. In August 1862 he resigned and resumed business in Providence. His publications include *Mortality of Prohibitory Liquor Laws* (1875); *Social Law of Labor* (1882); *Economic and Social History of New England 1620–1789* (1890); *War Government* (1906); *Early Rhode Island* (1911).

WEEDS are plants growing where they are not desired. There are no plants which are weeds, *per se,* since in nature each plant has its place, and since in cultivated areas any plant, useless or useful, may become a weed. Thus grass would be considered a weed in a bed of garlic, and vice versa. Many plants, however, are popularly dubbed weeds because they are troublesome in fields and gardens, but even among these are not a few which are cultivated; for instance, purslane, lamb's quarters and sorrel. Far from being the useless and obnoxious things that they have long been reputed to be, weeds have performed a distinct service, which they still continue, in agriculture; they have compelled the husbandman to practice clean cultivation, upon which the success of his crops very largely depends.

Weeds often must be eradicated upon land that has become foul under neglect. Upon pastures and lawns that commence to fail the two principal ways of management are to make more grass grow or to plow the land and grow some other crop upon it for a year or more. The former is usually more feasible with lawns; the latter with meadows and pastures. Often a reseeding to grass will be sufficient. The plantain, dandelion and similar weeds troublesome in lawns may be cut out individually, but to keep them out the growth of grass must be encouraged by sowing extra seed and by fertilizing. In land that has lain fallow the annual weeds may be destroyed by frequent cultivation; biennial and perennial weeds, by short rotations of crops, especially such as include intertillage crops, like potatoes, beans and turnips. The one necessity to observe in combating perennial weeds is to prevent their forming leaves and thus elaborating food. In low grounds where sedges, rushes and bracken often abound, the land may be rid of these weeds by draining. In gardens many weeds may be «smothered» by growing leafy crops which will shade the ground. Ground which is kept free from weeds in the early months may become choked with weeds toward autumn and these may reseed the ground for the following year. Mowing before the plants blossom, or plowing the ground are often practiced. In some cases, however, the plants may be allowed to remain as a cover crop to prevent the washing of the soil during winter. This practice is most common in orchards. A cover crop sown by the orchardist is preferable.

Besides the usual means of seed dispersal, such as wind and water, weeds are frequently distributed by means of baled hay, manure, and imperfectly cleaned seeds of the crops sown. This last is particularly prevalent with seeds hard to clean, such as grass and clover. Hence the advisability of purchasing only the

best seeds. It is not remarkable that many of the most troublesome weeds are imported from foreign countries, because being removed from their natural controls they find less resistance and spread accordingly.

Weeds are often of service in aiding the farmer to judge the needs of his land, since many kinds grow only where the conditions are peculiarly adapted to them. The character of their growth also indicates the quality of the soil. Wild carrot and the oxeye daisy grow only on poor soils, or soils that have been robbed of their fertility. Sheep sorrel indicates acid land and the necessity of applying lime to "sweeten" the soil. Bracken, sedge, and moss show that the land needs drainage. Dark green foliage and large size of plant and leaf are good indications of abundant nitrogenous plant food in the soil; while yellowish foliage and sparse, stringy growth shows lack of this material.

WEEHAWKEN, wē-hô'kĕn, township, New Jersey; in Hudson County; altitude 10 feet. It is situated on the Hudson River opposite New York City, with which it is connected by the Lincoln Tunnel (vehicular). It has textile-processing and other industries, and is served by the Erie, the Hoboken Manufacturers, the New York Central, and the New York, Ontario and Western railroads. Weehawken was incorporated in 1859. Here, on a little level plot of ground about 20 feet above the river, took place on July 11, 1804 the famous duel between Alexander Hamilton and Aaron Burr. The site of the duel was torn away in 1883 to make room for railroad tracks, and the monument which marked the spot where Hamilton fell was moved to the heights above. Pop. (1950) 14,830.

WEEK, a period of seven days, one of the common divisions of time. The week is an arbitrary division of time, and the question when, why and by whom it was first adopted necessarily arises in connection with its actual prevalence. One explanation is that the number seven occurs so conspicuously in mythical and occult lore. It was also early used as an indefinite unit, and things were counted by sevens, where later they were enumerated by dozens or hundreds. Another natural explanation offered is that it has been adopted as a quarter lunation; but as there is no absolute necessity for dividing the month into four, and a large fraction is needed to make the weekly square with the lunar periods, this explanation is not satisfactory. The week is, in fact, a much closer division of a year than of a month; but the division of the year into 52 portions is so purely arbitrary that this can hardly suggest the origin of the week. The convenience of some short recurring period or cycle of days is obvious, and it is the prevalence alone, and not the occurrence of a particular cycle, that has to be accounted for.

The practice of antiquity on the subject does not seem to have been so uniform as is sometimes supposed. Among the nations who adopted the week as a division of time, the Chinese, Hindus, Egyptians, Chaldeans, Jews, Persians, and Peruvians (Incas) have been mentioned, but in some cases the antiquity of the practice is doubtful, and in others the name has been appplied to other cycles than that of seven days. The nations with whom the weekly cycle has been traced with certainty to the greatest antiquity are the Egyptians and the Hebrews. With the former we only know of its existence, but with the latter it had a much more important character. Their earliest records speak of its existence, and refer it to a period previous to that of the nation itself. Laban, the uncle of Jacob, alludes to the week as an established measure of time in Genesis 29:27. The origin of the week is further ascribed in the Jewish Scriptures to the creation of the world, and is wrought into the institutions of the nation in a variety of ways, but particularly by the consecration of the seventh day to the worship of the Creator. The Hebrew word for week is of a general signification, and applies equally to a period of seven days, seven months, and seven years, each of which had a particular celebration attached to it in the Hebrew ritual; hence the use of days to represent years in the prophetic writings is according to the natural genius of the language. The number seven had a mystic significance attached to it in the symbolism of the Jewish religion in a variety of other ways.

The Romans and Greeks each divided the month into three periods (see CALENDAR), and were not acquainted with the week until a late period. The Romans, however, had for civil uses, as the arrangement of market-days, a cycle of eight days, the ninth day being the recurring one, instead of the eighth, as with us. The use of the week was introduced into the Roman Empire from Egypt about the first or second century of the Christian era, and had been recognized independently of Christianity before the Emperor Constantine confirmed it by enjoining the observance of the Christian Sabbath. The names given by the Romans to the days of the week, and which have pervaded the Romance languages, were derived from the planetary system, which was supposed to consist of the sun, moon and five planets, Mars, Mercury, Jupiter, Venus and Saturn.

WEEKES, wēks, **Henry**, English sculptor: b. Canterbury, 1807; d. Pimlico, London, May 28, 1877. He was for many years the principal assistant of the sculptor Sir Francis Legatt Chantrey. He was elected to the Royal Academy in 1850 and became professor of sculpture there in 1873.

Besides the earliest bust of Victoria as queen (1838), he executed statues of Charles II for the House of Lords; Sir Francis Bacon for Trinity College, Cambridge; and Hugh Latimer, Thomas Cranmer, and Nicholas Ridley for Martyrs' Memorial, Oxford.

WEEKS, wēks, **Edwin Lord**, American artist: b. Boston, 1849; d. Paris, Nov. 17, 1903. He was a pupil of the Beaux-Arts (Paris), of Jean Léon Gérôme and Léon Bonnat, and sketched and painted in Cairo, Jerusalem, Damascus, Tangier, and India, obtaining there material for the genre scenes from Eastern life with which he won his reputation. A frequent exhibitor at the Salon, he obtained honorable mention there in 1885. Among the other distinctions which he received were the diploma of honor at the Berlin international exhibition in 1891, and a special medal and prize in 1896 at the empire of India exhibition (London). Specimens of his work are in the Pennsylvania Academy of Fine Arts, Philadelphia; the galleries of New York City; and the Corcoran Gallery of Washington. Among his paintings are *Cup of Coffee in the Desert; Jerusalem*

from the Bethany Road'; 'Pilgrimage to the Jordan'; 'Scene in Tangier'; 'Arab Story-Teller' (exhibited at the Centennial Exhibition, Philadelphia, 1876); 'Departure for the Hunt — India'; 'Moorish Camel-Driver.' He also wrote 'From the Black Sea Through Persia and India' (1895), and 'Episodes of Mountaineering' (1897).

WEEKS, John Wingate, former United States Secretary of War: b. Lancaster, N. H., 11 April 1860; d. there, 12 July 1926. Reared on a farm, he was graduated from the United States Naval Academy in 1881; served as midshipman 1881–83; was assistant land commissioner of the Florida Railroad, 1886–88; member of Hornblower and Weeks, bankers and brokers of Boston, 1888–1912; alderman 1900–02 and mayor 1903–04 of Newton, Mass.; chairman of the Republican State Convention in 1905; member of Congress 1905–13 from the 12th Massachusetts District; member of the United States Senate 1913–19; received 105 votes for the Presidential nomination in 1916; in 1898 commanded a division of the Massachusetts Naval Brigade with rank of captain. He was Secretary of War from 1921 until October 1925. He successfully reduced the enlisted strength of the army from 250,000 to 150,000 men and put into full effect the National Defense Act.

WEEKS, Raymond, American philologist and phonetician: b. Tabor, Iowa, 2 Jan. 1863. He was graduated at Harvard University in 1890 and later studied at the universities of Paris and Berlin, taking his Ph.D. at Harvard in 1897. He was professor of the Romance languages at the University of Missouri in 1895–1908; held that chair at the University of Illinois in 1908–09, and at Columbia University, 1909–29. He was in the ambulance service in France in 1917–18. In 1910 he was one of the founders of the *Romanic Review;* in 1913 assistant editor of the 'New Standard Dictionary,' and was general editor of the Oxford French **Series;** was joint author of 'The N. E. A. Phonetic Alphabet' (1916); has contributed verse and short fiction to magazines and is author of 'Origin of the Covenant Vivien' (1902); 'La Chevalerie Vivien' (1909); 'Ode to France' (1917); 'Boys' Own Arithmetic' (1924); 'The Hound-tunes of Callaway' (1927).

WEEKS, Feast of (Heb. *Shabuoth*), the second of the great Hebraic religious festival. it is thus called from the fact that it forms the culmination of the seven weeks succeeding the Passover feast. Primarily it appears to have been connected with the celebration of the end of the harvest, but later also with the giving of the Law on the 50th day after the departure from Egypt. In the New Testament it is called Pentecost (q.v.), the Greek word (*πεντηκοστή*) signifying 50th (from *ἡμέρα*, day).

WEEMS, wēmz, Mason Locke, American Protestant Episcopal clergyman: b. Maryland, about 1760; d. Beaufort, S. C., 23 May 1825. He began the study of medicine, but gave it up and went to London, where he was educated for the clerical profession, but found no bishop in England to admit him to holy orders. There was then no Anglican bishop in America, and the professional plans of Weems were obstructed by peculiar difficulties. (For an account of them consult McMaster's 'History of the People of the United States,' Vol. I). Returning to this country, he preached at different places, apparently never having a regular charge, although it has been said that the rectorship of Mount Vernon parish (there was no such parish) was held by him before the Revolution, as claimed by himself; also that he officiated in the old Pohick Church, of which Washington was an attendant, which indeed he may have done, but not until long after Washington's attendance there had ceased. About 1790 he became a book agent for Mathew Carey (q.v.), and traveled through the South selling works, some of which were his own. He made himself popular by exercising his talents for comedy and his skill with the violin, probably diverting and (through his sermons) exhorting the people by turns. A book of his own writing which he offered for sale was 'The Drunkard's Looking Glass' (6th ed., 1818). His 'Life of Washington,' by which he is best known, first appeared in 1800, and during the 19th century the number of its editions exceeded 70. The traditional conception of Washington rests mainly upon this work, as do the story of the cherry-tree and other anecdotes which historians reject, most of which first appeared in the 5th edition (1806). His other publications, all more or less tawdry and inaccurate, include 'Life of General Francis Marion' (1805); 'The Philanthropist' (10th ed., 1809); 'God's Revenge Against Gambling' (3d ed., 1816); 'Life of Benjamin Franklin, with Essays' (1817); 'Life of William Penn' (1819); 'Hymen's Recruiting Sergeant' (7th ed., 1821 and 'The Bad Wife's Looking Glass' (2d ed., 1823).

WEENDIGO, wĭnd-ēgō (meaning «cannibal») mythical tribe of Indians believed in by the Algonquin and other eastern races. The Chippewa and the Ottawa thought they inhabited an island in Hudson Bay; while certain other tribes placed them indefinitely in the far north country. Indian stories tell of a terrible Weendigo with two faces and monstrous ears, who could see and hear everything. The «great weendigo» was a monster so huge that his step shook the earth. So terrible was his gaze that no one looked upon him and continued to live. For this reason no one could accurately describe him. He lived far within the forest; but, for the same reason, no one knew exactly where. Like the forest Indians, he was much of a wanderer, and consequently was found, now in one place, now in another. For this reason he was the more to be feared, as one was liable to come upon him suddenly when least expected. But though no one had lived to describe him, there were many who had heard his tramp as it shook the forest and his terrible voice as he roared in rage. Sometimes the Great Weendigo makes himself small and induces the unwary warrior or hunter to follow him; but he who does so never returns. He is much taller than the tallest wigwam ever built, and his ears stick out like those of a mountain cat. These he uses for hunting bags; and in them he stores, for the time being, all he does not care to eat. The Great Weendigo is supposed to be especially fond of children and to keep a supply of them constantly in his great ears. Sometimes children thus imprisoned have escaped from the Weendigo, when the proper magic has been brought to bear upon the giant. A customary way of frightening Algonquin children into being good was to tell them the Weendigo would

catch them and put them in his ears, or roast them and eat them. Numerous mythical folk-tales have grown up about the Weendigo, many of which are imaginative and dramatic. The Great Weendigo had the power of self-transformation; and he frequently changed his form to gain his ends. The Weendigo was firmly believed in from the Hudson Bay to the head of Lake Superior and throughout all the Algonquin country from this line eastward.

WEENIX, Jan, yän vā'nĭks, THE YOUNGER, Dutch painter, son of Jan Baptist: b. Amsterdam, 1644; d. there, 20 Sept. 1719. He painted landscapes, animals, flowers and fruit, but excelled in the representation of dead game and hunting scenes. His pictures of this class are unrivaled by any productions of the Dutch schools, and command large prices. He finished with extreme neatness, and exhibited a clear and brilliant coloring and a wonderful knowledge of chiaroscuro.

WEENIX, Jan Baptist, Dutch painter: b. Amsterdam, 1621; d. Ter May, near Utrecht, 1660. He was instructed by Abraham Bloemart and Nicolas Mojert, and at 22 visited Rome, where he acquired a reputation by his Italian seaports and landscapes with architectural accessories. The last 12 years of his life were passed in Holland. He was a rapid painter, having been known to finish three half-length portraits with accessories in a single day, and excelled in history, portrait, animal, landscape and marine painting, being on the whole most distinguished in the last-named department.

WEEPING CROSS, a cross of stone or wood, erected at the side of a road, at which penitents prayed and wept for their sins. Hence the old English saying, "To return by weeping cross," that is, to return in sorrow from some message or undertaking. These crosses were removed in England when that country became Protestant, and the saying is now obsolete.

WEEVER (variant of weaver, or of the obs. *wiver*, from Lat. *vipera*, viper), a fish of the genus *Trachinus*, two species of which are recognized: *T. vipera*, five to six inches in length, and *T. draco*, 10 to 12 inches. They possess sharp opercular and dorsal spines, with which they can inflict a painful wound. The sting is believed not to be poisonous, but it is very similar to that of the sting-ray (q.v.). The name weever is hence applied to any of the *Trachinidæ*.

WEEVIL, a general name applied not only to various genera of adult beetles but also to their larvæ. They form a group *Rhynchophora*, or snout-beetles, so called from the characteristic production of the head in the form of a prominent snout, bearing the elbowed antennæ at the sides and the small mouth at its tip. There are several families, but most of these beetles belong to the Curculionidæ, which is said to include upward of 600 genera and 20,000 species. All of them are vegetarians and the larvæ are little white or yellow, fat footless grubs which mostly live within the tissues of plants, and are especially destructive to nuts, seeds and fruits. One of the most conspicuous and harmful is cotton-boll weevil (*Anthonomus grandis*). It is about one-fifth of an inch long and may be differentiated from related species by the fact that the tibiæ of the first pair of legs are provided with two small spines. Immediately after transforming from the pupal state the color is reddish but some time after emergence the color becomes considerably darker. The grub-like larvæ are considerably longer than the adults, strongly curved, white with pale yellowish heads. The eggs are deposited in punctures made by means of the beak of the female weevil in the buds (called squares) and bolls. The larvæ devour the interior. Infested squares practically invariably fall to the ground but bolls always remain attached to the plant. In the case of the squares, of course, the fruit is ruined. In case of bolls only the infested like or apartment is destroyed. The life-cycle is completed in about 20 days and there is an inextricable confusion of generations. The winter is passed in the adult stage, the individuals flying to the woods or seeking shelter in débris around or inside of the cotton fields.

This insect probably originated in Central America. It was introduced into the United States near Brownsville, Tex., about 1892. By 1895 it became established as a serious pest and today it has become thoroughly established over nearly the whole cotton belt except California and is a permanent menace to the crop. By 1924 it had reached Virginia, having traveled from 40 to 70 miles annually, causing an annual loss of many millions of dollars. The following method of control is recommended; uproot and burn all plants in the fall; plant early maturing varieties of cotton and hasten the crop; practice rotation of crops; burn trash where they hibernate; dust with arsenate of calcium containing not less than 40 per cent nor more than 75 per cent water soluble arsenic pentoxide and a density of not less than 80 nor more than 100 cu. in. per pound. Distribute by hand dusters, power dusters or airplanes at night, three applications at four-day intervals. Dust only when the yield is at least one-half bale per acre. Recently sodium fluosilicate has been used effectively.

The grain-weevil (*Sitophilus granarius*) is a little dark red beetle about an eighth of an inch long. The eggs are deposited on wheat after it is stored, and the larvæ burrow therein, each larva inhabiting a single grain. The rice-weevil (*S. oryzæ*) destroys rice and Indian-corn in a like fashion; this species has four red spots on the elytra or wing-covers. Another species (*Calandra palmarum*) infests palm-trees, is common in Guiana and attains a length of two inches, the larvæ burrowing in the pith of the trees. *C. sacchari* inhabits sugar-canes. The genus *Rhynchites*, of which the grape-weevil (*R. bacchus*) is an example, has the head broad behind; it devastates the growing vines, and strips them of their leaves. The plum curculio (*Conatrachelus nenuphor*) causes great damage to plums, cherries and other stone fruits. The eggs are laid one at a place in the young, forming fruit, upon the flesh of which the larva feeds, causing it to drop prematurely or to become "wormy." The beetle is less than one-fifth of an inch long and dark brown spotted with black and yellow. The familiar chestnut-worm is the larva of *Balaninus rectus*, remarkable for the great length of the snout, which exceeds the short robust body and which is adapted for piercing the thick burrs of the

young chestnuts, permitting the deposition of an egg in the kernel. Related species of the genus infest other nuts. Equally troublesome to fruit-growers are the species of *Anthonomus,* of which one pretty little weevil (*A. signatus*) causes great damage to the Sharpless and other staminate varieties of strawberry. This species attacks the flowers, and the larvæ feed upon the pollen. Quite different in its habits is the potato weevil or potato-stalk borer (*Trichobaris trinotata*), the larva of which bores passages in the stems of potatoes and wild plants of the same family. The clover-weevil (*Phytonomus punctatus*) has green larvæ, which differ from all of the foregoing in living exposed to the air and light, though they feed chiefly at night. They eat the leaves, and as they hibernate in the ground and begin to feed almost as soon as the clover sprouts in the spring they become most serious pests. The adults are nearly a third of an inch long, thick-bodied and short-snouted, with strongly knobbed antennæ.

To the family *Bruchidæ* belong the extremely destructive pea and bean weevils, which have the proboscis short and curved down on the breast and the antennæ not elbowed. They are small beetles with stout bodies and the swollen abdomen often projecting beyond the tips of the wing-covers. Unlike the *Curculionidæ,* which become quiescent and assume an appearance of death, these beetles are extremely active and fly when disturbed. The larva of the pea-weevil (*Bruchus pisi*) damages peas, the eggs being laid when the peas are ripening. They destroy much of the substance of the grain, lessen its germinating power and pupate in its interior. The mature insect is black marked with white spots, and about an eighth of an inch long. The *B. pisi* was at one time so destructive in North America that its ravages threatened to wholly exterminate the pea crops. Several species are named corn-weevils, from their destructive effects in granaries. *B. granarius* also attacks peas, and one species infests the cocoanut. The bean-weevil (*B. fabæ*) is plain brown in color but otherwise similar.

Weevils are very difficult to control on account of their small size, inconspicuousness and the fact that the destructive larvæ are generally beyond the effective reach of insecticides. The best measures consist in the total destruction by burning of all infested fruits, nuts or stems, the digging or plowing in the late fall of the ground in which the pupæ hibernate, and in the case of the pea and bean weevils the fumigation with carbon bisulphide of all infested seed. Consult Harris and Flint, 'Insects Injurious to Vegetation' (New York 1884); Saunders, 'Insects Injurious to Fruits' (Philadelphia 1883); Smith, 'Economic Entomology' (Philadelphia 1896); also Bulletin 731 (Washington 1918) and Farmers' Bulletin 1262 (1922) of the U. S. Department of Agriculture and other special government publications.

WEEYOT. See WISHOSKAN.

WEIDNER, wīd'nėr, **Revere Franklin,** American Lutheran theologian: b. Centre Valley, Pa., 22 Nov. 1851; d. Tangerine, Fla., 5 Jan. 1915. He was graduated from Muhlenberg College, Allentown, Pa., in 1869, from the Lutheran Theological Seminary, Philadelphia, in 1873, and after being ordained to the ministry was pastor at Phillipsburg, N. J., 1873–78, and at Philadelphia 1878–82. He was professor of English, history and logic at Muhlenberg in 1875–77, and in 1882–91 was professor of dogmatics and exegesis at Augustana Theological Seminary, Rock Island, Ill. In the last-named year he accepted the presidency and the chair of dogmatic theology at the Chicago Lutheran Theological Seminary. He published 'Commentary on the Gospel of Mark' (1881); 'Biblical Theology of the Old Testament' (1886); 'Annotations on the General Epistles' (1897); 'Theologia; or the Doctrine of God' (1903); 'Studies in Exodus' (1903), etc.

WEIGALL, Arthur Edward Pearse Brome, English Egyptologist: b. 20 Nov. 1880; d. 2 Jan. 1934. Studied at Wellington College and at New College, Oxford; commenced archaeological investigations when 18; assisted Petrie at Abydos 1901–02; excavated at Sakkarah in 1902–04; and the mortuary temple of Thothmes III at Thebes in 1905; was inspector of antiquities under the Egyptian government 1905–14, when he retired. Among his investigations are noted the antiquities of Nubia, the eastern desert and Imperial Prophyry quarries, Wady Hammonat and Kassair and the tombs of the nobles of Thebes. Upon his return to London in 1914 he designed stage scenery and costumes with considerable success. He wrote 'A Report on the Antiquities of Lower Nubia' (1907); 'A Catalogue of the Weights and Balances of the Cairo Museum' (1908); 'A Guide to the Antiquities of Upper Egypt' (1910); 'The Treasury of Ancient Egypt' (1910); 'History of Events in Egypt from 1798 to 1914' (1915); 'Life of Akhnaton, Pharaoh of Egypt' (1910, rev. 1922); 'Life of Cleopatra' (1914, rev. 1924); 'Madeline of the Desert' (1920); 'Garden of Paradise' (1923); 'Tutankhamen and Other Essays' (1923); 'Ancient Egyptian Works of Art' (1924); 'History of the Pharaohs' (1922–26); 'The Not Impossible She' (1926); 'Flights Into Antiquity' (1928); 'Nero' (1930).

WEIGAND, vī'gänt, **August,** Belgian musician: b. Belgium; d. Oswego, N. Y., 26 May 1904. He began his musical career as organist of Saint Giles' Church, Liège, and subsequently long presided at the organ of the Sydney, New South Wales, town-hall, then the largest instrument in the world. His achievements as organist and composer won for him a professorship in the Royal Conservatoire at Liège. He came to the United States in 1903, gave numerous concerts, opened the large organ at Brown University and was appointed to open the grand organ at the Louisiana Purchase Exposition, Saint Louis, in June 1904. In a dozen years he gave throughout Europe more than 1,800 concerts. He was the recipient of various distinctions, and was generally known as Chevalier Weigand.

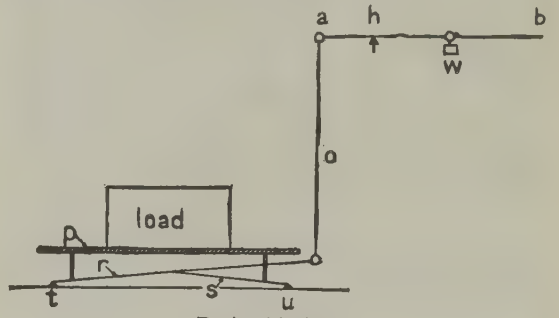
WEIGHING MACHINES, mechanical devices for ascertaining the weight of objects. It is to be understood, however, that the element thus determined is a relative value, and is entirely independent of the magnitude of the force of gravity or the tendency of a body to fall. It is measured at sea-level and at the

mean diameter of the earth. For example, the force of gravity decreases with elevation, but a commercial unit of weight such as a "pound" is the same at the top as it is at the foot of a mountain. In the usual method of determining weights of this character, a "unit of weight" is first adopted, and then a "set of weights" procured, each of which represents a certain predetermined number of the units. With these, by the aid of a machine so constructed as to be capable of establishing an equilibrium between any number of the weights and the article being weighed, the ratio of the weight of the article to that of the adopted unit is determined. Such machines may be conveniently arranged in three general classes — "equal armed" balances, "unequal armed" balances, and "spring" balances.

Equal armed balances are represented by the various forms of "scale-beams," in which the scale-pans hang below the beam, and the "counter-scales" in which the scale-pans are above the beam, both forms operating by adjustment of equilibrium between a known and an unknown weight. Unequal armed balances are represented by those consisting of a single steelyard, and those formed by combinations of unequal armed levers and steelyards, such as platform scales and weighbridges, in which a small known weight at one end of a beam counterbalances a heavy unknown weight at the other end. Spring balances operate on the principle that, when a helix is subjected to a tension, the amount of elongation increases proportionally with the increase in the force of tension. In the simplest form, it consists of a helical spring of hard steel of a high elastic limit. As commonly used it is suspended from a fixed point by a hook at its upper end, while its lower end is bent into a hook, which is crossed by another hook to which the article to be weighed is attached. An index attached to the spring and moving along the face of a graduated plate indicates the amount of tension in terms of the adopted unit of weight. The contrivance is so arranged that the axis of the spiral is always a plumb line, under tension or at rest, and is capable of weighing only an amount within the elastic limit of the spring. The capacity of such balances is generally small, and they are extensively used in shops, and for other purposes where a high degree of accuracy such as may be obtained by lever balances is not required. On the other hand, the various forms of dynamometers employed for registering the pull of locomotives are made with enormous capacities. In this connection the "torsion balance" may be conveniently mentioned, although in reality it is a machine generally used for the purpose of measuring horizontal forces, rather than weights as here understood. In its simplest form it consists of a beam, supported by a wire stretched horizontally which passes through its centre of gravity. When twisted by the application of a weight to the beam, the elasticity of the wire acts the part played by the weight of the beam in an ordinary balance. For measuring horizontal deflections caused by electric, magnetic, and other forces, the wire is stretched vertically.

For all forms of weighing machines of the equal armed type with small capacities. such as counter-scales, chemical and assay balances, etc., see BALANCE.

The majority of the machines of large capacity known as "platform-scales," used for weighing heavy loads such as carts loaded with grain, hay, coal, building materials, etc., operate on the principle of the lever, and belong to the class designated as unequal-armed balances. They are sometimes arranged as "decimal balances," the ratio between the small known weight on the weighing beam and the unknown weight on the platform or bridge being indicated in multiples of 10. Such a balance consists of a lever (ab), suspended at (h), and connected by the rod (o), with two levers (r) and (s), hinged at (t) and (u), respectively. A platform (p), resting by means of standards upon the levers (r) and (s), accommodates the load which is counterbalanced on the long arm of the weighing beam or lever (ab), by a sliding weight— (w). When a load is placed upon the platform (p), the levers (r) and



Decimal Balance.

(s), are depressed, and exert a downward pull on the short arm of the weighing beam through the rod (o), with a consequent lifting of the long arm. This pull is counterbalanced by sliding the weight (w) along the long arm until it is brought into a horizontal position. The weighing beam being graduated with an adopted unit of weight and fractions thereof (usually pounds), the weight of the load on the platform is ascertained by a simple direct reading of the graduated scale. In the smaller scales, the weight (w) equals one pound, and counterbalances a load of 100 pounds upon the platform, but it is evident, that by varying the number of levers and the relative lengths of their arms, any desired ratio between the load and the counter weight may be readily obtained. In scales used for weighing loaded wagons and cars, the ratio varies from one to 500, or one to 1,000. Cattle scales are capable of weighing from 10 to 200 head of cattle at a single operation, and the capacity of grain scales ranges upward of 500 bushels, while the large iron and steel manufacturing plants and gun shops employ machines with capacities exceeding 100,000 pounds. The machine at Watervliet Arsenal, Watervliet, N. Y., used for weighing guns, has a capacity of 300,000 pounds.

With the advent of the automobile and its far greater capacity of burden the platform-scales formerly used to weigh loads drawn by horses have become obsolete, and with the rebuilding of such weighing machines automatic recording devices have been added, so that a modern scales of this class will weigh a load of coal approximating five tons within the

limit of error of three ounces, and print the correct weight upon a tape without the services of any attendant.

Self-discharging scales are also much in use for measuring units of weight; as for instance the filling of packages of commodities, as coffee, sugar, flour, and cereals. The same idea is embodied in receiving scales in large establishments, where coal, feed-water, sand, cement, ore, and crushed stone, are weighed as delivered, the receiving hopper discharging when the weight equals one ton, 100 pounds, or any other desired amount.

Railroad or track-scales are of prodigious size and capacity. The largest of this type in the world is a "suspended-platform" scale in the West Albany yard of the New York Central Railroad. The weighing rail is 90 feet long, and the capacity is 825 tons.

A new idea in heavy-work scale construction is known as the flexure-plate scale. In this type thin plate fulcrums of chrome-vanadium-steel take the place of the usual knife-edge pivots. They operate by bending, instead of frictional movement on bearings. They have been found of most dependable accuracy and unequaled endurance, being unaffected by dampness or changes of temperature, and thus entirely free from the variations common to the ordinary track-scales.

The conveyor scale weighs material as it passes on a conveyor belt, making use of electricity instead of weights for the recording. The belt is so arranged in reference to the weighing apparatus that the full belt is weighed against the empty return belt. A vertical plunger in a tube partly filled with mercury rises and falls in the tube according to the weight of material passing. The moving mercury brings more contact points into action the greater the thrust of the plunger, and the varying current makes its record automatically on a traveling tape. A standard comparison of amperes per hour, and tons per hour, gives the figure by which the weight is readily computed.

The computing scale is a machine which carries an attachment for indicating a certain limited range of prices. Usually it carries a cylinder covered with a paper roll ruled in many different proportions, each ruling indicative of a certain price unit. The cylinder turns with the weight, thus showing the cost at several different prices per pound.

The difficulty of exactitude in weighing is recognized and a legal "tolerance," as it is called, is permitted, within which no one can be accused of dishonesty or fraud. These tolerances are as follows: on counterpoise scales, one grain on one fourth ounce; two grains on one ounce; 10 grains on 10 ounces; 10 grains on one pound; 40 grains on 10 pounds; 100 grains on 50 pounds. On platform scales one ounce is allowed on 50 pounds; one pound on 800 pounds; two pounds on one ton. On railroad or track-scales the permissible error is four pounds per ton.

WEIGHT THERMOMETER. See THERMOMETER.

WEIGHTS AND MEASURES are fundamental necessities of commerce, industry and science. Measurement is required in the exploration of lands and waterways, in their location and transfer, in the work of construction of buildings, bridges, railroads and other engineering works, in the manufacture of foods, in the preparation of compounds and in the purchase, shaping and sale of materials. Weights and measures are essential to all barter of goods. Here, the accuracy may range from the "heap" or "pile" of ancient times, to the one one-hundredth of a cent used in cotton and spelter quotations "on change," estimates of value which we call prices being based on a specified weight of gold. Weights and measures are essential in all construction whether the precision be the "rule of thumb," or the millionth of an inch in optical work, or the one-ten-thousandth of an inch in the manufacture of fine machinery. The pharmacist with his weights compounds the prescriptions which mean health and life to the sick. In the extractive and compounding industries, weights and measures are used to determine the essential proportions in analyses and compounds, and precision is the main condition of reproducibility of results. Likewise, the manufacturer must accurately weigh, measure and test his materials to secure perfect construction. Surveying and navigation would be very primitive were it not for the rigorous measurements of base lines, accurate triangulation, precise leveling, including even such delicate measurements as the variation of latitude. Weights and measures are in fact necessary in the discovery, development, and statement of industrial and scientific facts.

The birth of the exact sciences was coincident with the development and application of quantitative measurements to the phenomena of nature, and the rapid growth of modern science has since been parallel with that of precision. James Watt was one of the earliest to suggest international standards which would enable scientific results when published in terms of such standards as to be intelligible and reproducible the world over. Precise and uniform standards made possible the interchangeability of parts in machinery, first practically applied by Eli Whitney and today one of the most important principles in manufacturing.

Classification.—Weights and measures ordinarily include those defining length, area, volume, capacity, and weight. These are relatively the most important measures used by man. However, within the last half century when such products as power, electric current, heat, light, refrigeration, and services have entered the world's markets as commodities for manufacture, purchase and sale—the scope of weights and measures has widened to include units used in the measurement of velocity, pressure, energy, electricity, temperature, and illumination. Technical requirements also resulted in a series of compound units such as the knot, a unit of speed for vessels of one minute of the earth's circumference per hour; the ton-mile used in transportation rates and statistics; the foot-pound, a unit of energy; the dyne, the international unit of force and other units of the centimeter-gram-second system of scientific units in use throughout the world. Such compound units are multiplying apace with technical needs, and have proven of inestimable value and economy by the facility and precision which they afford in conveying exact quantitative results of experiment and observation. With advancing needs the units of weight and measure have extended to microscopic and to telescopic dimensions. The millimicron of the physicist and the still smaller Angstrom unit, of which it requires 254,000,500 to make one inch, are used in spectrum analysis for measuring the dimensions

of light waves, while on the other hand the "earth's orbit" (meaning the mean radius of the orbit) is used by astronomers in measuring stellar distances. In addition, the "light-year" is used for the greatest distances, this unit being the distance which light traverses in one year, or about 6,000,000,000,000 miles. With the extension and division in size of units, the kinds of instruments utilized, and methods of application of the units themselves, have multiplied. Almost every occupation has its particular units, its methods of making measurements, and its special measuring instruments. A few of the thousands of the latter may be cited, such as the common desk rulers, carpenter's folding rules, draughtsman's scales, surveyor's chains, engineer's tapes and level rods, lumberman's log rules and board measures, the merchant's yard stick, the tailor's tape, the shoe, glove and hat measures, machinist's scales, measuring bars, micrometers, micrometer calipers, limit gauges of ring and plug types, end and line standards of precision. In measuring volume we have the standard capacity measures, wooden dry measures, a vast variety of standard flasks, glass graduates such as burettes, pipettes and other volumetric apparatus of the druggist, physicist and chemist, the gauging rods for casks and cargoes, gasoline measuring pumps, gasometers reading in cubic feet, tanks and reservoirs with graduated scales reading volumes directly. For weighing, we have even-balance scales, steelyards platform scales, spring balances, all ranging from the most delicate analytical balances to the master scales for weighing freight cars. Scales are especially designed for every particular need, and the countless varieties attest the high state of the art of weighing and its great importance in industrial and scientific work. Such instruments have multiplied in form and number, and the demand for them has grown so rapidly that the manufacture of weights, measures and measuring instruments forms in itself a whole group of industries.

With the development of units of measure of the order of intermolecular distances on the one hand and of almost interstellar distances on the other, and the multiplication of kinds of instruments used in measurement, has come the invention of a large variety of measuring appliances which automatically indicate the result upon a scale. Of this class are thermometers, spring balances, aneroid barometers, pressure gauges, speedometers, and indicating meters of all kinds. Computing scales not only indicate the weight, but show the computed total price of the article at several prices per pound. Many of this class of instruments also make continuous record of the measurements, showing by a curve the values at successive moments of time. Of this type are the automatic recording instruments used to record temperature, air pressure, sunshine, rainfall, electrical quantities as well as tide recorders, anemometers and many others. Equally interesting are those measuring instruments like dividing engines, trip scales or trip measures which besides measuring definite lengths, weights or quantities automatically perform certain operations, such as graduating a scale, delivering or tipping a certain weight of grain, or delivering certain volumes of liquids. Closely related are those devices which integrate quantities delivered or magnitudes measured, such as the small map wheels which measure distances on maps, or the planimeters which measure areas within irregular contours, and all forms of gas and water meters, integrating rain gauges, integrating watt meters for measuring electric power consumed. These instruments usually indicate on a dial the total number of units measured since the last zero setting.

Metrology.—Many sciences and industries have given the science of metrology their best thought and labors. Chemistry opened up new chapters in the science of the refractory metals, developing iridium and platinum of purity requisite for the world's fundamental standards of mass and length, producing in conjunction with metallurgy the remarkable nickel-steel alloy "invar" (q.v.), having practically a zero temperature coefficient of expansion; the alloy manganin, free from temperature coefficient for electrical resistance; Jena glass, a material for measuring flasks and thermometer bulbs which practically eliminates temperature disturbances. To optics and the glass industry we are indebted for the microscopes, telescopes, polariscopes and other optical instruments which form essential parts of modern measuring apparatus. Optical methods based upon the interference of light waves have made possible the detection of change of dimension far beyond the power of the microscope to detect. By such methods plane surfaces are produced having errors of less than a millionth of an inch, and in the interferometer is provided one of the most delicate and sensitive length-measuring instruments known to man. Metallurgy and engineering have developed methods of fusing, casting and tempering materials to be used in measuring apparatus, and have developed the accurate machining of such instruments. Astronomy has given the precision measurements of time, the "second" being the unit of time in the international C. G. S. system of units. Mathematics has devoted a large section of its science to the theory of observations and added rigor in their adjustment, and in the elimination of accidental errors, and by developing the theoretical side of precision measurements has rendered the greatest service to metrology.

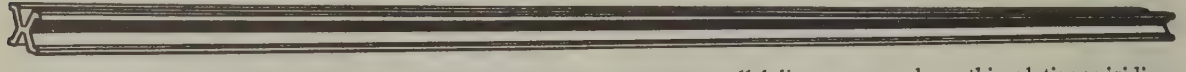
Unit Standards.—The standards of length and mass are fundamental. From these and the unit of time practically all other standards are derived, either directly or indirectly. The derived standards include those used in the measurement of volume, density, capacity, velocity, pressure, energy, electricity, temperature, illumination, and the like. The production of copies, multiples and subdivisions of the fundamental standards, the construction of the derived standards, and the comparison of the standards used in scientific work, manufacturing, and commerce, with the fundamental or derived standards of the government, are functions of the National Bureau of Standards in the United States and of similar bureaus in other countries. In the United States the standard of the weights and measures of trade is maintained through the state, county and city sealers of weights and measures with an efficiency dependent upon local administration. For more precise purposes, however, uniformity and precision are attained and maintained only by regular reference of the local standards to the fundamental standards of the government, at the National Bureau of Standards in Washington.

The units of weight and measure in the United States are practically those used in the colonies prior to the formation of our government. While Congress has never definitely authorized the

weights and measures in common use, it has sanctioned their use by its act of June 14, 1836, providing that accurate copies of the yard, pound, etc., be furnished as standards to each state of the union. The constitutional power "to fix the standard of weights and measures," vested in Congress (I. 3, ¶ 5, United States Constitution), has rarely been exercised, so that legislation on weights and measures has been confined to the individual states, and in this manner numerous differences in usage grew up in the several states, although the same general system of weights and measures prevails throughout the country. The customary units of length are defined by reference to the yard. The yard itself was formerly defined as the length of a certain bronze bar, the standard yard, kept at the Office of Standard Weights and Measures in Washington. Since 1893 the yard is defined in terms of the international meter. The yard appears to have been a unit of length in England since very early times. The name signified in Old English and in Anglo-Saxon (gyrd) a rod or stick. A standard bronze yard of 1496 still exists in England, having been used for the verification of other yards until 1588, when a new standard was made which is also in existence today. This yard, known as the Winchester standard, was the legal standard in England until 1824, when new standards, the imperial standards, were authorized.

When the Coast and Geodetic Survey was organized it was found necessary to have a definite standard of length, and an 82-inch bar was secured from the instrument maker, Troughton, of London. This bar was nearly a copy of Troughton's scale, and had not been compared with the British standard yard, but the distance between the 27th and 63d inch marks on the bar was taken as representing the standard yard, and was made the basis of the standards sent out in accordance with the act of Congress of 1836. In 1834 the British imperial yard was destroyed by fire and when a new standard had been prepared, copies of it were made, two of which were presented to the United States in 1856. These copies were compared with the Troughton scale, and the latter was found to be 0.00087 inch longer than the new imperial yard at the standard temperature of 62°F. One of the copies was then accepted as standard by the United States Office of Standard Weights and Measures in place of the Troughton scale. This copy of the imperial yard was the standard on which all measurements of length in the United States were thereafter based until 1893, when the yard was defined in terms of the international prototype meter. The matter had been left entirely to the treasury department, which had adopted different yards from time to time, assumed to be equal to the British imperial yard.

The copies of the imperial yard had shown noticeable changes relative to the standard when subsequently compared, and this led to the belief that the imperial yard itself was not constant. Shortly after the arrival of the national prototype meter a careful determination of the relation of the imperial yard to the international meter at the Office of Standard Weights and Measures showed that the relation differed from that legalized in 1866 by less than the uncertainty of the comparison, and it was decided to adopt the meter as the fundamental standard of length, and to define the yard in terms of it. Not only is the constancy of the length of the imperial yard suspected, but in addition the lines, which are about 1-1000 of an inch wide, are much too broad for present requirements. On the other hand, the international meter and its copies satisfy the rigorous requirements of modern metrology. The kilogram was also declared to be the fundamental standard of weight. The present standards of the United States are, therefore, independent of the British standards and in part differ from them. The prevalent idea that the weights and measures in common use are identical with the British imperial system is, therefore, erroneous. The United States yard is longer than the imperial yard by about one part in 300,000, and this inequality extends to all of its subdivisions and multiples. The present material standards of the United States are the national prototype meter No. 27 and the national prototype kilogram No. 20, received by the president of the United States on Jan. 2, 1890. These are accurate copies of the international prototype meter and kilogram which are the fundamental standards of length and weight designed for the entire world. The latter standards are preserved at the International Bureau of Weights and Measures in accordance with the International Metric Convention of 1875, now signed by the leading countries of the world. These countries jointly maintain and direct the work of this bureau through official representatives forming an international committee, composed of eminent scientific men.



The National Standard of Length. The distance between two parallel lines engraved on this platinum-iridium bar kept at the National Bureau of Standards is the primary standard meter for all metric measurements of length in the United States. It is Prototype No. 27 of the international standard kept at the International Bureau of Weights and Measures at Sèvres, France. This national standard of length, far from being just a museum item, functions actively as a fundamental reference and control in commerce and industry. Laboratory and industrial meter bars are checked against "working standards" of length, which, in turn, are compared at intervals with the standard meter.

The units of length and the derived units of area, volume and capacity are derived from the international meter in the ratio of 1 meter = 39.37 inches (law of July 28, 1866). Since 1893 the Office of Standard Weights and Measures and the National Bureau of Standards which superseded that office, have used the equivalent 1 yard = 3600/3937 meter (by order approved April 5, 1893). This action fixed the values, inasmuch as the reference standards are as perfect and unalterable as human skill could make them. Besides the yard, the units of length most universally employed in the United States at the present time are the inch, foot, and mile.

An inch-millimeter conversion for industrial use, in which 1 inch = 25.4 millimeters, has been adopted by the American Standards Association, and by similar standards associations in a large number of countries. This relationship is numerically between the official relationships used in the United States, and that in Great Britain.

The "inch" is the 1–36 part of the yard and

like it has been in use since ancient times. The name (derived from the Latin *uncia,* meaning the 12th part) occurs in Anglo-Saxon in the form of "ynce." It probably originated only as a convenient subdivision for the foot. Lengths shorter than one inch are commonly expressed in fractions of an inch. Two methods of subdivision are in common use; among builders and woodworkers it is customary to use the binary subdivisions, half, quarter, eighth, etc., but machinists also divide the inch into tenths, hundredths, and thousandths. The inch is usually denoted by the symbol ″; but botanists use the symbol ′ for the inch. The "miner's inch" is a rather vague unit for the flow of water varying from 1.36 to 1.73 cubic feet per minute, and is the flow of water through a single square inch of orifice under varying heads of water.

The "foot" is legally defined as one third of the yard, or 12 inches. As its name implies, it was probably based on the length of the human foot. Almost every nation, ancient and modern, has had a unit called the "foot," its value differing somewhat, as might be expected with a unit of so crude an origin. Most countries, however, have now adopted the metric system, the foot being discarded as an official measure, though universally used in English countries. Lengths shorter than one foot are usually expressed in inches and fractions of an inch, but among surveyors and civil engineers it is quite common to use decimal fractions of the foot. The foot is generally denoted by the symbol ′, but botanists use the symbol ° to denote feet. Some artisans use the foot and the inch but not the yard, others the yard and its binary divisions, but not the foot or inch. Thus the foot and inch are used to the exclusion of the yard in building, while the yard and its binary subdivisions to the exclusion of the foot and inch in measuring cloth.

The "statute" or "land mile," is the unit most commonly used for longer distances, and is equal to 5,280 feet. The name is from the Latin *mille passuum,* 1,000 paces, the Roman pace being a double step and consequently about five feet in length. This mile was used by the Anglo-Saxons. Almost every European nation has had a unit called the "mile," but widely at variance with one another, ranging from about two-thirds of the United States mile (Holland) up to seven United States miles (Norway). The old British statute mile was about 300 feet shorter than the United States mile but the present British unit is practically the same as that of the United States.

The following units of length are used in special work and are arranged in the order of their magnitude. Metric units are not included, as they are for the most part official only, and not generally in use in commercial and industrial activities in Anglo-Saxon countries. They are commonly used in a larger part of the world.

Mil (.001 inch) is used in electrical work, especially in indicating the cross section of wires.

The point (approximately 1–72 inch) is used in designating the sizes of type, the point system designating the sizes of type by the number of seventy-seconds of an inch height of the type face. The em is a unit of measure used in composition and varies with the size of the type, usually being considered as the square of the face height.

The line (1–12 inch) is little used, mechanics preferring to divide the inch into tenths, hundredths and thousandths. It is used by printers and by botanists, the latter denoting the line by the symbol ‴. The line "button measure" is 1–40 inch as defined in the tariff act.

The barleycorn (one-third inch) is an old unit still surviving in shoemakers' shoe sizes, these being graded by thirds of an inch or barleycorns, in a system of 13s.

Four units based upon the "hand" are sometimes used. These are the nail (two and one-fourth inches) for measuring cloth, originally the distance from the end of the thumb nail to the joint at the base of the thumb, and later fixed as 1–16 yard; the palm (three inches) includes the breadth of the hand exclusive of the thumb; the hand (four inches), originally the breadth of the palm, is used in measuring horses and is almost exactly one decimeter; the finger (four and one-half inches) is about the length of the middle finger and is only used as a rough unit in cloth measure. This should not be confused with the finger breadth used in measuring charges of powder.

The surveyor's link (7.92 inches) is the length of one link or 1–100 part of a surveyor's chain, and is used in the survey of lands.

Quarter (nine inches) is sometimes used in measuring cloth (more frequently in Great Britain) to designate a quarter of a yard. A unit of the same length called the span was originally half a cubit, but probably has not been used in modern times as an officially recognized unit.

The engineers' link (12 inches) used as a unit in engineering is the hundredth part of the engineers' chain and is decimally divided. The 10th of the engineers' link is 1.2 inches.

The pace is a conventional unit for measuring distances and is the length of a stride measured from the heel of one foot to that of the other; a full pace measures about one yard. This is the value of the United States military pace, double time, with a cadence of three steps a second. The regulation military pace quick time is 30 inches with a cadence of approximately two steps per second. The Roman pace was a double step of about five feet.

The English ell, a unit still referred to but seldom used, had a value of 45 inches, varying, however, in different places. The Flemish ell of 27 inches was in common use in the Low Countries.

The fathom (six feet) is used in measuring depths of water or mines. The name comes from an Anglo-Saxon word *faethm,* signifying "embrace," and originally meant the length of rope between the two hands when the arms were held outstretched.

The rod, perch, or pole is equal to five and one-half yards and is used in measuring land. It has varied in different places from five to eight yards and is supposed to have been the length of the ancient goad used to measure the width of the first furrow.

The surveyor's or Gunter's chain (22 yards) was so chosen that 10 chains square might exactly equal one acre. This chain is the official unit prescribed formerly for the use of surveyors surveying public lands under the supervision of the surveyor general and now often used in relocating old surveys.

The engineers' chain (100 feet) is used in engineering, and is decimally divided into feet, tenths, and hundredths of a foot. The use of

the two chains in many cases for the same land for different purposes requires reduction tables. On account of the direct relation to the foot, the engineers' chain is becoming very widely used; measurements being expressed in feet and decimals of a foot.

The bolt for measuring cloth is generally given as 40 yards, though the name means simply a roll of definite length. The customary length of the bolt varies with different fabrics and manufacturers.

The skein for yarn is often defined as 120 yards. Its length varies, however, according to the material and the locality.

The United States cable's length (720 feet), used by mariners, is 120 fathoms as recognized by the United States Navy.

The furlong (220 yards) originally meant "length of a furrow," supposed to be the distance oxen could plow without stopping to rest.

The hank is a unit of length for yarn. In the United States the length of a hank of cotton is usually 840 yards, while that of linen is 3,000 yards; different lengths, however, are also in use under that title.

The nautical mile or geographical mile has been defined as 1–60 part of the length of a degree of a great circle of the earth. Since the earth is not a perfect sphere, however, the degree varies in length and this has led to much confusion in usage regarding the nautical mile. The definition accepted by the United States Coast and Geodetic Survey (consult Report of 1881, Appendix 12) is as follows: The 1–60 part of the length of a degree on the great circle of a sphere whose surface is equal to the surface of the earth. This makes the length of the nautical mile 6,080.20 feet or 1,853.248 meters. The uncertainty in the dimensions of the earth affects the last decimal place given. The nautical mile is often miscalled "knot." The latter term, however, is not a measure of length, but a measure of speed, equal to one nautical mile per hour. The admiralty "knot" of Great Britain is 6,080 feet per hour.

The league is equal to three miles, the land league being equal to three United States statute miles (15,840 feet) and the United States marine league to three nautical miles (18,240.6 feet). Its value varies in different countries. The marine league is the distance from shore over which a country has jurisdiction under international law.

A degree of the earth's meridian, or of the circumference at the equator, is very nearly equal to 60 nautical miles.

The astronomical unit, equal to the mean radius of the earth's orbit or nearly 93,000,000 miles, is sometimes used in stating astronomical distances.

In stating interstellar distances it is sometimes found convenient by astronomers to use the light year, being the distance traversed by light in one year, or 64,600 astronomical units.

Besides the measures of length given above, there are numerous very special methods of denoting length in case of special commodities. The thickness of sheet iron and steel is denoted by a system of arbitrary gauge numbers. The numbers in use differ for different products. On March 3, 1893 Congress passed an act establishing a standard gauge for sheet and plate iron and steel for use in the customs service. In this system the gauge numbers indicate thickness, or the weight per unit area. Sizes of wire are also denoted by a special system of arbitrary gauge numbers. The number of different systems which have been used is quite large. Pfeilschmidt's *Wire and Sheet Gauges of the World* gives comparative tables for 11 systems of wire gauges. At present the most common gauges in use in this country are the Brown and Sharpe gauge and the Birmingham wire gauge. (See WIRE.) The fineness or coarseness of yarn is denoted by a system of numbers, called "counts," which indicate usually the number of hanks of the yarn in question which will weigh one pound. Thus No. 10 yarn (English cotton yarn and spun silk count) is a yarn of such fineness that 10 hanks (of 84,000 yards) are required to make a weight of one pound, or again No. 1 wool (Aberdeen count) is such that one spindle (of 14,400 yards) shall weigh a pound. There are about 24 different systems of counts in use, and in order to introduce uniformity in counting textile yarn throughout the world, the international metric count was approved by the International Paris Conference of 1900. According to this count, No. 1 means that a length of 1 meter will weigh 1 gram, and 100 meters of No. 100 yarn will weigh 1 gram. The grex system of yarn numbering developed from this, a grex unit being equal to the weight in grams of 10,000 meters of yarn or other material.

In addition to the above there are a large number of special systems of numbering particular commodities such as hats, shoes, gloves, nails, cordage, books, and other articles too numerous for description.

The units of superficial measure or area are usually the squares of the linear units and as such need but little comment. The circular mil (.7854 square mil) is the area of a circle .001 inch in diameter. One circular inch contains 1,000,000 circular mils, and one square inch contains 1,273,240 circular mils. The square inch is the most common small unit of area, being used in measuring pressures, strength and other properties of materials, and in engraving, cloth analysis and many other purposes. The square foot (144 square inches) is also largely used. It is the basis of the board foot which is 144 cubic inches of undressed lumber, being reckoned as one square foot of one inch board, or its equivalent. The "square" is a unit used in carpentry for flooring, ceiling, and shingling, and contains 100 square feet, architects' and builders' measure.

In surveyors' measure 1 acre = 10 square chains = 160 square poles = 100,000 square Gunter's or surveyors' links. The acre (43,560 square feet) was probably as much land as could be tilled in a day and therefore of rather indefinite extent until later times. It is a unit of the same order as the French *journée* and the German *Morgen*. The acres of various countries differ in size, for example, the Irish acre of 7,840 square yards; the Scottish acre of 6,104 square yards; the Cheshire acre of 10,240 square yards; Cunningham acre and the Imperial acre.

In subdividing public lands in the United States, the lands are laid out in townships. One township = 36 sections or square miles = 144 quarter sections = 23,040 acres. The "homestead" is a free grant of public land having a maximum area of one-quarter section or 160 acres. In the Philippine Islands, the "homestead" is 64 hectares, which is almost identical with the homestead as defined above.

Among the more important units of volume

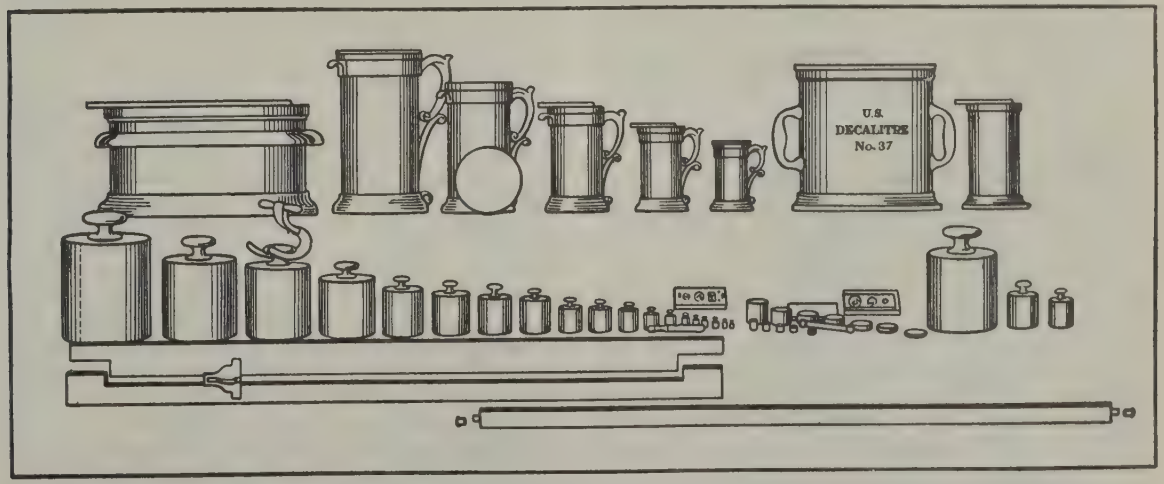
are the cubic inch, the cubic foot, the cubic yard, and the cubic mile. The cubic inch is practically the smallest unit of volume based directly on linear units. It is very largely used. The cubic foot (1,728 cubic inches) is used in engineering to express volumes of gas, water, or other solids. In some states, such as Washington and Colorado, the cubic foot is established by statute as the legal unit for measuring the volume of water. A special system of units is used in the measurement of wood; 144 cubic inches or one foot square of one inch board is expressed as one board foot. A timber foot, however, is 1,728 cubic inches or one cubic foot. A cord foot is a pile of wood 1 by 4 by 4 feet. In the absence of state laws to the contrary a cord of wood is 128 cubic feet. In the lumber business, boards are usually bought and sold by the 1,000 board feet to simplify computation. In New Hampshire, a measure for lumber was adopted in 1866 based upon an "imaginary cubic foot" equal to about 1.4 cubic feet. This unit is also used in parts of Maine and Vermont. Round timber is measured as follows: "A stick of timber 16 inches in diameter and 12 inches in length shall constitute one cubic foot, and the same ratio shall apply to any other size and quantity. Each cubic foot shall constitute 10 feet of 1,000 board feet." In the practical use of this rule it is customary to consider 115 cubic feet equivalent to 1,000 board feet, instead of 100 cubic feet, according to the wording of the statute. In this case the diameter is taken at the middle of the log inside the bark. If the diameter is measured at the small end of the log, 106 cubic feet are allowed for 1,000 board feet. The New Hampshire rule is called the Blodgett Rule. Several log rules are specified by state law or have some currency. The International Log Rule is specified by more states than any other. By it the number of board feet is computed for 4-foot sections, by the use of a formula. Tables have been prepared to eliminate much of the computation. The cubic yard is used largely in engineering and in computing grading, cuts and fills, a cubic yard being equal to about one load.

The perch, in addition to being a unit of length and a unit of area, is also widely used as a unit of volume of brickwork and masonry. The perch of masonry, however, is a widely varying unit, ranging from 16½ cubic feet to 25 cubic feet. In Colorado it is 16½ cubic feet, 25 cubic feet in North and South Dakota, 24¾ cubic feet in Delaware. The latter perch is equal to a section of brickwork 1 by 1½ feet by 16½ feet, or one perch in length.

A cord of masonry is usually reckoned at 100 cubic feet, although in some cases it is 96 cubic feet.

The cubic mile is used in expressing very large volumes, such as the silt carried by rivers.

Liquid Measure.—The fundamental unit of liquid measures in the United States is the wine gallon of 231 cubic inches—a unit abandoned by England in 1824, but now generally adopted by the various states of the Union. The British imperial gallon measures 277.42 cubic inches, and is the volume of 10 pounds of water at 62°F. The liquid measures of the United States unfortunately bear no relation to those of England. As late as the first part of the 20th century there was confusion caused by the use in the United States of gallons other than the gallon of 231 cubic inches. The ale, beer, or milk gallon, as it was variously termed (282 cubic inches), was most often encountered. But annual conferences on weights and measures, beginning in 1905, have done much to unify the laws on weights and measures in the several states, including the elimination of the ale, beer, or milk gallon. The ordinary liquid measures are usually 1 gallon = 4 quarts = 8 pints = 32 gills. The "proof gallon" is a wine gallon of spirits containing one half its volume of nearly pure alcohol at 60°F., and is the basis for computing the United States internal revenue tax. For example, a gallon of spirits containing 40 per cent alcohol would be 80 per cent proof, and the number of proof gallons is computed by multiplying the per cent of proof by the number of wine gallons. In addition to the capacity measurement by volume, the legal weight of a gallon of certain commodities has been fixed by statute in some states. The wording of these statutes differs: in some cases they define the purity of the product, in others they provide for the sale by weight, retaining the trade usage of the term gallon. Examples are 6½ pounds of kerosene in Kansas, 8 pounds of castor oil in Kansas, 11 pounds of sorghum molasses in Indiana, and 11 pounds of maple sirup in Ohio.



This complete set of standards of capacity (top row), mass (center), and length (below) is calibrated by the National Bureau of Standards in terms of the national standards and furnished to each of the states for use in regulation of weights and measures. The state standards are returned periodically to the bureau for recomparison.

The subdivisions of the gallon, the quart, pint, and gill are largely used in trade. In addition to the general liquid measures enumerated above, apothecaries have a special system of capacity measures based on the volume of the United States liquid pint of 28.875 cubic inches. One pint = 16 United States fluid ounces = 128 United States fluid drams = 7,680 United States minims.

The minim is the smallest of the United States units of volume and is about 0.00376 cubic inches. A minim of pure water weighs about 0.95 grains and corresponds to the "drop," which it approximates in size. The United States minim is about 4 per cent larger than the British Imperial minim. It is denoted by the symbol ♏.

The drop varies from 0.02 to 0.1 cubic centimeter and is not a fixed unit, but is convenient for use in dispensing very small quantities of liquids. It is not subdivided and its size depends upon the liquid and the method of dropping. The ordinary form of drop pipette of the ophthalmologist delivers drops of about a half United States minim.

The United States fluid dram (60 minims), is equal to one-eighth United States fluid ounce, its volume differing from the volume of one avoirdupois dram of water, from the volume of one apothecaries' dram of water (by weight), and is about 4 per cent larger than the fluid dram in use in Great Britain. It is about 4 cubic centimeters, or an average teaspoonful, and is denoted by the symbol ƒ3.

The United States fluid ounce (480 United States minims) is the 1–16 part of the wine pint and has a volume of about 1.8 cubic inches. It differs from the British unit of the same name as well as from the volume of the avoirdupois ounce of water and the troy or apothecaries' ounce of water. Other measures of less definite character are often found convenient, such as the teaspoonful, dessertspoonful, tablespoonful, wineglassful and teacupful. The spoons used as culinary measures contain the following quantities: a tablespoon, 4 fluid drams or 15 cubic centimeters; a teaspoon, 1⅓ fluid drams or 5 cubic centimeters.

Dry Measures.—The dry measures in general use in the United States bear no direct relation to the liquid measures of the United States or Great Britain. The following are the ordinary units of dry measures: one bushel = 4 pecks = 32 dry quarts = 64 dry pints. The fundamental unit is the Winchester bushel, a unit abandoned by England in 1824. The Winchester bushel had a capacity of 2,178 cubic inches. In the United States the name Winchester has been attached to the London bushel with a volume of 2,150.42 cubic inches and is about 69 cubic inches or 3 per cent smaller than the Imperial bushel of Great Britain—a proportionate difference existing in the subdivisions of the bushel.

During the 19th century there was considerable confusion because of the variance in state laws giving special definitions of bushels for specific purposes. Most of these have been repealed. But in Connecticut, Delaware, Maryland, Michigan, and Oklahoma, the charcoal bushel is defined as 2,748 cubic inches, in Colorado it is defined as 2,500 cubic inches, and in Missouri and Oklahoma as 2,680 cubic inches. In Vermont the law reads that "one bushel and three-quarters of a peck shall be deemed a bushel of limes or ashes." Besides the usual "struck bushel" there is also the "heaped bushel," required in some states to be "as high as the article will admit," and elsewhere "as high as may be without special effort or design," but being specifically stated in Connecticut as 2,564 cubic inches.

The many objections to buying and selling agricultural products by volume, such as the difficulty of detecting error or fraud, the variation in the size of the heap, the ease of packing short quantity in a given volume, the effects of expansion, moisture, or shaking, and the general uncertainty of estimates of quantity based upon volume, early led to the practice now quite general, of defining the bushels as definite weights for the different commodities. Unfortunately the matter was left to the several states with the result that the lack of uniformity in legislation and custom has introduced some confusion. In most cases these laws do not define bushels as units of measure, but rather provide for selling specific products by weight, retaining the trade practice of stating quantities in terms of "bushels." Although this may seem to be a source of confusion in compiling accurate statistics because of the use of a term that is variable, there is no more confusion than if the bushel of 2,150.42 cubic inches were used and such items as degree of filling, amount of shaking down, and subsequent refilling, were variables. Obviously statistics by weight for agricultural products would have much merit.

The barrel is a convenient receptacle for packing, transporting, and storing commodities. It has also long been used as a unit of measure. As these containers varied in size, so has the barrel as a unit varied. In at least one instance it is defined in terms of units of volume, the apple barrel in Massachusetts being 7,056 cubic inches. In many states it is defined in gallons, being 42 gallons for all liquids in Tennessee, 31 gallons for beer and other malt liquors in New York; the most usual quantity is 31½ gallons. As in the case of gallons and bushels, the weight of some products has been specified by state laws for selling by weight under the term barrel. Probably the most common example of this was the flour barrel of 196 pounds; but the practice arose of selling flour in bags or sacks containing simple fractions of 200 pounds, and this practice became universal in the United States during World War II. Not as many products have been specified by weight per barrel as in the analogous cases of the gallon and bushel. However, 200 pounds of shelled corn constitute a barrel in Maryland and the District of Columbia, 200 pounds of pork in Ohio, and several other states, 150 pounds of potatoes in Connecticut, 200 pounds of corn meal in Wisconsin, and 200 pounds of fish in a number of states including Ohio. In some states the dimensions of the barrel are specified; thus the cranberry barrel in Massachusetts is required to be not less than 25¼ inches between the heads, length of staves 28½ inches, diameter of head not less than 16¼ inches including beveled edges, outside bulge circumference not less than 58 inches, and thickness of staves not greater than four tenths of an inch. In the petroleum industry a 42-gallon barrel is commonly used for statistical purposes.

The hogshead (two barrels), the pipe (four barrels), and the tun (eight barrels) are more commonly not intended as definite measures but merely convenient receptacles for liquids in bulk.

TABLE SHOWING IMPORTANT UNITS OF WEIGHTS AND MEASURES AND THEIR EQUIVALENTS IN UNITED STATES UNITS[1]

Name	Country	United States Equivalent	
Almude	Portugal (Lisbon)	4.423	gallons
"	Portugal (Oporto)	6.701	"
Anker	Union of South Africa	9.307	"
Ardeb	Egypt	5.619	bushels
Are	Metric	0.0247	acre
Arroba	Argentina	25.320	pounds
"	Bolivia	25.37	"
"	Brazil	32.385	"
"	Chile	25.36	"
"	Costa Rica	25.366	"
"	Cuba	25.366	"
"	Mexico	25.367	"
"	Paraguay	25.36	"
"	Peru	25.36	"
"	Portugal	32.382	"
"	Salvador	25.36	"
"	Spain	25.36	"
Arroba (liquids)	Cuba	4.263	gallons
Arroba (oil)	Spain	3.319	"
" (wine)	"	4.262	"
Arshin	Yugoslavia	26	inches
" (cloth)	Turkey	27	"
" (new)	"	39.37	"
" (old, land)	"	27.9	"
"	USSR	28	"
Aune	France	46.79	"
Bale (coffee)	Arabia	285	pounds
Barril	Argentina	20.077	gallons
Bat (or tical)	Siam	0.529	ounce
Berkovetz	USSR	361.128	pounds
Bushel	Great Britain	1.032	bushels
Caffiso	Italy (Messina)	3.1	gallons
"	Malta	5.404	"
Candy (cotton, raw)	Bombay	784	pounds
Candy (cotton, raw)	Madras	500	"
Cantar (or kintal)	Turkey	125	"
Cantara	Bolivia	4.263	gallons
"	Spain	4.263	"
Cantaro	Malta	175	pounds
Carga	Mexico	5.154	bushels
"	Spain (Malaga)	177.5	pounds
"	" (Valencia)	388.44	"
Catty	China	1 ⅓	"
"	Hong Kong	1 ⅓	"
"	Java	1.356	"
"	British Malaya (Penang)	1.426	"
"	Philippines	1.395	"
Cental	Great Britain	100	"
Centare	Metric	1.196	sq. yards
Centilitre	"	0.0182	dry pints
Centigramme	"	0.1543	grains
Centimetre	"	0.3937	inch
Centner	Denmark	110.231	pounds
"	Germany	110.231	"
"	Poland	89.398	"
"	Switzerland	110.231	"
Chang	China	11.75	feet
"	Siam	2.65	pounds
Chek	Hong Kong	14 5/8	inches
Chetverik	USSR	2.978	pecks
Chih	China	12.6	inches
Cho	Japan	2.45	acres
Chupak	British Malaya	1.032	dry quarts
"	" "	1.2009	liq. quarts
Decagramme	Metric	0.353	ounce
Decalitre	"	1.135	pecks
"	"	2.642	gallons
Decametre	"	10.936	yards
Denum (new)	Turkey	0.618	acre
" (old)	"	0.227	"
Dessiatina	USSR	2.7	acres
Diraa baladi	Egypt	22.835	inches
" mimari	"	2.46	feet
Dirhem	"	1.761	drams
Djerib	Turkey	2.471	acres
Donum	Cyprus	0.331	acre
Ell	Great Britain	45	inches
Endazeh	Turkey	25.688	inches
Fanega	Argentina	3.893	bushels
"	Chile	2.753	"
" (corn)	Cuba	3.00	"
"	Ecuador	1.574	"
"	Mexico	2.577	"
"	Paraguay	8.173	"
"	Spain	1.575	"
Fanegada	Peru	1.596	acres
Feddan	Egypt	1.038	"
Frail	Spain	50	pounds
Frazila	East Africa	35	"
"	Zanzibar	35	"
Funt	Poland	0.9	"
Gallon	Great Britain	1.201	gallons
Galon	Bolivia	0.888	gallon
"	Peru	0.888	"
Garnetz	USSR	2.978	dry quarts
Garrafa	Brazil	1.408	liq. pints
Go	Japan	0.191	liq. quarts
Hectare	Metric	2.471	acres
Hectolitre	"	2.838	bushels
"	"	26.418	gallons
Kilogramme	"	2.2046	pounds
Kilolitre	"	28.38	bushels
"	"	264.18	gallons
Kilometre	"	0.621	mile
Kin	Japan	1.323	pounds
Koku	"	5.119	bushels
"	"	47.655	gallons
Kwan	"	8.267	pounds
Leaguer	Union of South Africa	151.92	gallons
Li	China	1,890	feet
"	"	0.0126	inch
Libra	Argentina	1.013	pounds
"	Brazil	1.013	"
"	Chile	1.014	"
"	Colombia	1.102	"
"	Costa Rica	1.014	"
"	Cuba	1.014	"
"	Dominican Republic	1.014	"
"	Honduras	1.014	"
"	Mexico	1.015	"
"	Paraguay	1.014	"
"	Peru	1.014	"
"	Portugal	1.012	"
"	Spain	1.014	"
Ligne	Mauritius	0.089	inch
Litre	Metric	0.908	dry quart
"	"	1.0567	liq. quart
Litron	Greece	0.264	gallons
Livre	"	1.051	pounds
Livrepoid	Haiti	1.079	"
Marco	Mexico	7.40	oz. troy
Maund	Aden	28	pounds
"	India (Bombay)	28	"
"	" (Madras)	25	"
" (factory)	"	74.667	"
" (standard)	"	82.286	"
Mazsa	Hungary	220.46	"
Metre	Metric	39.37	inches
Millimetre	"	0.03937	"
Miscal	Persia	0.01014	pounds
Momme	Japan	0.1323	ounce
Morgen	Union of South Africa	2.117	acres
Muid	Union of South Africa	3.0946	bushels
Oke	Egypt	2.751	pounds
"	Greece	2.822	"
"	Turkey	2.826	"
Pack (wool)	Great Britain	240	"
Pé	Brazil	13.12	inches
Pfund	Austria	1.235	pounds
"	Germany	1.1023	"
" (or Funt)	USSR	0.903	"
Picul	Borneo	135.635	"
"	China	133 ⅓	"
"	Japan	132.277	"
"	British Malaya (Penang)	142.628	"
Pollegada	Brazil	1.09	inches
Pond	Netherlands (legal)	2.2046	pounds

[1] The metric system is in general use throughout the civilized world except in Anglo-Saxon countries. In Latin American countries many of the old Spanish and Portuguese units have considerable use. References are occasionally found to old units in European and Asiatic countries. In some cases the units do not have a precise value, and some units are spelled differently in English by different authorities.

TABLE SHOWING IMPORTANT UNITS OF WEIGHTS AND MEASURES AND THEIR EQUIVALENTS IN UNITED STATES UNITS[1]— Continued

Name	Country	United States Equivalent	
Poud	USSR	36.1128	pounds
Pulgada	Argentina	0.947	inch
"	Chile	0.914	"
"	Mexico	0.916	"
Pund	Denmark	1.102	pounds
Quart	Great Britain	1.032	dry quarts
"	" "	1.201	liq. "
Quintal	Argentina	101.28	pounds
"	Bolivia	101.4	"
"	Brazil	129.539	"
"	Chile	101.43	"
"	Colombia	110.231	"
"	Costa Rica	101.4	"
"	Cuba	101.43	"
"	Dominican Republic	101.41	"
" (metric)	Metric	220.462	"
"	Mexico	101.467	"
"	Peru	101.43	"
"	Portugal	129.526	"
" (old)	Spain	101.432	"
Ri	Japan	2.440	miles
Rood (Cape)	Union of South Africa	12.396	feet
Rotl	Egypt	0.99	pounds
Seer (factory)	India	1.867	"
" (standard)	"	2.057	"
Shaku	Japan	11.93	inches
" (cloth)	"	14.913	"
Stere	Metric	1.308	cubic yards
Stone	Great Britain	14	pounds
Sun	Japan	1.193	inches
Tael	China	1⅓	ounces
Tan	Japan	0.245	acre
To	"	0.512	bushel
Tola	India	0.4114	ounce
Ton	Canada	2,000	pounds
" (metric)	Metric	2,204.622	"
Tonde	Denmark	3.948	bushels
Tonelada	Portugal	1,748.736	pounds
"	Spain	2,028.66	"
Tsun	China	1.26	inch
Tsunbo	Japan	3.953	sq. yards
Vara	Argentina	34.094	inches
"	Bolivia	33.43	"
"	Brazil	43.74	"
"	Chile	32.91	"
"	Colombia	31.50	"
"	Cuba	33.386	"
"	Dominican Republic	32.91	"
"	Mexico	32.992	"
"	Peru	32.91	"
"	Portugal	43.31	"
"	Spain	32.91	"
"	Venezuela	33.38	"
Vedro	USSR	3.249	gallons
Verst	"	3,500	feet
Zak	Netherlands	2,368	bushels
Zar	Persia	40.95	inches

The smaller units of dry measure, such as the peck, dry quart and dry pint, are largely used in retail trade, the pint and quart being used for smaller products like berries.

Avoirdupois System.—The avoirdupois system of weights is used for almost all commodities except the precious metals and jewels. The avoirdupois dram differs from the apothecaries' dram, and the avoirdupois ounce and pound differ from the troy units of the same name. Ambiguity is avoided only by properly qualifying the terms. The use of such unqualified terms as ounce, pound or ton causes great confusion owing to the uncertainty and ambiguity of the terms. The "avoirdupois pound" or "troy ounce," however, are definite units. The avoirdupois units are as follows:

One long ton = 20 long hundredweights = 80 long quarters = 2,240 pounds = 35,840 ounces = 573,440 drams = 15,680,000 grains.

One short ton = 20 short hundredweights = 80 short quarters = 2,000 pounds = 32,000 ounces = 512,000 drams = 14,000,000 grains.

The fundamental unit of the avoirdupois system is the avoirdupois pound now derived from the International kilogram, in accordance with the law of 1866 and the executive order of 1893, the value being 453.5924277 grams. It is a matter of controversy as to the time the avoirdupois and troy pounds were introduced into England. The earliest mention in law of the troy pound is in 1414. The earliest mention of avoirdupois is 1335. Congress has never directly legalized any standard of weight except the troy pound and that only for purposes of coinage. To avoid confusion in comparisons of mass, the ratio of the avoirdupois pound to the troy pound was fixed at 7,000 to 5,760, measured in grains.

The United States avoirdupois dram (or drachm) is the 1/16 part of the avoirdupois ounce (28.3495 grams). This unit must not be confused with the apothecaries' dram (weight) which is the 1/8 part of the apothecaries' ounce or 60 grains. The avoirdupois dram is largely used in the textile industries. The avoirdupois ounce is the 1/16 part of the pound and contains 16 drams. The avoirdupois stone is a denomination often used in England, and varies with different commodities, the most common value being fixed in England as 14 pounds.

The hundred weight (cwt.) is the 1/20th part of the ton. In the United States, Canada, and South Africa it is 100 pounds; in Great Britain it is 112 pounds.

The short ton of 2,000 pounds is generally used in the United States, Canada, and South Africa; in Great Britain the long ton of 2,240 pounds is required. In comparing statistics one must be sure of the ton used in each case. Besides the short ton and the long ton there is the metric ton (approximately 2,246 pounds) and also several special tons, as, for example, the displacement ton of 35 cubic feet, the shipping ton of 40 cubic feet, the timber ton of 42 cubic feet, and the register ton of 100 cubic feet. When a ton of hay is sold by measurement rather than by weighing in certain states, the number of cubic feet to be considered equal to a ton is specified, thus 343 cubic feet in North Dakota and Ohio, and 380, 422, or 512 cubic feet in New Mexico, according to the time that the hay has been stacked.

Troy Weights.—The troy weights are as follows: one pound = 12 ounces = 240 pennyweights = 5,760 grains. The troy pound was legalized in 1828 as the standard unit to be used by the mint of the United States in the regulation of the coinage. In view of the confusion in the weights and measures of trade, Congress found it important to legalize some particular weight for the use of the mint, and by the act of May 19, 1828, legalized the copy of the Imperial Standard troy pound. This copy was procured by Albert Gallatin in England in the preceding year and was received by President John Adams Oct. 13, 1827. It was based upon the old Imperial Standard troy pound of 1758, legalized in 1825. This troy pound has not been recognized as a legal standard in England since 1855, and was declared illegal, with penalty attached, in 1878.

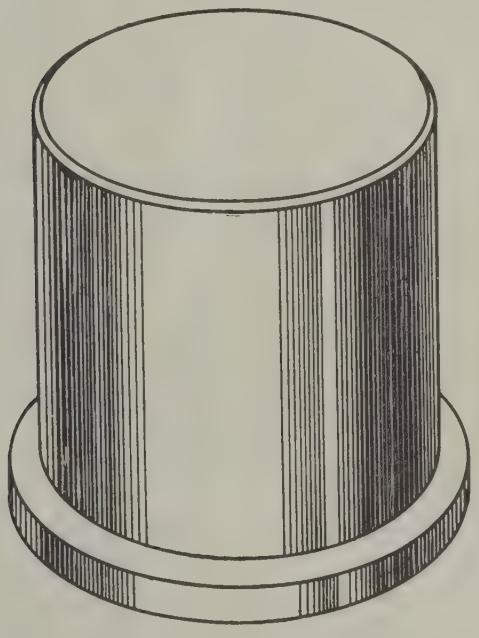
The grain is the 1–5,760 part of the troy pound, and is the only unit which is identical in the troy, apothecaries', and avoirdupois systems. A very old English statute (51 Henry III, 1266)

provided that the English penny should weigh "thirty-two grains of wheat well dried and gathered out of the middle of the ear." The grain has been used as a unit of weight in many countries, but with varying values from 0.68 to 1.54 United States grains. The grain, as used in the United States, is 0.0648 gram.

The pennyweight is the 1–240 part of the troy pound.

The troy ounce is used in stating the quantities of silver and other precious metals. In England it is the highest unit used in the troy system. In assays, the troy ounce is frequently divided decimally. One hundred seventy five troy ounces equal 192 avoirdupois ounces.

Apothecaries' Weights.—The units of apothecaries' weights are as follows: one apothecaries' pound = 12 ounces = 96 drams = 288 scruples = 5,760 grains. The apothecaries' pound is equivalent to the troy pound in the United States, but in England the apothecaries' weights were discontinued in 1858 under authority of the medical act, and avoirdupois weights substituted in dispensing medicines. In the United States, although the metric system is gaining in use for dispensing medicines, the apothecaries' weights are still used: the grain, the scruple (20 grains), the dram (60 grains), and the ounce (480 grains). The apothecaries' pound (equal to the troy pound) is rarely used.



The national standard of mass, known as Prototype Kilogram No. 20, is a platinum-iridium cylinder 39 mm in diameter and 39 mm high. It is an accurate copy of the international standard kept at the International Bureau of Weights and Measures at Sèvres, France. Prototype No. 20 was furnished the United States by the International Bureau in accordance with the metric treaty of 1875. Recomparison with the international standard in 1937 showed that the United States standard has remained constant within one part in 50 million during approximately 50 years.

Metric Carat.—The basic unit used in the weighing of diamonds is the metric carat of 200 milligrams. This was adopted by the United States in 1913 and has been adopted practically universally throughout the world. The so-called international carat of 205 milligrams, used before the adoption of the metric carat, was very nearly the value of the old English carat. The metric carat is divided decimally. Another mode of division is into four diamond grains, sometimes referred to as carat grains, and each of these grains is then subdivided into 16 parts. The term carat is derived from the name of a small, hard bean, formerly used to weigh diamonds. The carat used in weighing diamonds is quite different from carats as used to define the purity of gold alloys, a carat in that case being one part of gold in 24 of the alloy.

Metric System.—The metric system is in general use in most of the non-English speaking countries of the world. But in the British Commonwealth of Nations and in the United States the use of the metric system is largely restricted to scientific work. In the United States the use of the metric system was made legal for all purposes in 1866. Scientists have universally adopted the metric system because their results are then readily comparable with similar results obtained in other countries and because of the advantages of the decimal character of the units. The basic units of the metric system are the meter for length and the gram for mass (weight). The primary standards, a meter bar and a kilogram (1,000 grams), are kept in a suburb of Paris, France, but copies have been distributed to the principal countries of the world. The liter is the metric unit of capacity corresponding to the volume of water weighing one kilogram under specified conditions. For most practical purposes the liter can be considered as equal to the volume of a cube one tenth of a meter (one decimeter) on a side. See also BALANCE; METRIC SYSTEM; TONNAGE; WEIGHING MACHINES.

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WEIHAIWEI, wā'hī'wā', seaport, China, former British naval and coaling station, in the province of Shantung, near the eastern extremity of the Shantung Peninsula, 40 miles east of Chefoo. It lies on the south shore of the entrance to the Gulf of Pechili, opposite Port Arthur on the north shore, about 100 miles distant. During the Sino-Japanese War, the Japanese destroyed a Chinese fleet here and captured the town, which they evacuated early in 1898. By a convention of July 1, 1898 the port of Weihaiwei, together with the adjacent waters and some neighboring

territory, was leased to Great Britain. The leased territory included the island of Liu Kung, all the islands in the bay and a belt of land 10 miles wide along the whole coast of the bay; area, 285 square miles; pop. 154,416; but the population of the town of Weihaiwei is only about 2,500 inhabitants, being an old-time walled town. By the terms of the lease Great Britain had sole jurisdiction within the limits of this territory, but within the walls of the city, Chinese officials might exercise such authority as was not inconsistent with the defense of the territory. The British government could also erect fortifications and carry out other defensive works in a defined region lying outside of the leased territory. Chinese war-vessels retained the right to use the waters. Weihaiwei was not to be fortified, but was used as a flying naval base and place of exercise and sanatorium for the China squadron. As a result of the Shantung settlement at Washington in 1922 England offered to return Weihaiwei to China on certain terms which China accepted but the unsettled condition of the country hindered progress in carrying out these plans and Great Britain remained in possession of Weihaiwei until Oct. 1, 1930, when she formally handed it back to China. The chief imports are piece goods, raw cotton and yarn, oil, rice, flour, and tobacco; the exports are ground-nut oil, ground-nuts, eggs and sugar. There is weekly mail service to Shanghai and Europeans visit the place in summer because its climate is the best in the Far East. Consult Annual Report on Weihaiwei; Bruce-Mitford, C. E., *The Territory of Weihaiwei* (1902); Johnston, R. F., *Lion and Dragon* (London 1910).

WEIMAR, vī'mär, Germany, the capital of the state of Thuringia on the Ilm River, 13 miles east of Erfurt. It stands in a beautiful valley surrounded by hills, on ground partly elevated and partly flat. It is irregularly built except in the suburban portions. Its notable public edifices are the grand-ducal palace, a handsome structure erected partly under the superintendence of Goethe; the so-called Red and Yellow castles, now united and occupied by several public departments; the grand-ducal library (in the Green Castle), containing 300,000 volumes and a large collection of maps; the museum; the Stadtkirche, with an altar-piece, one of the finest works of Lucas Cranach, in which he has introduced portraits of himself and Luther and Melanchthon; and the modern Gothic townhouse. The public monuments comprise the Goethe-Schiller monument in bronze, statues of Herder, Wieland, the composer Hummel, the Grand-Duke Karl August and various others, and a monumental fountain. Goethe's house is now used as a Goethe National Museum, and Schiller's contains relics of its former distinguished owner. A Goethe and Schiller Archives building was opened in 1896. Goethe and Schiller are interred in the grand-ducal vault in the new cemetery. Stretching away from the palace is a fine park on the banks of the Ilm. Weimar has a gymnasium, a realgymnasium, academy of painting, school of drawing, normal school and other educational institutions. It has neither trade nor manufactures of much consequence, the manufactures of iron, wood, straw, leather and cloth being carried on to some extent, but as the capital of the state it is the seat of the legislature and of all the more important courts and public offices. It long ranked as a sort of "German Athens" in consequence of the enlightened patronage which the Duke Karl August (d. 1828) afforded to the four great literary men of Germany, Goethe, Schiller, Herder and Wieland. In 1919 the National Assembly of the German nation met at Weimar and there the constitution of the new German Republic was made and adopted. The Treaty of Versailles (1919) was ratified at Weimar during the session of the assembly. Population (1939) 65,989.

WEINBERGER, vīn'bĕrg-ûr, **Jaromir,** Czechoslovak composer: b. Prague, Jan. 8, 1896. Pupil of Karel Hoffmeister, Jaroslav Křička and Max Reger. Teacher of composition in the Ithaca Conservatory, Ithaca, New York 1922–1926; later teacher and conductor in Bratislava, Moscow, Vienna, and London; since 1939 resident in Fleishman, New York. Influenced in his earlier works by French impressionism, Weinberger later applied his skillful orchestration to the eclectic organization of folklore material. His compositions include: *Czech Rhapsody; Lincoln Symphony;* a sonata, and other piano and orchestral works; a ballet, *The Seduction of Evelina* (1917); the operas *Švánda Dudak* (*Schwanda the Bagpiper,* 1927; New York 1931), his most successful work; *Die Geliebte Stimme* (1930); *The Outcasts of Poker Flat* (1932); *Wallenstein* (1937); and an operetta, *Frühlingstürme* (1932).

WEINGARTNER, vīn'gärt-nĕr, **Felix von,** Austrian conductor and composer: b. Zara, Dalmatia, June 2, 1863; d. Winterthur, Switzerland, May 7, 1942. He studied at Graz under W. A. Remy; at Leipzig Conservatory; and under Liszt at Weimar, where his first opera, *Sakuntala,* was produced in 1884. He subsequently held important posts as kapellmeister, leading the royal orchestra in Berlin from 1891 to 1898; served as conductor or director in Munich, Vienna, and Basle, and from 1935 again at Vienna; and conducted concerts in New York (1905), Boston (1912–1913), and in London and South America (1919). Among his important compositions are the operas *Malawika* (1886); *Genesius* (1892); and *Orestes* (1902); six symphonies; two symphonic poems; a violin concerto, much chamber music, and many songs. He also edited works of Berlioz, Weber, and Méhul, orchestrated a Beethoven sonata, and wrote several books on musical subjects, including a volume on conducting.

WEINMAN, Adolph Alexander, American sculptor; b. Karlsruhe, Germany, Dec. 11, 1870. He came to the United States when a child and later studied art in New York, under Saint Gaudens at the Art Student's League, and at Cooper Union. He is a member of the National Academy, the National Sculpture Society and the National Institute of Arts and Letters. In 1915 he served on the International Jury of Awards at the Panama Exposition. Among his works are the General Macomb Monument at Detroit, Mich.; the Lincoln memorials, Hodgenville, Ky., and Madison, Wis.; the Lincoln statue, State Capital, Frankfort, Ky.; the statuette of Lincoln, Metropolitan Museum, New York; sculptures for the post office, Supreme Court and Archives buildings, Washington, 1933.

WEIR, wēr, **Harrison William,** English artist and journalist: b. Lewes, Sussex, May 5,

1824; d. Appledore, Kent, Jan. 3, 1906. He was apprenticed to the color printer George Baxter (1804–1867) and was later employed as an illustrator for the *Illustrated London News* and for other periodicals, such as the *Graphic,* the *Pictorial Times,* and the *Black and White.* A great lover of animals and an expert poultry breeder and horticulturist, Weir illustrated—and occasionally wrote—many books on natural history, domestic animals, and animal stories.

WEIR, John Ferguson, American artist and writer: b. West Point, N. Y., Aug. 28, 1841; d. Providence, R. I., April 8, 1926. He was a pupil of his father, Robert Walter Weir. He became a member of the National Academy of Design in 1866; director of Yale University School of Fine Arts in 1869; and retired in 1913. He is known by his statues of President Woolsey and Professor Sullivan of Yale; and by his paintings, which are grouped with the Hudson River School. Deeply interested in religion, he wrote *Human Destiny in the Light of Revelation* (1903).

WEIR, Julian Alden, American artist: b. West Point, N. Y., Aug. 30, 1852; d. New York, N. Y., Dec. 8, 1919. The son of Robert Walter Weir, he studied with his father and at Paris with Jean Léon Gérôme. Weir's painting was strongly influenced by the French impressionists, but is even closer to the work of James Whistler, showing clearly the influence of the decorative aspects of Japanese art. Examples are to be found in the Luxembourg, Paris, and in a great many art museums in the United States. *Breton Interior* obtained a second-class medal at the Paris Exposition of 1889. His *Idle Hours,* now in the New York Metropolitan Museum, received the $2,000 prize of the American Art Association. In the same gallery are *The Red Bridge* and *The Green Bodice,* the latter one of Weir's masterpieces. Weir's long career as an artist was marked by independence and naturalness. It was only after repeated experiments that he achieved the general recognition which the reticent, refined, and distinguished style of his maturity deserved.

WEIR, Robert Stanley, Canadian lawyer and poet: b. Hamilton, Ontario, Nov. 15, 1856; d. near Lake Memphremogog, Quebec, Aug. 20, 1926. He was educated at McGill University and in 1881 was called to the Quebec bar. He then practiced in Montreal, and in 1926 was named a judge of the Exchequer Court of Canada.

Weir was the author of a number of legal treatises, and two volumes of verse, *After Ypres and Other Verses* (1917) and *Poems, Early and Late* (1923).

His best-known lyrics are the words to the Canadian song, *O Canada!*

WEIR, Robert Walter, American artist: b. New Rochelle, N. Y., June 18, 1803; d. New York, N. Y., May 1, 1889. After studying under John Wesley Jarvis he began portrait painting in 1821 and in 1824 went to Italy, where he studied in Florence under Pietro Benvenuti, and in Rome. In 1829 he became a national academician and was professor of drawing at the military academy at West Point, 1837–1879. He was of especial prominence as a historical painter. Among his works are the *Embarkation of the Pilgrims* (1836–1840) in the rotunda of the Capitol at Washington; and *Peace* and *War,* painted for the chapel at West Point. John Ferguson Weir and Julian Alden Weir were his sons.

WEIRTON, wēr't'n, city, West Virginia; in Hancock and Brooke counties. It is situated on the Ohio River, 33 miles west of Pittsburgh, Pa., and is served by the Pennsylvania Railroad. Weirton is a steel-manufacturing center, with one of the largest tin-plating plants in the world. There are also manufactures of chemicals and cement products. In the late 1790's a blast furnace was built here by Peter Tarr, who in 1813 supplied cannon balls for Oliver Perry's fleet on Lake Erie. Tarr's furnace is preserved by a local commission. Although it grew rapidly after 1910, Weirton and its neighboring communities remained unincorporated until 1947, when Weirton, Weirton Heights, Marland Heights, and Hollidays Cove were consolidated. Government is by mayor, city manager, and council. Pop. (1950) 24,005.

WEISER, wē'sēr, city, Idaho; seat of Washington County; altitude 2,115 feet. It is situated on the Snake River, 62 miles northwest of Boise, and is served by the Union Pacific Railroad. The surrounding area is interested in stock raising and mining. It has a flour mill, dairy products plant, iron foundry, brick and bottling works, and ships fruits. There are large deposits of gold, silver, copper, iron, gypsum, and other ores in the nearby Seven Devils Mountains. The city was laid out in 1877 and incorporated in 1887. The original settlement, however, was destroyed by fire in 1890. Pop. (1950) 3,961.

WEISHAUPT, vīs'houpt, **Adam,** German mystic: b. Ingolstadt, Feb. 6, 1748; d. Gotha, Nov. 18, 1830. Educated at Ingolstadt, he there became in 1772 extraordinary professor of law and in 1775 professor of natural and canon law. His appointment to the latter post brought him into collision with the clergy, especially the Jesuits, whose bitter enemy he became. At Ingolstadt in 1776 he founded the secret, rationalistic anticlerical order of the Illuminati (q.v.), whose doctrines are said to have been systematized by Baron Adolphus Knigge (q.v.) and other Freemasons. In 1784, however, Knigge withdrew after a quarrel, and in 1785 Weishaupt was obliged to leave Ingolstadt and in 1787 settled in Gotha, where he was later made a councillor of state by the duke. He is said to have severed all connection with the Illuminati after 1787 and to have died reconciled with the Catholic Church.

Weishaupt's most important writings are *Geschichte der Verfolgung der Illuminaten in Baiern* (1786), and *Das verbesserte System der Illuminaten* (1787).

WEISMANN, vīs'män, **August,** German biologist: b. Frankfurt am Main, Jan. 17, 1834; d. Freiburg im Breisgau, Nov. 5, 1914. He studied medicine at Göttingen, and after devoting himself especially to the natural sciences in 1863 went to Giessen to study zoology under Rudolf Leuckart. He was appointed extraordinary professor at the University of Freiburg in 1866; ordinary professor there in 1873. In 1875–1876 he published *Studien zur Deszendenztheorie,* which was translated into English in 1882 as *Studies in the Theory of Descent,* with a preface by Charles Darwin. A series of treatises in which he developed his characteristic theories (for which see WEISMANNISM), included *Über die Vererbung* (*On Heredity;* 1883).

'Uber die Dauer des Lebens' ('On the Duration of Life'), 'Ueber Leben und Tod' ('On Life and Death'), 'Die Kontinuität des Keimplasmas als Grundlage einer Theorie der Verebung' ('The Continuity of the Germ-Plasm as the Basis of a Theory of Heredity'), 'Die Bedeutung der Sexuellen Fortpflanzung für die Selektionstheorie' ('The Significance of Sexual Reproduction for the Theory of Selection'), 'Ueber den Rückschritt in der Natur' ('On Retrograde Development in Nature') and 'Amphimixis.' These have appeared in an English translation under the title 'Essays upon Heredity and Kindred Biological Problems' (Vol. I, 1889; Vol. II, 1892). Weismann's other works include 'Das Keimplasma' (1892), in English as 'Germ Plasm' (1893); 'Die Allmacht der Naturzüchtung' ('The Omnipotence of Natural Selection,' 1893); 'Aeussere Einflüsse als Entwickelungsreize' ('External Influences as Stimuli to Development,' 1894); 'Neue Gedanken zur Vererbungsfrage' ('Fresh Thoughts on the Question of Heredity,' 1895); and 'Ueber Germinalselektion' ('On Germinal Selection,' 1896). See HEREDITY; WEISMANNISM.

WEISMANNISM, the essential teaching of August Weismann (q.v.), sometimes referred to as "Neo-Darwinism." Interest and controversy have gathered mainly round his answer to the question, "How is it that a single cell of the body can contain within itself all the hereditary tendencies of the whole organism?" In all theories of heredity (q.v.) biologists have assumed that characters acquired by the individual are transmitted to offspring. This Weismann denies and while biologists have concerned themselves with speculation as to the mode by which such transmissions are effected, he challenges them to prove that they are effected at all. The burden of proof is thus thrown upon his opponents, whose assumptions must give way to experimental evidence, which alone can determine, and that only after protracted record of cases, whether individually acquired characters are transmitted or not. Death, he contends, is not a primary attribute of living matter; the protozoans, or one-celled organisms, being immortal in so far that they do not die naturally. The protozoan, a microscopic jelly-like, apparently — not really — structureless mass, with no seeming unlikeness of parts, multiplies by division. Each half becomes a complete individual and grows in like manner as the whole to which it belonged, till it also divides and so on with the multiplication of protozoans *ad infinitum.* It cannot be said of either half that one is parent and the other offspring, for both are of the same age, and only, in a limited sense, as the subdivisions into separate individuals are repeated, can we speak of succession of generations. In these processes there is nothing analogous to death. "There are," Weismann says, "no grounds for the assumption that the two halves of an amœba are differently constituted internally, so that, after a time, one of them will die while the other continues to live. Observations show that when division is almost complete the protoplasm of both parts begins to circulate and for some time passes backward and forward between the two halves. A complete mingling of the whole substance of the animal and a resulting identity in the constitution of each half is thus brought about before the final separation? Consequently, there is unlimited persistence of the individual; potential, although not absolute, immortality so long as life lasts on the earth.

While the one-celled organisms are thus immortal, only the reproductive cells of the metazoans, the many-celled, are immortal. How has this come about? Weismann accounts for it by the failure of certain protozoans to divide equally, whereby unlikeness of parts and differences of position of parts resulted. "The first multicellular organisms were probably clusters of similar cells, but these units soon lost the original homogeneity. As the result of mere relative position there arose division of labor. some of the cells were especially fitted to provide for the nutrition of the colony, while others undertook the work of reproduction." Clearly, those on the outside, being exposed to the direct and constant action of their surroundings, would be the media of nutrition, and the builders-up of the cell-commonwealth. So the result of this cell-clustering would be that the cells fell into two classes, body cells and germ-cells. While the body cells were solely concerned with the nutrition of the organism, losing in this specialization of function the power of reproduction, that power became concentrated in the germ-cells, or, speaking more precisely, in the germ-plasm, which is located in the nucleus of the germ-cell. It is these germ-cells which are the immortal part of the metazoans. With increasing subdivision of function there has been increasing modification of the organism, but the two-fold classification of the somatic or body cells and the germ-cells has remained. The death of the body cells is involved in the ultimate failure to repair waste, because a worn-out tissue cannot forever renew itself, and because cell-division has its limits. In brief, death is the penalty paid for complexity of structure. As it is impossible for the germ-cell to be, as it were, an extract of the whole body, and for all the cells of the body to dispatch particles to the germ-cells whence these derive their power of heredity (the fundamental idea of Darwin's theory of pangenesis, q.v.), the germ-cells, so far as their essential and characteristic substance is concerned, are not derived from the body of the individual, but directly from the parent germ-cell. Heredity, Weismann contends, is secured by the transference from one generation to another of a substance with a definite chemical and molecular constitution — in other words, by the "continuity of the germ-plasm." This germ-plasm (which, Weismann's critics argue, runs perilously near a metaphysical concept) is assumed to possess a highly complex but extremely stable structure, so stable "that it absorbs nourishment and grows enormously without the least change in its complex molecular structure." Of this germ-plasm it is further assumed that a small portion contained in the parent egg-cell is not used up in the construction of the body of the offspring, but is reserved unchanged for the formation of the germ-cells of the following generations. Only variations of the germ-plasm itself are inherited, and it is upon these variations that natural selection operates. Variations are due not to

the influence of external condition nor to use or disuse of organs, but to sexual conjugation. The process combines two groups of hereditary tendencies derived from the mingled germ-plasms of the male and female parents, resulting in those individual differences which form the material from which new species are produced by the action of natural selection. Those differences multiply in geometrical ratio.

The sum of the matter is that natural selection (q.v.) is the dominant factor, that use and disuse of parts and the action of the environment count for nothing, or, at the most, for but a little. (See USE AND DISUSE). Here and there Weismann makes concessions as to the modifying influences of body cells on the germ-cells, and as to the ultimate origin of hereditary individual differences in the direct action of surroundings, which are a partial surrender of his main contention as to the isolation of the germ-plasm. It is not easy to reconcile the theory of an insulated germ-plasm with the ceaseless manufacture, secretion and expulsion of germ-cells, the materials of which are derived from the materials nourishing the entire organism; nor with the subtle influence of the nervous system on the reproductive organs.

Perhaps the most serious difficulty in Weismann's theory is in the reconciliation of psychological evolution with the continuity of the germ-plasm. For the researches of Spencer, Balfour and others have demonstrated that the nervous system had its origin in modifications of the primitive skin due to the direct action of the environment. Though we criticise his theory in our present knowledge, we do grant that to him science owes a great debt. The conception of the isolation of the germ cells from somatic influences we owe to him and the belief that the chromosomes represent the parts of the nucleus which have special significance in the process of heredity.

Bibliography.—Haeckel, 'Generelle Morphologie' (1866); Darwin, 'Variation Under Domestication' (1868); Brooks, 'The Law of Heredity' (1883); Virchow, 'Descendenz und Pathologie' (Virchow's Archiv, ciii, 1886); Eimer, 'Die Entstehung der Arten' (1888); Galton, 'Natural Inheritance' (1889); Romanes, 'An Examination of Weismannism' (1893); Spencer, 'A Rejoinder to Professor Weismann' (1894); Hertwig, 'The Biological Problem of To-day' (1894). For critiques of Weismann, consult Eimer, Virchow, *op. cit.*; Spencer, 'Factors of Organic Evolution' (1886); Lock, R. H., 'Variations, Heredity and Evolution' (1916).

WEISS, Charles Andre, French authority on international law: b. Mulhouse, Alsace, 30 Sept. 1858. He took his LL.D. at the University of Paris in 1880 and later became a member of the faculty there. He has been prominently connected with various societies and commissions dealing with international law, and has written voluminously and with praiseworthy clarity upon the subject. He is a chevalier of the Legion of Honor. He has been President of the Institute of International Law since 1921 and is professor of international law at the University of Paris. Author of 'Le droit civil et la legislation comparée' (1900); 'The Violation by Germany of the Neutrality of Belgium and Luxemburg' (1915); 'La Reparation des dommages de guerre' (1917); 'Manuel de droit international privé' (1882, 8th ed. 1921).

WEISS, John, American clergyman: b. Boston, 28 June 1818; d. there, 9 March 1879. He was graduated at Harvard in 1837; in the winter of 1842–43 studied at Heidelberg, Germany; was graduated in the last-named year at the Harvard Divinity School, and settled as minister of a Unitarian church in Watertown, Mass. His anti-slavery utterances having disturbed the harmony of his pastorate, he resigned, and in 1847 became minister of a Unitarian society in New Bedford, Mass., but was soon compelled by reason of ill health to retire. Again in 1859–70 he was minister of the Watertown church, from which he finally withdrew in order to pursue his literary work. He was one of the most brilliant of the New England reformers and transcendentalists, and his writings display a mind at once mystical and scientific, strongly rationalistic on religious subjects, but endowed with a fine poetic power of interpretation, which he applied to religious history and symbolism, as well as to questions of philosophy and life, to which he brought prophetic insight and fervor. His publications include 'Æsthetic Prose' (1845), a translation of Schiller's philosophical and æsthetic essays; 'Life and Correspondence of Theodore Parker' (1864); 'American Religion' (1871); 'Wit, Humor, and Shakespeare' (1880); and 'The Immortal Life' (1880).

WEISSENFELS, vīs'sĕn-fĕls, Germany, town in the Prussian province of Saxony, on the Saale River, 14 miles southwest of Leipzig, on the main line of the railroad from Bebra to Frankfort-on-the-Main. It was the capital of the duchy of Saxe-Weissenfels in 1656–1746. The Augustusburg Palace, built in 1664–90, is now used as a military school. There are deposits of lignite and sandstone in the vicinity. Manufactures include machinery, ironware, shoes, paper, sugar and electrical appliances. Pop. about 35,000.

WEITENKAMPF, Frank, American connoisseur of prints: b. New York, 13 April 1866. He studied at the Art Students' League, New York. He is chief of the art and print departments of the New York Public Library, where he has done notable work in arranging continuous exhibitions of carefully selected prints. In 1914 New York University gave him the degree L.H.D. He has prepared many pamphlets cataloging and describing prints; has contributed to various encyclopedias and to the 'Standard Dictionary'. Author of 'How to Appreciate Prints' (1908; new ed. 1932); 'American Graphic Art' (1912; new ed. 1924); 'The Etching of Contemporary Life' (1916). He edited 'Famous Prints: Masterpieces of graphic art reproduced with critical notes' (1926).

WEITLING, Wilhelm Christian, German communist: b. Magdeburg, Prussia, 1808; d. New York, 25 Jan. 1871. He early became an advocate of communism, traveling and lecturing in its behalf. He took part in the Revolution of 1848 and afterward came to the United States. He founded the Socialist society known as Arbeiterbund in New York, and was connected with the establishment of a communistic colony in Wisconsin, although he lived in New York. Author of 'Guaranties of Harmony and

Freedom (1842); *Humanity as It Is and as It Should Be* (1845).

WEITSPEKAN INDIANS, wīt'spĕk-ăn (from *Weitspek,* the name of one of their towns). A linguistic stock of North American Indians, comprising several small tribes collectively known as the Yurok, occupying the lower Klamath River in California, from the mouth of the Trinity down. On the coast, Weitspekan territory extends from Gold Bluff to about six miles above the mouth of the Klamath. The Chilula are an offshoot of the Weitspek, living to the south of them, on Redwood Creek to a point about 20 miles inland, and from Gold Bluff to about midway between Little and Mad rivers.

WEIZMANN, vīts'män, **Chaim,** Israeli statesman and scientist: b. Motele, near Pinsk, Russia, Nov. 27, 1874; d. Tel Aviv, Israel, Nov. 9, 1952. He studied at the universities of Berlin and Freiburg, and in 1901 was appointed lecturer in chemistry at Geneva. In 1904 he went to England, becoming reader in biochemistry at the University of Manchester and in 1910 securing naturalization as a British subject. Soon after appointment in 1916 (during World War I) as director of the laboratories of the British Admiralty, he discovered a process of synthesizing acetone, employed in the manufacture of high explosives; he retained this post until 1919. He had been an ardent Zionist for many years, and in 1917 he was largely instrumental in securing the British government's undertaking (the Balfour Declaration) that a national home for the Jews would be established in Palestine. He served as president of the World Zionist Organization from 1921 to 1929, and of the Jewish Agency for Palestine during the next two years; in 1931 he was also elected president of the Zionist Federation of Great Britain and Ireland. From 1935 to 1946 he was again president of the Jewish Agency, in this capacity taking a prominent part in the events which led up to establishment of the state of Israel. He was president of the board of governors of the Hebrew University in Jerusalem from 1932 onwards, and he was also director of the Daniel Sieff Institute, at Rehovoth, where much of his time was spent. His scientific work there was largely in the field of agronomics, notably research and experimentation on the castor bean. On May 16, 1948, following proclamation of the new state of Israel, he was elected by the State Council president of the council of government, a post tantamount to provisional president of the state.

WELCH, Ashbel, American civil engineer: b. Nelson, N. Y., Dec. 4, 1809; d. Lambertville, N. J., Sept. 25, 1882. From 1835 to 1874 he was chief engineer of the Delaware and Raritan Canal. He also constructed the Belvidere and Delaware Railroad, and in 1862 was appointed manager of the New Jersey lines of the Pennsylvania Railroad. The block system (q.v.) in railroading was introduced into the United States by him.

WELCH, Herbert, American bishop and educator: b. New York City, Nov. 7, 1862. He graduated at Wesleyan University in 1887 and at Drew Theological Seminary three years later, and was ordained in the ministry of the Methodist Episcopal Church. In 1905, after occupying several pastorates in the New York City area, he was elected president of Ohio Wesleyan University. He served in that post until 1916, when he became resident bishop of his church in Japan and Korea. Returning from the Orient in 1928, he spent four years as bishop of the Pittsburgh, Pa., area, and in 1932 he went to China as bishop of the Shanghai area; there he remained until his retirement in 1936. From 1938 to 1939 he was resident bishop of the Boston, Mass., area; and from 1940 to 1948 he was chairman of the Methodist Commission for Overseas Relief. His books include *That One Face* (1925); and *Men of the Outposts* (1937).

WELCH, Philip Henry, American humorist: b. Angelica, N. Y., March 1, 1849; d. Brooklyn, N. Y., Feb. 24, 1889. He was a journalist on the Rochester, N. Y., *Post-Express* from 1882 to 1884, and thereafter he was a member of the staff of the New York *Sun.* A popular humorist and satirist, he published a selection of his columns under the title *Said in Fun* (1889).

WELCH, William Henry, American pathologist: b. Norfolk, Conn., April 8, 1850; d. Baltimore, Md., April 30, 1934. After securing his medical degree at Columbia University in 1875 he continued his studies in Germany, and in 1878 he established at Bellevue Hospital Medical College, New York City, the first pathology laboratory in the United States. He went to Johns Hopkins University in 1884 as Baxley professor of pathology; he held this post until 1916, and from 1889 he was also pathologist to Johns Hopkins Hospital. From 1916 to 1926 he was director of the newly established Johns Hopkins School of Hygiene and Public Health, then becoming professor of the history of medicine, a chair he continued to occupy until his retirement in 1930. He was chairman of the board of scientific directors of the Rockefeller Institute of Medical Research from 1901 until his death. The bacteria causing gas gangrene, which he studied, was named for him Welch bacillus.

WELCH, town, West Virginia, McDowell County seat, on the Big Sandy River 36 miles west of Bluefield; it is served by the Norfolk and Western Railroad. The town was named for Isaiah Welch, a Confederate officer who developed coal lands in the vicinity. Pop. (1940) 6,264; (1950) 6,603.

WELCKER, vĕl'kĕr, **Friedrich Gottlieb,** German classical philologist and archaeologist: b. Grünberg, Hesse, Nov. 4, 1784; d. Bonn, Prussia, Dec. 17, 1868. He was educated at the University of Giessen, where he became professor of archaeology in 1809; successively, he occupied like chairs at the universities of Göttingen, 1816–1819, and Bonn, 1819–1861.

WELD, Theodore Dwight, American abolitionist: b. Hampton, Conn., Nov. 23, 1803; d. Hyde Park, Mass., Feb. 3, 1895. Impaired sight necessitated his leaving Phillips Andover Academy. He was one of the 63 original founders of the American Anti-Slavery Society, and from 1830 to 1833 he was general agent of the Society for the Promotion of Manual Labor in Literary Institutions. In 1833 he entered Lane Theological Seminary, Cincinnati, Ohio; in the evenings he taught colored youths. He was charitable and disinterested, and did not

hesitate to denounce slavery and the slave trade openly and publicly. He left the seminary when the trustees suppressed the local antislavery organization and began a course of lectures. He was repeatedly mobbed, but his commanding presence and athletic attainments, as well as his fearless and wonderful eloquence, enforced respect; at Granville, Ohio, when advised that the church would be burned if he lectured as advertised, he informed the trustees that he would then speak from its foundations; to threatening letters he replied: "Come, but bring your own winding sheets, which I cannot supply"; six undisturbed lectures followed. At Painesville, Ohio, such was his eloquence that the leader of the mob kicked in the head of the bass drum with which he had thought to drown the speaker's voice. In 1836 his voice partially failed him, but he taught school and used his pen vigorously. In 1838 he married Angelina Emiline, daughter of Judge John Grimke, of South Carolina, who, having become a Quaker in 1835, emancipated her inherited slaves. He edited the American Anti-Slavery Society's publications in Washington, D.C., and was confidential adviser with congressmen who favored abolition of slavery in the District of Columbia.

WELDING. Introduction.—Although welding in its elementary form has been known for hundreds of years, it was during World War I that its application became important from an industrial standpoint. Basically, welding is the joining of two or more metal parts into a homogeneous unit by means of heat and pressure.

A *weld* according to the standard definition of the American Welding Society is "A localized coalescence of metal wherein coalescence is produced by heating to suitable temperatures, with or without the application of pressure, and with or without the use of filler metal. The filler metal either has a melting point approximately the same as the base metals or has a melting point below that of the base metals but above 800°F."

Welding is defined as "The metal joining process used in making the weld." The American Welding Society in its Master Chart of Welding Processes lists thirty-seven such processes. (See Fig. 1.) Each of these processes accomplishes the same basic purpose, that is, providing the heat and pressure necessary to obtain a weld.

As a general rule the welding processes are complementary rather than interchangeable; which process to use is determined by the specific application, by the material involved, by the production facilities available and other similar factors.

The Master Chart of Welding Processes divides the welding processes into eight separate groups, in all but one case the division being on the basis of the source of heat, i.e., arc, gas, forge, etc. The group which is the exception, brazing, differs from all the other groups in that capillary attraction is necessary to secure the proper flow of the brazing alloy or filler metal.

The most commonly used groups of processes, gas welding, arc welding, resistance welding and brazing are discussed in detail in separate articles. The other groups of processes are discussed together in the article at the end of the series.

In industry it is common to develop variations in one or another of the welding processes to satisfy specific production requirements. These variations, according to the standard nomenclature of the American Welding Society are known as *methods*. For example, oxyacetylene welding of steel castings using a bronze welding rod is known as *braze welding*. Similarly in resistance welding, push welding (or poke welding), which is the making of a spot weld using one electrode and a backing bar, is a method of spot welding.

The third principal distinction between one welding application and another is the *procedure*, which is the detailed methods and practices involved in making a weldment. A welding procedure would include such factors as current, voltage, position of welding for arc welding; torch tip size, size of welding rod and position of welding for gas welding; current, voltage, electrode size and shape for resistance welding and similar factors for other welding processes. In addition a welding procedure for any of the processes would include the order in which successive welds are to be made to complete the structure and any heat-treatment which may be necessary.

Industrially, welding is used today in every major industry. In tooling-up for a new model, an automobile manufacturer may spend upward of a million dollars on resistance welding equipment; other welding equipment does not require such major expenditures. Many, many bridges and buildings are fabricated by welding, and where noise abatement is necessary during construction, as is the case in building hospital additions, the use of welding is usually mandatory. Large boilers, pressure vessels for chemicals and petroleum products and gravity storage tanks are almost always welded today. Without welding, the shipbuilding and aircraft industries would never have been able to meet the enormous demands for planes and ships to fight World War II. Large pipelines, such as the "Big Inch" and the "Little Inch" are joined by welding. For the home, brazing and other welding processes are commonly used in manufacture of refrigerators, radios, cabinets and similar metal products. The handles of pots and pans are economically and permanently attached to the pots and pans themselves by spot or projection welding. Street railway tracks as well as railroad tracks are joined to make continuous lengths by thermit welding. Bicycle frames are usually brazed.

The materials used in these structures and products include practically every metal and alloy commonly used: low-carbon and high-carbon steels as well as a variety of alloy steels including stainless steels; aluminum, magnesium; copper, brass, bronze, lead; cast iron, wrought iron; nickel, Monel; Inconel; silver; gold; and platinum.

SIMON A. GREENBERG,
Technical Secretary, American Welding Society.

ARC WELDING

The remarkable growth of the process of arc welding has made this modern method of construction and maintenance an outstanding development in industry. Although welding had come into its own long before the outbreak of World War II the simplicity and high speed in metal fabrication made possible by the electric arc were dominant factors in shortening the war in Europe and assuring a successful conclusion to the conflict in the Pacific. Not only did welding permit the mass construction of ships, airplanes, guns, tanks, and other essential military equipment in record-breaking time, but the economy

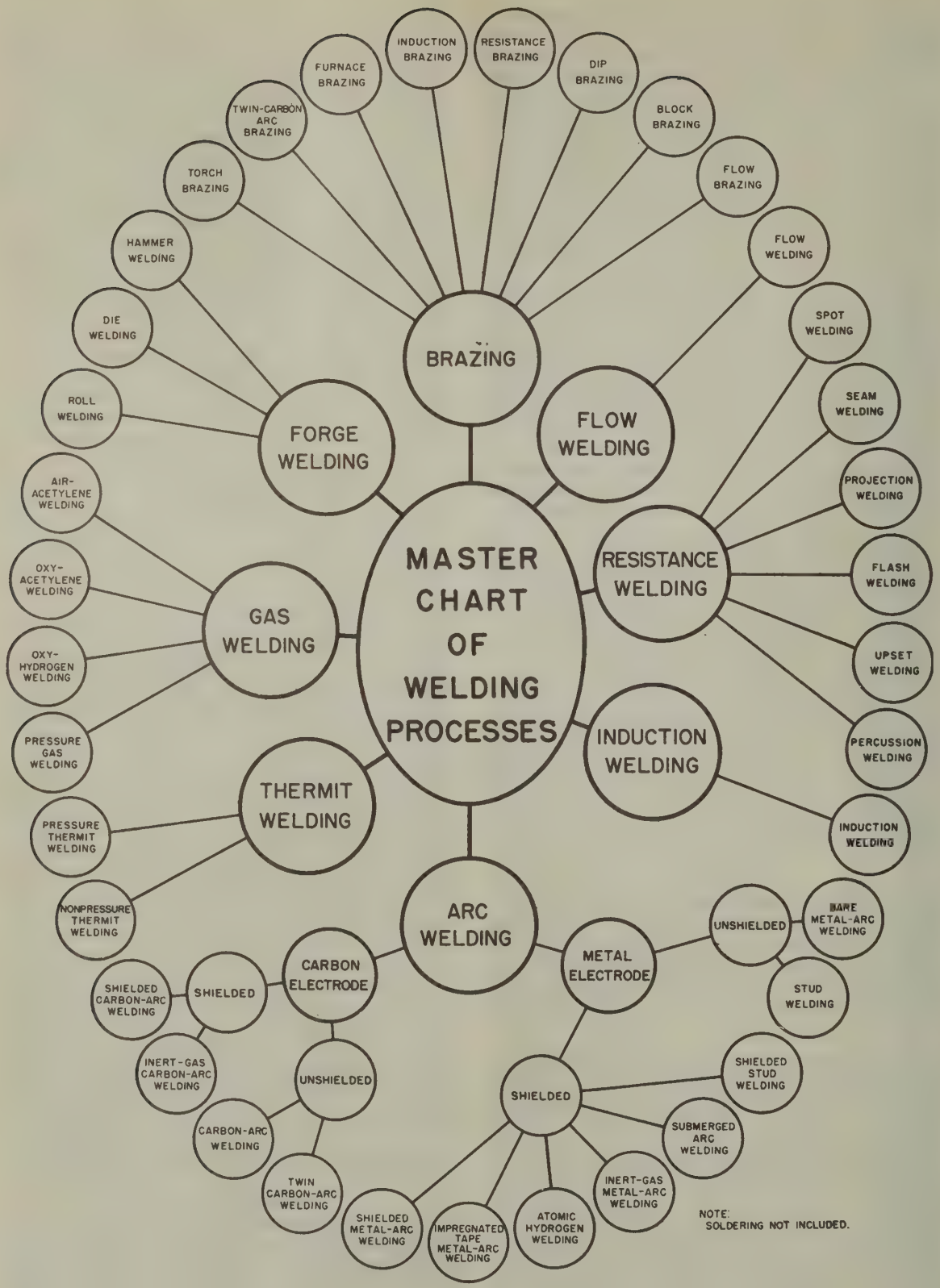
MASTER CHART OF WELDING PROCESSES
BRAZING
INDUCTION BRAZING
RESISTANCE BRAZING
DIP BRAZING
BLOCK BRAZING
FLOW BRAZING
FURNACE BRAZING
TWIN-CARBON ARC BRAZING
TORCH BRAZING
FORGE WELDING
HAMMER WELDING
DIE WELDING
ROLL WELDING
FLOW WELDING
RESISTANCE WELDING
SPOT WELDING
SEAM WELDING
PROJECTION WELDING
FLASH WELDING
UPSET WELDING
PERCUSSION WELDING
INDUCTION WELDING
GAS WELDING
AIR-ACETYLENE WELDING
OXY-ACETYLENE WELDING
OXY-HYDROGEN WELDING
PRESSURE GAS WELDING
THERMIT WELDING
PRESSURE THERMIT WELDING
NONPRESSURE THERMIT WELDING
ARC WELDING
CARBON ELECTRODE
SHIELDED
SHIELDED CARBON-ARC WELDING
INERT-GAS CARBON-ARC WELDING
UNSHIELDED
CARBON-ARC WELDING
TWIN CARBON-ARC WELDING
METAL ELECTRODE
UNSHIELDED
BARE METAL-ARC WELDING
STUD WELDING
SHIELDED
SHIELDED STUD WELDING
SUBMERGED ARC WELDING
INERT-GAS METAL-ARC WELDING
ATOMIC HYDROGEN WELDING
IMPREGNATED TAPE METAL-ARC WELDING
SHIELDED METAL-ARC WELDING
NOTE:
SOLDERING NOT INCLUDED.

Fig. 1.

effected through its general use was responsible for surprising decreases in the cost of producing such materiel.

Although arc welding has been known since 1881, when arc lights were first introduced, the process did not come into general use until about the time of World War I, when improved methods facilitated its use. Following the principles of the carbon arc light, a Russian, N. V. Bernardos, developed a carbon arc welding process which was patented in 1887. A few years later, another Russian, Nicholas Slavianoff, developed an arc welding process similar to the carbon arc process except that, in the latter case, the arc was formed between a metallic wire, or electrode, and the work to be welded. This process is known as metallic arc welding, patents on which were issued in the United States to C. L. Coffin in 1889.

An arc lamp has two carbon electrodes, the ends of which are slightly separated. When a powerful electric current passes from one electrode to the other, it has to jump the gap between them. In doing so, the electricity generates intense heat between the tips of the electrodes. This intense heat produces the brilliant light, or arc, from which the arc lamp takes its name.

The arc for welding is produced in a similar way, except that one end of the circuit becomes the work to be welded. An electric current is forced to jump the gap between the electrode and the work being welded to complete its circuit. Current is carried from the arc-welding machine, through an insulated wire cable, to the electrode, and then across the gap, to produce the heat necessary for welding. It then goes back to the welding machine through another cable, thus forming a complete electrical circuit. As the electric current jumps the gap, it generates an intense heat that immediately melts the metal to be welded. The temperature of the electric welding arc is probably in excess of 3,583°C. (6,500°F.).

While the arc for an arc lamp and the arc for welding are the same in principle, there is one very important difference. In one instance, the arc heat is used to produce *light;* in the other, it is used to produce heat, to melt steel, or some other metal.

The heat of the welding arc, produced by the electrical current in crossing the gap, melts the part, or parts, being welded, and also melts the end of the electrode. The molten metal from the tip of the electrode flows across the arc to the part being welded. In some metal arc processes the electrode does not melt but an additional filler rod is used. When the melted steel cools, the parts which have been welded together—no matter how many there are in the particular structure—have become a single piece. Not only is the welded structure one integral unit but, when mild steel is used, the structure may be actually stronger in the welds than anywhere else.

The remarkable simplicity of arc welding lies in its ability to join metal directly, in many cases, without intermediate connecting members, and without the many operations of other industrial processes. This simplicity of operation has improved the quality, and reduced the cost, of many products, and of every type of structure.

The benefits made possible by welding, as compared to other methods used in construction have affected such a wide range of items that any attempt to enumerate them would mean listing practically every kind of structure and product made of metal, from huge battleships and buildings to small parts of delicate machinery. In addition to making the fabrication of metal structures faster, easier, and more economical, arc welding has become more and more versatile in serving its original purposes as a tool for repairing broken parts, and for resurfacing (building-up) worn surfaces.

The process first received general recognition during World War I when the dynamited cylinders of some interned German vessels were successfully repaired by metal arc welding. Doubtless one of the reasons for its present widespread acceptance is the fact that the selling price of welding equipment and supplies was continuously reduced during its development.

Molten steel has an affinity for oxygen and nitrogen. Exposed to air, molten steel enters into chemical combination with oxygen and nitrogen to form oxides and nitrides. These impurities tend to weaken and embrittle the steel, as well as affect some of its other properties such as lessen its resistance to corrosion.

In an unshielded arc, molten globules which pass from electrode to work are exposed to an ambient atmosphere which contains oxygen and nitrogen. Molten base metal is also exposed to these elements. If the metal, during solidification, is completely protected from contact with ambient atmosphere, no injurious chemical combination can take place. Such protection can be achieved by completely shielding the arc. Tremendous impetus was given welding by the commercial development of the shielded type of electrode in 1929. This important technical advance constituted a vast improvement over the commonly used bare electrode, and also over certain lightly-coated electrodes. The latter had been used in some degree, but were found commercially impractical because of their high cost and slow speed.

The Shielded Arc.—An arc can be shielded by completely enveloping it with an inert gas, which will not enter into chemical combination with molten metal and at the same time will prevent contact with atmospheric oxygen and nitrogen. Welds made with a completely shielded arc are largely free of oxides and nitrides, and are therefore composed of metal having superior mechanical characteristics to that of metal deposited by an unshielded arc.

In manual welding a shielded arc is obtained through the use of specific types of electrodes which are heavily coated. The heavy coating is of such composition that, in the heat of the arc, it gives off a gas which envelopes and shields the arc from the ambient atmosphere.

The action of the arc on the coating of the electrode results in a slag formation, which floats on top of the molten weld metal and protects it from the ambient atmosphere while cooling. After the weld metal is sufficiently cooled, the slag may be easily removed.

Metallic Arc Welding.—In metal arc welding, regardless of whether shielded or bare electrodes are employed, the arc occurs between the work to be welded and a metal wire. Under the intense heat developed by the arc, a small part of the work to be welded is brought to the melting point almost instantaneously. The other end of the arc, the tip of the electrode, is likewise melted, and tiny globules of molten metal form. Those globules are then forced across the arc and deposited in the molten seat waiting for it in

the work. The globules are actually forced across the arc, as gravity does nothing more than assist this deposition of metal when the work is flat. It is this fact which permits the use of metal arc welding in an overhead position.

Carbon Arc Welding.—In carbon arc welding, the arc is formed between the work and a carbon rod held in the electrode holder. The heat of the arc melts a small pool in the surface of the work to be welded. This pool is kept molten by playing the arc across it, and extra metal to form the weld is added by a filler rod. Carbon arc welding is a puddling process, and is not applicable to vertical or overhead welding. Its greatest use is in automatic welding, or in specialized applications.

Automatic Welding.—In automatic welding, a completely shielded arc can be obtained by employing either the carbon arc or the metal arc. In the automatic carbon arc process, a specially prepared substance is introduced into the arc flame at the point of fusion. The combustion of this substance in the arc provides an inert gas which completely encloses and shields the arc from the ambient atmosphere. Another form of shielding is obtained by the automatic deposition of powder on the joint ahead of the arc. The arc penetrates through the powder to weld the joint. In addition to the inert gas formed, a slag is produced which floats on top of the molten metal and protects it from the atmosphere while cooling. In the automatic metal arc method known as submerged arc welding, welds are made under a heavy granular flux, automatically fed onto the seam just ahead of the arc. In this process the flux completely covers the arc, acting as a refining agent for the molten weld metal and also protecting the hot solid bead from the ambient atmosphere during cooling. In submerged arc welding, the welding bead, flux hopper, and spool of welding wire may be mounted on a portable tractor unit, or, in certain kinds of work, it may be mounted to travel on an overhead beam. In another arrangement, the unit is mounted on a special adjustable fixture designed to accommodate specific types of work. These simple yet effective methods of shielding the arc permit a very economical production of welds which possess physical properties equal to, or better than, those of mild rolled steel.

New Types of Arc Welding.—In addition to automatic and manual, metal and carbon arc welding, several other arc welding processes have been developed for welding specialized types of work.

Atomic-hydrogen arc welding is used for welding both ferrous and nonferrous metals, but it is especially useful in welding thin sheet metal where a high finish is required. In this process an arc is established and maintained between two tungsten electrodes while a stream of hydrogen gas is passed through the arc. As this hydrogen reverts to molecular form in the arc, an intense heat is given which is used to fuse the metal being welded. The work does not form part of the welding circuit so the arc must be played over the surface of the metal in much the same manner as is a gas torch. The process has certain advantages but is generally more expensive than the metal arc process.

Inert-gas arc welding is employed for welding nonferrous metals such as aluminum and magnesium. This process uses a single tungsten electrode and the arc is made between the electrode and the work. The electrode is not consumed during welding. A filler rod is used when extra metal is needed for the joint. The arc, filler metal and pool are shielded by a mass of inert gas (helium or argon) which is supplied through an opening in the insulated tube surrounding the electrode. The process is used both manually and automatically.

Source of Current Supply for Arc Welding.—Arc welding requires a continuous supply of electrical current, sufficient in amount, and of proper voltage. Voltage across the arc will range from about 15 volts to 45 volts, and in operation varies constantly. Current ranges vary from 20 or 25 amperes to as much as 1,200 amperes. Either direct current or alternating current may be used for welding.

Equipment generally used for welding with alternating current is the transformer type welder. Welding transformers are especially designed to provide control of the welding current through a wide amperage range and to withstand the severe loads of welding service.

The equipment most commonly used for d.c. is a motor generator of the variable voltage type, the motor of the machine being arranged for any commercial power supply. The generator is arranged so that the voltage automatically adjusts itself to the varying voltages demanded by the arc.

In the United States, the first welding machines used were the so-called constant-potential type, which lacked the economies developed in later machines, such as those incorporating the Homrighaus Patent of The Lincoln Electric Company. The Homrighaus Patent covered the design of a single-operator, variable voltage type welder, and made possible great subsequent economies. Current types of welders available include portable, stationary, and welders on skids for mounting in trucks. The variable voltage type welder is comparatively small in size, having easy portability. This factor allows the machine to be easily and quickly placed near the work to be welded, thus eliminating the extensive installation of large size wiring required to bring the welding current to the work. The variable voltage machine is the most widely used, and, at the same time, the most economical type of welder.

Welding Electrodes.—The variety of electrodes available for various steel applications permits accurate matching to the specific job, assuring maximum quality and economy. The various mild steel electrodes may be classified as follows: (1) the method of use, such as working position (flat, vertical, overhead, horizontal); (2) the type of joint, such as fillet or groove; (3) mechanical properties of the deposit, such as tensile strength and ductility and by operating characteristics which vary according to the nature of the covering. These factors are involved in the general classifications assigned to various types of electrodes by the American Welding Society in its "Filler Metal Specifications" for different materials including steel, stainless steel, aluminum, and copper.

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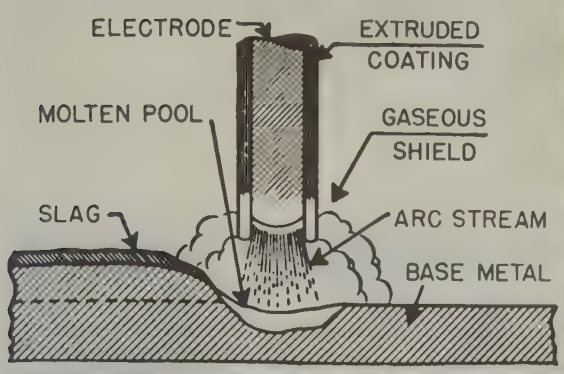
GAS WELDING

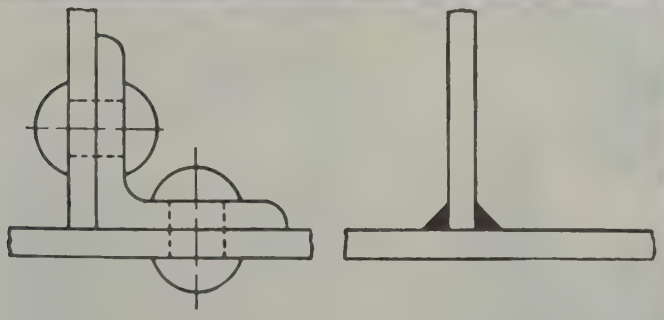
A nonpressure (fusion) welding process wherein the welding heat is obtained from an oxygen-fuel gas flame is known as gas welding.

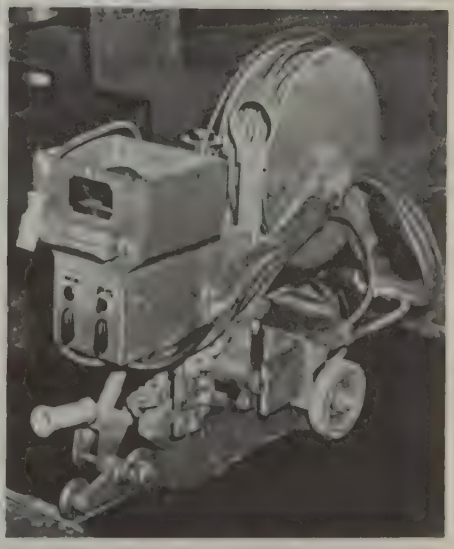
WELDING

Right: Welding an automotive part by means of a carbon arc. *Below:* Sketch illustrating shielding of arc and slag protection of weld while cooling. *Center:* Fabricating high pressure boilers with the shielded arc.

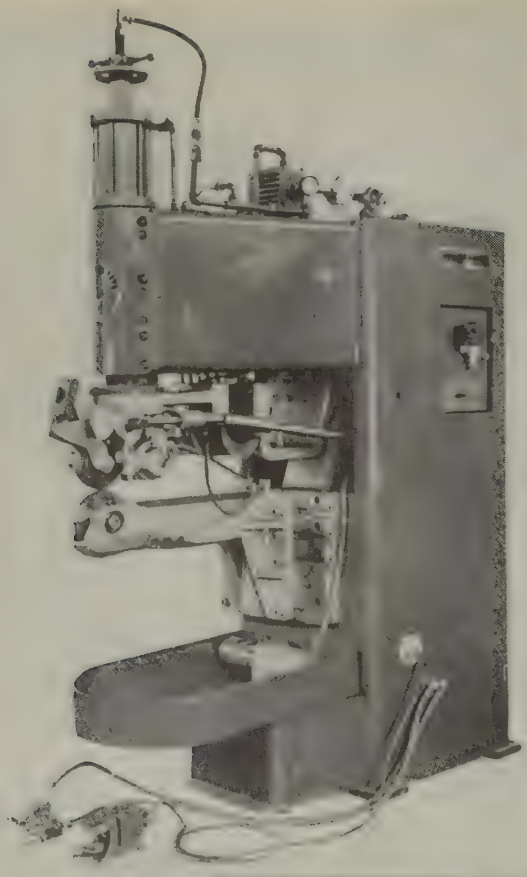
Photograph (center) News Bureau, O.W.I.



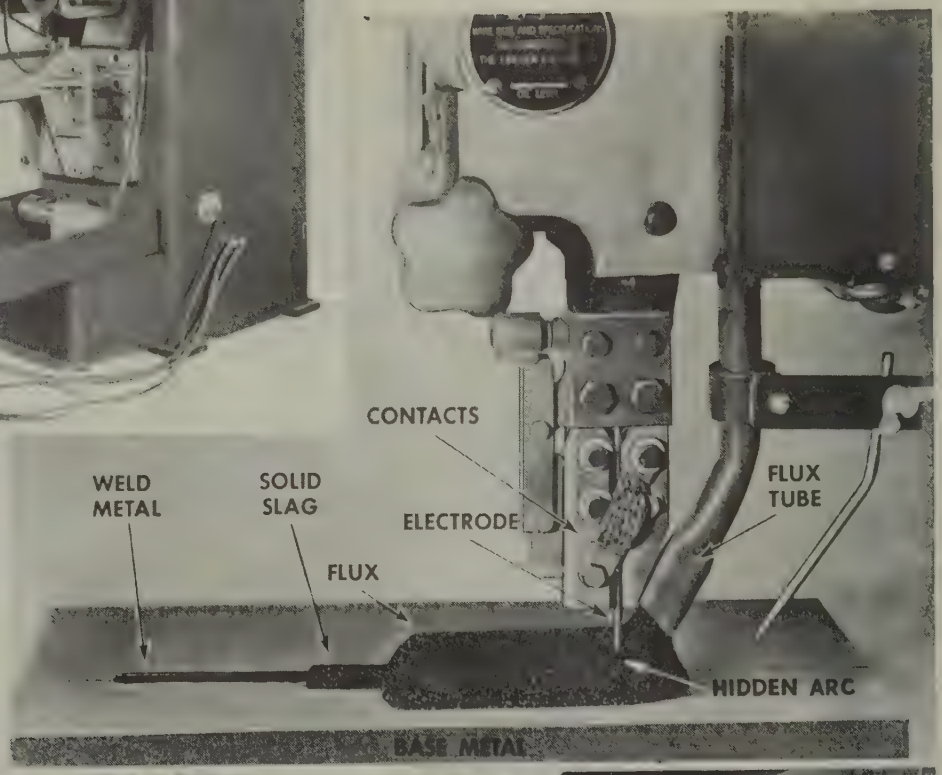


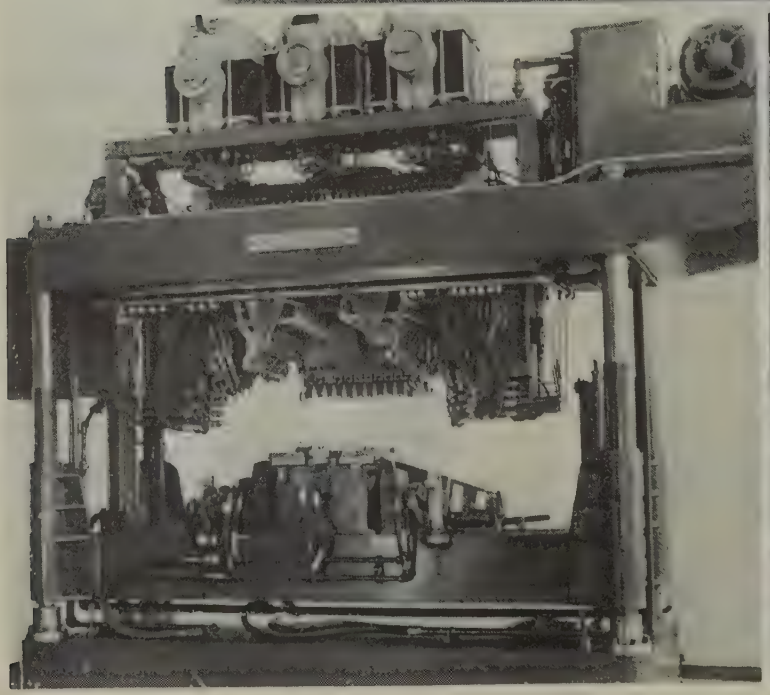


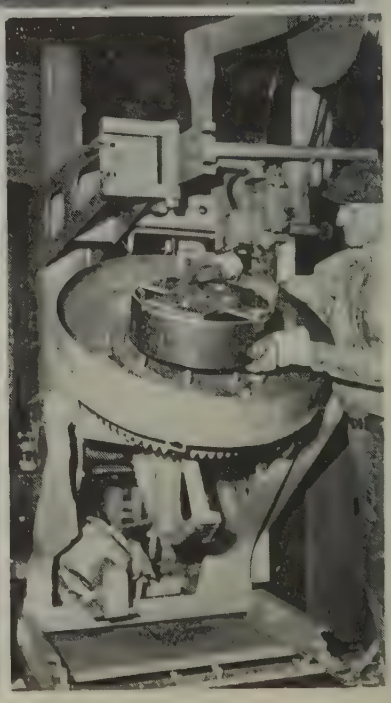
Above: The economy of welded design is obvious in the comparison of the simple joints above, showing (left) riveted construction and (right) welded construction. *Right:* Tractor type automatic welder utilizing the metallic arc process.



Left: Resistance welder for seam welding. *Below:* Cutaway view of butt weld showing elements of "Lincolnweld" hidden arc automatic welding operations. *Bottom left:* Automatic multi-point resistance welder machine. *Bottom right:* Special fixture used for automatic metallic arc welding of special parts such as the motor bracket shown here.







While oxygen may be used in combination with hydrogen or one of several carbohydrogens, it is combined with acetylene (C_2H_2) for most of the gas welding applications. Although pressure is not usually used for oxyacetylene welding, it is necessary in the related process known as pressure gas welding.

Oxyacetylene welding was impossible until a means was discovered by which acetylene [1] could be produced easily and cheaply. By 1895 when Thomas L. Willson had established facilities to produce calcium carbide, acetylene became recognized as a valuable illuminant and heating gas.

The first oxyacetylene torch was invented by Edmond Fouché, a Frenchman, used experimentally about 1901, and commercially about 1903. This was a high pressure torch, for at that time acetylene was compressed in acetone containing cylinders at several atmospheres of pressure. Inasmuch as both gases were compressed to high pressure it was quite easy to obtain a good mixture of both acetylene and oxygen entering the torch. Later, upon changing positions, Fouché went to work for a company which produced acetylene from low pressure generators and consequently designed a torch that would work on low gas pressures. This torch received its oxygen under high pressure which, upon entering the mixing chamber of the torch, expanded and drew acetylene from the acetylene orifice by the injector principle. These early acetylene torches thus incorporated the principles that are present in our modern low and medium pressure welding torches.

Until Eugène Bournonville, a French inventor, brought the first welding torch to this country in 1906 very little progress was made in any type of gas welding. With the introduction of the welding torch, however, some of the earlier users of welding began to use welding equipment for commercial purposes and a major industry was started.

Oxyacetylene welds are made by using a torch or blowpipe flame to heat the metals to be joined to the melting point. Usually some new metal is added from a welding rod which is melted at the same time and flowed together with the fused metal of the two edges of the joint. The temperature of the flame is from 5800° to 6300°F., being produced by the combustion of the acetylene (or other fuel gas) in oxygen delivered through the torch.

There are two different stages of combustion in the oxyacetylene flame. The first of these is a luminous cone at the tip of which the highest temperature is produced. One part of oxygen to approximately one part of acetylene is delivered through the torch and consumed in the luminous cone or the first reaction of the flame. This combustion produces carbon monoxide and hydrogen which burn in the secondary reaction, obtaining the oxygen from the surrounding atmosphere, and producing carbon dioxide and water vapor.

Equipment.—The apparatus for gas welding consists of a torch, two lengths of hose, and two regulators or reducing valves. One of these is attached to the oxygen cylinder, and the other to the acetylene cylinder or pipe line. When full, the pressure within the oxygen cylinders is approximately 2,000 pounds per square inch, and the pressure in the acetylene tanks about 250 pounds per square inch. Obviously these pressures must be reduced in order to utilize these gases at the torch, and this is the purpose of the regulators. Acetylene must never be used at a pressure in excess of 15 pounds per square inch.

It is important to have regulators with two gauges—one showing the pressure of the gas within the cylinder, the other showing the pressure of the gas within the hose line to the torch. These gauges should always be in good condition. Dangerous pressures in the hose lines can very easily occur through the use of broken or inaccurate gauges.

Types of Torches.—There are a number of different types of torches upon the market designated particularly by the relative pressures of the two gases. For instance, there is the low pressure or injector type torch in which the acetylene is supplied to the torch at a pressure of less than one pound per square inch. This pressure is constant for most sizes of tips. The oxygen pressure, on the other hand, is considerably higher, ranging from 10 to 30 pounds per square inch, or more, depending upon the tip size. The tip is designed with an injector nozzle through which the oxygen passes and draws the acetylene through the torch and into the mixing chamber in the tip. Because of the difference in the pressure of the two gases, it is necessary to have a very small opening for the oxygen through the injector nozzle, and a much larger opening for the acetylene situated adjacent to the mixing chamber.

Equal pressure torches are those designed with equal area inlets to the mixing chamber of the tip for both oxygen and acetylene, because with this type of torch, both gases are delivered from the regulators at equal pressures.

All torches are designed to deliver one part oxygen through the torch for each part of acetylene entering through the acetylene passage. While it is true that 2½ volumes of oxygen are required to completely consume 1 volume of acetylene, only one of these volumes is delivered through the torch, and burns at the tip of the torch to produce the luminous cone of flame; the secondary reaction, or flame envelope, obtains the remaining 1½ parts of oxygen from the surrounding air.

Tip Sizes.—Torch tips are interchangeable in a given torch, and are made in various sizes to produce larger or smaller flames as may be required for the thickness of the metal to be welded. A very light gauge sheet of steel, for instance, requires a very small flame, hence a small tip; while a piece of steel plate one inch thick requires a much larger tip. These various sizes of tips require varying pressures of both oxygen and acetylene, and these pressures are themselves important.

Technique.—As heretofore explained, oxygen and acetylene are delivered through the hose lines to the torch, and are adjusted for either neutral, oxidizing (excess oxygen), or carburizing (excess acetylene) flames, depending upon the metal being welded. The adjustment of the flame is perhaps the most important factor in this welding process.

The torch is ordinarily held in the right hand of the operator. The welding rod, of the correct diameter, depending upon the thickness of the work, is held in the left hand. The rod may be either bent to an angle or held straight. The

[1] Discovered by Edmund Davy, an English chemist, in 1836.

plates or casting to be welded should be prepared by single or double veeing of the edges to be welded, veeing in the shape of a deep U, or in the case of sheet metal, flanging the edges upward, etc.

Welding may proceed either forward (forehand technique) or backward (backhand technique) as desired—that is, away from the operator or toward him. Sometimes the flame is moved in a semicircle (weaving) and the rod is moved in a straight line back and forth immediately ahead of it in alternating motions. At other times the torch is held without side movement, but gradually progressing forward, and all puddling is done with the welding rod in the puddle. Movement will often depend upon the individual operator. The exact technique with reference to the movement of the torch and rod will also depend to a large extent upon the class of work being accomplished, and the kind of rod used. There are several well-recognized methods, all of which will produce satisfactory welds.

Welding Rods.—It is very essential that suitable welding rods be selected for the job at hand. If, for instance, cast iron is to be welded, the rods should be of a grade of cast iron conforming to the requirements of the specifications or of another suitable material (such as a bronze welding rod). If low carbon steel plate is to be welded, the welding rods should be of low carbon steel. If higher carbon or the alloy steels are to be welded, the rod should likewise be an alloy steel, chrome vanadium steel, or molybdenum steel. On the other hand, if the work is brass, bronze, copper, or aluminum, the rods should consist of alloys of these metals.

When nonferrous welding rods or cast iron welding rods are used, it is generally found advantageous to use a fluxing material to improve welding characteristics.

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RESISTANCE WELDING

Resistance welding was first patented in 1886 by Elihu Thompson. The heat which effects the welding is caused by the electrical resistance of the contacting areas to be welded.

Fundamentals.—The equipment that is required for resistance welding consists of a rigid frame, housing a high secondary current welding transformer; the electrodes for contacting the work; the conductors connecting these electrodes with the welding transformer; means for imposing electrode pressure on the work; means of welding current regulation; a contactor to interrupt the power to the welding transformer; and a timer which is capable of properly controlling the action of the contactor.

The heat or energy being generated in the weld is expressed by the formula $W=I^2Rt$, where W is heat in watt-seconds, I is the current in amperes flowing through the weld, R is the resistance in ohms, and t is the time in seconds. Thus, resistance factors affecting the amount of heat being produced by a given welding current for a unit of time are: (1) the electrical resistance of the materials being welded; and (2) the contact resistance between weldments as determined by surface condition, scale, welding pressure, and other such factors. A great number of metal elements and alloys have been satisfactorily welded in production. Low carbon steel is easily welded. Copper and aluminum alloys are more difficult to weld because of their lower electrical resistance, which necessitates a much greater welding current to obtain satisfactory fusion.

Spot Welding.—This type of resistance welding unites two or more sheets of metal, producing a lap joint by concentrating the welding current and pressure on the materials by means of relatively small electrodes. A press type welder is one in which a slide, carrying the upper electrode holder, moves vertically on antifriction bearings when operated by an internal air cylinder. Means are provided for vertical and horizontal adjustment of the lower arm position, and for adjusting the operating stroke of the upper electrode assembly. Air Pressure regulators and gauges are built in the upper arm structure. Equipment for controlling the magnitude of the weld current and the length of the weld time are enclosed in the frame. Operation of the machine is fully automatic, closing and separating the welding electrodes at prescribed intervals as long as the foot switch is depressed by the operator. The three transformers supply the low voltage welding current to a special secondary switching device which conducts the welding current output from each transformer to the electrodes in sequence. This machine is capable of welding an assembly completely in five seconds. Usually, welding machines of this type are specially built for the welding of only one type of assembly, and are justified by their high rate of production. The electrodes of any resistance welding machine are of prime importance, because of their influence on both production quality and operating cost. Electrode materials must carry large currents without burning or blistering, and must also have considerable mechanical strength in order to withstand the high welding pressures and repeated impacts on the materials being welded. Since the face of the electrode becomes quite hot in operation, it is desirable that it have a high annealing temperature. Strong, high-conductivity copper alloys are available in many degrees of hardness.

Seam Welding.—This process is very similar to spot welding, except that, in seam welding, the stud type electrodes of spot welding are replaced with welding wheels which roll along the work and produce a series of overlapping spot welds to form a continuously closed joint. The rate of seam welding is usually from 2 to 100 feet per minute. At the higher speeds, the current application is continuous, each half cycle of alternating current producing a small weld overlapping the previously formed weld to form a continuous seam. When welding at lower speeds, it is desirable that the welding current be interrupted so as to provide a cooling time for the solidification of each individual spot. Adjustments for welding current, pressure, speed, and operating stroke are provided on the machine. By use of the insert type mandrel the machine may be converted to "circular" welding, wherein the wheels are turned 90 degrees. The same machine can thus be used for welding the longitudinal seams and end seams of a cylindrical container.

Projection Welding.—This variant type of resistance welding is one in which localization of pressure and current is accomplished by means of embossments on one or both of the parts being welded. These embossments permit the use of flat or plain electrodes, or dies, on the welding machine. It is often possible to make

all projection welds necessary to accomplish the assembly of the two "parts" or "weldments" in one operation. Projection welding usually offers the most rapid assembly method of any of the resistance welding processes.

Flash Welding.—In this process the two parts are loaded in the machine slightly separated. After clamping by the electrodes, the power is turned on, applying the welding voltage between the weldments and initiating the travel of the movable platen at the same time. When contact is established between the parts, the voltage across these parts is sufficient to cause a sparking, or flashing, which throws off molten particles of metal. This flashing continues, as the moving platen goes slowly forward, until the entire area to be welded is flashing vigorously. When the heat from this flashing has rendered the parts sufficiently plastic, they are suddenly "upset," or pushed together. This contact squeezes out any burned metal, slag, oxide, or other impurities which would otherwise weaken the weld joint. Immediately following this upset movement, the power is interrupted, allowing the weld to cool.

Resistance Welding.—*Application.*—Resistance welding processes are best suited to mass production of sheet metal assemblies less than ¼ inch in thickness. The most important factors governing the choice of welding equipment are: (1) required production speed, and (2) total quantities involved. High production justifies the use of special equipment, higher in first cost, but lower in operating cost, and producing at a higher rate of speed. Special machines are usually amortized over a short period of time ranging from one to five years. The more standard types of equipment are expected to be utilized on future welding jobs, so that their useful lives may be from five to fifteen years. The actual power cost for operation of the machine is usually insignificant in the total consideration, because of the very short time required for the performance of a weld. The power demand of the welding machine, however, at times necessitates the installation of additional power supply equipment. Because of the short welding time (as low as .01 second), discoloration, burning, and weakening of the material is largely eliminated.

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OTHER WELDING PROCESSES

Among the welding processes used for fewer applications, but no less important in their place are Forge Welding, Thermit Welding, Flow Welding and Induction Welding.

Forge Welding.—Basically forge welding is the method of the blacksmith shop. It involves the application of heat by a furnace and the application of pressure by hammer blows. Although quite commonly used before the advent of arc welding for certain types of pressure vessels and other similar applications, forge welding is little used today except for special applications such as the cladding of steels which is known as *roll welding* and the fabrication of pipe which is known as *die welding*. *Hammer welding,* the third process in this group, is used for some hardware manufacture and by the railroads in the safe ending of boiler flues.

Thermit Welding.—Thermit, as employed for welding, is a mechanical mixture of finely divided aluminum and iron oxide in the form of magnetic iron scale roughly in the proportion of one to three. The temperature resulting from the ignition of this thermit mixture is about 5000°F. or more. Additions are made to this basic thermit mixture to affect the temperature or to alter the chemical composition of the resultant weld.

The thermit reaction is started by means of an ignition powder containing barium peroxide. This reaction occurs in a suitably designed crucible which is tapped when the metal becomes molten. This molten metal flows into the area to be welded which has been formed by a wax pattern and around which a suitable mold has been formed. In these steps, thermit welding very largely resembles usual casting procedures.

Of the two thermit processes, *pressure thermit welding* and *nonpressure thermit welding,* the latter is by far more commonly employed. Pressure thermit welding is used mostly for the welding of pipe.

While originally used for the repair of heavy castings and forgings, nonpressure thermit welding has come to be used in new fabrication as well, particularly in the production of very large castings by welding two or more small cast sections together. During World War II, the stern frames of ships were fabricated this way. Thermit welding is also used in joining the tracks of street railways and overland railroads eliminating the existence of joints, thereby increasing the smoothness of the ride.

Flow Welding.—Except for special applications this is a relatively uneconomical process of welding and finds little general use. In this process molten filler metal is poured over the joint to be welded thereby heating the parts and at the same time providing the filler metal to fill the joint. The most common application of flow welding is the repair of cast manganese bronze propeller blades. This process is sometimes called "burning in."

Induction Welding.—This is a relatively new process and its use has not been explored too much to date. The principle involved in induction welding is the heating of metal by means of an induced electric current produced by placing the part in a magnetic field. High-frequency current ranging from 300 cycles per second up to as high as 2000 cycles per second is used. Present applications involve the welding of steel sheet and wire ranging in thickness from 0.010 inch to about ⅜ inch. Shapes welded have been generally round or oval; other shapes can be welded if provision is made in the design of the equipment to secure uniform distribution of the heat.

Simon A. Greenberg.

BRAZING

Brazing is a metal joining process, the origin of which has been lost in antiquity. Closely related to welding (q.v.), it is distinguished from the other welding processes by the following standard definition of the American Welding Society: "A group of welding processes wherein coalescence is produced by heating to suitable temperatures above 800°F. and by using a nonferrous filler metal having a melting point below that of the base metals. The filler metal is distributed in the joint by capillary attraction."

Comparing brazing and other welding processes, it will be noted that (1) brazing does not

involve melting of the base metal parts, whereas this is necessary for welding; (2) a closely fitted joint is required to enable movement of the molten brazing metal (filler metal) by capillary attraction, whereas this is absent in welding. Since brazing metals, (called brazing alloys) by themselves, exhibit low strength, closely fitted joints are used so that the film of brazing metal will be thin. Further, good practice dictates the use of lap type joints rather than butt joints.

Virtually all metals and alloys which melt above 800°F. can be brazed with one or more of the available alloys. In order to achieve low melting temperatures, alloys are generally employed except in the case of copper which is used in the commercially pure form. Some of the more common types of brazing alloys together with the approximate ranges of operating temperatures are listed herewith: magnesium brazing alloy, 800°-1000°F.; aluminum brazing alloy, 1000°-1200°F.; silver brazing alloy, 1100°-1600°F.; brass (spelter) brazing, 1600°-1900°F.; copper brazing, 2000°-2100°F. Magnesium and aluminum brazing alloys are suitable only for brazing metals of similar composition. However, the other types, because of their low melting points are frequently used for joining dissimilar metals. Careful cleaning before brazing and the use of chemical fluxes during brazing are necessary to assure sound brazed joints.

The means of heating provides the distinction between the eight common processes of brazing which are torch, induction, furnace, dip, resistance, block, flow and twin-carbon arc. In torch brazing, a gas flame, usually oxyacetylene, is used to heat the parts and flow the alloy. Induction brazing derives its heat from a high frequency electric current induced in the parts to be brazed. Furnace brazing may be performed in either electric or gas fired furnaces, with or without protective furnace atmospheres. Dip brazing involves the use of molten baths of either brazing alloys or salts; the former provides the brazing alloy while the latter merely supplies the heat (and sometimes the flux) with the alloy introduced separately. Resistance to the passage of low voltage and high currents furnishes the heat in resistance brazing; standard resistance welders, modified, are generally employed. Large massive, metal blocks, heated separately in a furnace supply the heat for block brazing. In flow brazing, molten brazing alloy is flowed over the parts to be brazed thus furnishing the necessary heat. An electric arc between two carbon electrodes develops the heat for twin-carbon arc brazing.

Brazing as an industrial production technique finds applications in such widely diversified fields as plumbing, heating, machine tools, instruments, steel mills, railroads, sporting goods, jewelry and many others.

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WELDON, Richard Chapman, Canadian legislator and educator: b. Sussex, New Brunswick, Jan. 19, 1849; d. Nov. 27, 1925. After practising law he was dean of Dalhousie's law faculty (1883–1914). From 1887 to 1896 he was also a member of Parliament.

WELFARE ISLAND, a part of New York City's Manhattan Borough, in the East River. Extending about a mile and three quarters, its southern point is opposite 51st Street and the northern opposite 86th Street, Manhattan. It is the site of numerous municipal welfare institutions. Gov. Wouter Van Twiller in 1637 purchased it from the Indians. Acquired in 1668 by Capt. John Manning, after his death it passed to his stepdaughter, Mrs. Robert Blackwell, and was called Blackwells Island. In 1828 the city purchased it from the Blackwell family, and in 1921 renamed it Welfare Island.

WELL-TEMPERED CLAVIER, The (Ger. *Das Wohltemperirte Clavier*), the celebrated collection of 48 preludes and fugues composed by Johann S. Bach, 1685–1750 (q.v.) to test the system of equal temperament in tuning. For this purpose he wrote a prelude and fugue in each key, the keys following one another not in relation, but in the order of chromatic ascent. See also MEANTONE; TEMPERAMENT.

Consult *Grove's Dictionary of Music and Musicians,* vol. 5, pp. 746, 747 (New York 1935).

WELLAND, city, Province of Ontario, Canada, county seat of Welland County. Incorporated as a village in 1858, two years after the erection there of the county buildings, Welland was incorporated as a town in 1878, and as a city in 1917. The Welland Ship Canal, connecting Lake Erie and Lake Ontario, runs through the center of the city, which is also served by the Canadian Pacific; Canadian National; Michigan Central; Wabash; Pere Marquette; Toronto, Hamilton and Buffalo; and Niagara, St. Catherines and Toronto (electric) railways. Industries include iron and brass foundries, boiler works, cordage works, cotton mills, and the manufacture of agricultural implements, light and heavy forgings, rubber goods, electrical equipment, steel, overalls, fertilizers, etc. The city maintains an up-to-date fire department, and has one of the most modern waterworks systems in Canada. It has an excellent public school system, including a high and vocational school; a number of banks; a public library; parks and athletic fields. There are United, Presbyterian, Baptist, Anglican and Roman Catholic churches. Welland County General Hospital is located here. Welland's growth has been steady. In 1871 its population was 1,110; in 1881, 1,870; by 1911 it had increased to 5,318 and by 1951 to 15,382.

WELLAND SHIP CANAL. See under CANADIAN CANALS.

WELLER, Reginald Heber, American Protestant Episcopal bishop: b. Jefferson City, Mo., Nov. 6, 1857; d. Nov. 22, 1935. He studied at the University of the South 1875–1877, and was graduated from the Nashotah Theological Seminary, Wisconsin, in 1884. Ordained to the priesthood, he was rector of Eau Claire, Wis., 1884–1888; of Waukesha, Wis., 1888–1890 and of Stevens Point, Wis., 1890–1900. He was consecrated bishop-coadjutor of Fond du Lac on Nov. 8, 1900, the somewhat spectacular ceremonial practiced on this occa-

sion calling forth some criticism; and succeeded as bishop Aug. 30, 1912. He died at Jefferson City, Mo., Nov. 22, 1935.

WELLES, wĕlz, **Gideon,** American political leader: b. Glastonbury, Conn., July 1, 1802; d. Hartford, Conn., Feb. 11, 1878. He studied at Norwich, Vt., in the academy which later became Norwich University, but did not complete the course there, and for a time turned his attention to the study of law. In 1826, however, he entered journalism as editor of the Hartford *Times,* which under his management became one of the leading Democratic papers of the state. He was one of the first publicly to advocate Andrew Jackson's election to the presidency, and always warmly supported him. In 1827–1835 he was a member of the Connecticut legislature, and both as legislator and editor advocated the abolition of imprisonment for debt, opposed the practice of special legislation, and succeeded in obtaining the passage of general laws for the incorporation of business corporations. In 1836 he resigned the editorship of the *Times,* but continued to write for that paper. In 1835, 1842, and 1843 he was chosen state comptroller; in 1836–1841 he was postmaster of Hartford; and in 1846 was appointed chief of the bureau of provisions and clothing in the Navy Department, which office he held till 1849.

He had always been opposed to the extension of slave territory, and on the organization of the Republican Party in 1855 became identified with it, and was Republican candidate for governor of Connecticut in 1856, and a member of the national committee. In 1861 he was appointed secretary of the navy, and conducted the affairs of his department with marked executive ability throughout the Civil War; he continued in office under President Andrew Johnson till 1869. He was later affiliated with the Liberal Republicans, and in 1876 was a supporter of Samuel S. Tilden. He was author of *Lincoln and Seward* (1874). The *Diary of Gideon Welles* (3 vols., 1911) is an important historical document.

WELLESLEY, wĕlz'lĭ, **Arthur.** See Wellington, Arthur Wellesley, Duke of.

WELLESLEY, Richard Colley (1st Marquis Wellesley), British statesman: b. Dublin, June 20, 1760; d. London, Sept. 26, 1842. He was educated at Oxford, and on his majority took his seat as earl of Mornington in the Irish House of Peers. Three years after, he was returned to the British House of Commons as member for Beeralston, and afterward sat for Windsor (1787–1796), and for Old Sarum (1796–1797). He was appointed governor general of India in 1797, and in 1799 created Marquis Wellesley in the Irish peerage. His administration was notable, both for its ability and the large accessions of territory made under it by the conquest of Mysore and the humbling of the Mahrattas. In 1809 he became foreign secretary under Spencer Perceval. In 1812 he resigned his place chiefly because he was in favor of Catholic emancipation, and did not return to office till 1821, when he became lord lieutenant of Ireland. This post he retained till 1828, when he was removed from it by his brother, the duke of Wellington, who was an opponent of emancipation and had become prime minister. In the Grey ministry he held the office of lord steward till 1833, when he again became lord lieutenant of Ireland. Displaced in the following year by the Peel ministry, he afterward held the office of lord chamberlain for a few months in 1835.

Consult Owen, S. J., ed., *Selections of Dispatches* (1877); Hutton, W. H., *Lord Wellesley* (1893); *The Wellesley Papers: Life and Correspondence of Richard Colley Wellesley,* 2 vols. (1914).

WELLESLEY, town, Massachusetts, in Norfolk County; altitude 140 feet; 12 miles southwest of Boston; on the New York Central Railroad. It is principally a residential and college town, with many broad streets and handsome residences. Wellesley College (q.v.) and Dana Hall, a preparatory school for girls, are located here. Within the boundaries of Wellesley College campus lies Lake Waban. The town has a public library. Babson Institute is located in Wellesley Hills. The few industrial establishments manufacture electrical machinery, hosiery, building supplies, and paper boxes. The first white settlement was made here about 1660. In 1704 a sawmill was set up, and later other industries were developed. Wellesley was set off from Needham and incorporated in 1881. The township includes the villages of Wellesley Hills and Wellesley Farms. Government is vested in a town meeting and a board of selectmen, elected annually. Pop. (1940) 15,127; (1950) 20,549.

WELLESLEY COLLEGE, a college for women located in Wellesley, Mass., about 12 miles from Boston. It was founded by Henry Fowle Durant to give "to young women opportunities for education equivalent to those usually provided in colleges for young men." The charter was obtained in 1870, and the college first opened to students in 1875. It is nonsectarian in control; three representatives of the alumnae serve on the board of trustees. In 1894 the system of elective courses was established, which with some modifications is still in force. The college confers one baccalaureate degree, B.A., and the graduate degrees of M.A., M.S. in education, and M.S. in hygiene and physical education. Certain courses are required in hygiene, biblical history, English and speech; in addition, each candidate for the degree must complete within the 120 semester hours, required 12 semester hours in each of three groups of subjects (art, music and language; social sciences; mathematics and science) and 42 semester hours in one field of concentration. Required courses and courses counted for distribution may be included in the concentration, in which a major of 24 to 30 hours must be in one department, 18 to 12 in one or more other departments supplementary to the major. Pedagogical courses are offered in the history and principles of education and in method of teaching; art and music are included in the curriculum. The college contributes toward the support of the American School of Classical Studies in Athens, the American School of Classical Studies in Rome, and the Marine Biological Laboratory at Wood's Hole. Scholarships are available for undergraduates, and both fellowships and scholarships for graduate students of recognized ability. In 1946 the Wellesley Institute for Foreign Students was established for the purpose of orienting those foreign students accepted by American colleges and universities. The Wellesley Summer Theater and School was established in 1947.

The campus has a particularly beautiful situation within the limits of the town; it includes a lake which affords excellent opportunity for rowing and skating. The older buildings include the Farnsworth Art Building, Whitin Observatory, Houghton Memorial Chapel, the Library, Billings Hall for Music, Mary Hemenway Hall for physical training, the President's House, Simpson Infirmary, Page Memorial Kindergarten, and 20 halls of residence. Among the newer buildings are the Recreation Building, Sage Hall for botany and zoology, and Pendleton Hall for physics, chemistry, and psychology. The library of over 200,000 volumes has the famous Plimpton Collection of Italian books and Renaissance manuscripts, the Ruskin Collection, and rare editions of English poetry. Enrollment (1947–1948) 1,723.

WELLESLEY ISLANDS, Australia, in Gulf of Carpentaria are politically attached to Queensland. Mornington, the northernmost and largest island, is 40 miles long by 15 miles broad.

WELLHAUSEN, vĕl'hou'zĕn, **Julius,** German Orientalist and Biblical scholar: b. Hameln, Westphalia, May 17, 1844; d. 1918. He studied theology in the University of Göttingen, in 1872 was appointed professor of theology in Greifswald University, but resigned in 1882 because he could no longer hold the accepted views of Scriptural inspiration. He went to Halle as extraordinary professor of Oriental languages and in 1885 was appointed to an ordinary professorship at Marburg, whence in 1892 he removed to Göttingen to occupy a similar post. In 1871 he published a text-critical work on the books of Samuel, and in 1874 appeared his treatise *Die Pharisäer und Sadducäer.* The first volume of *Geschichte Israels* was issued in 1878 and a second edition of it in 1883, under the title, *Prolegomena zur Geschichte Israels* (5th ed., 1899). *De Gentibus et familiis Judaeis* (1870); *Der Text der Bücher Samuelis untersucht* (1871). His masterly treatise on *Die Komposition des Hexateuchs und der historischen Bücher des Alten Testaments* (1885; 3d ed. 1899) originally appeared in the *Jahrbücher für Deutsche Theologie* (1876–77). Later works are *Muhammed in Medina* (1882); *Der Arabische Josippus* (1897); *Reste arabischen Heidentums* (2d ed. 1897), first published in the *Skizzen und Vorarbeiten; Die Kleinen Propheten übersetzt, mit Noten* (1892; 3d ed. 1898); different books on the evangelists (1903–08); *Einleitung in die drei ersten Evangelien* (1905; 2d ed. 1911); and *Kritische Analyse der Apostelgeschichte* (1914).

WELLING, James Clarke, American educator: b. Trenton, N. J., July 14, 1825; d. Hartford, Conn., Sept. 4, 1894. He was graduated from Princeton in 1844, was appointed associate principal in the New York Collegiate School in 1848 and in 1856–1865 was literary editor of the Washington *Daily National Intelligencer.* He was clerk of the United States Court of Claims in 1862–1867, in 1867–1870 was president of Saint John's College, Annapolis, Md.; occupied the chair of belles-lettres at Princeton in 1870–1871; and in 1871–1894 was president of Columbian College, Washington, D.C. He was a regent of the Smithsonian Institution, president of the Corcoran Gallery of Art and also of the Philosophical and the Anthropological Societies of Washington. While president of Columbian College (now George Washington University), he taught courses in history and international law. His *Addresses, Letters, and Other Papers* were published posthumously in 1903.

WELLINGBOROUGH, England, urban district and town in Northamptonshire, 10 miles northeast of Northampton. It is situated at the junction of several railway lines and serves as a market town for the surrounding agricultural area. There are metal and leather industries. Old buildings in the town include St. Luke's Church, a Norman and Gothic structure, and a grammar school founded in 1595. Pop. (est. 1947) 28,571.

WELLINGTON, Arthur Mellen, American civil engineer: b. Waltham, Mass., Dec. 20, 1847; d. New York, May 16, 1895. Defective eyesight prevented his entering a university but he studied civil engineering under Prof. J. B. Henck in Boston. He was later associated with the laying out of Prospect Park, Brooklyn, and from 1868 was a railroad engineer. In 1881–1884 he was chief engineer of the Mexican National and the Mexican Central railroads. He was the author of the plan for multiplying the traffic facilities of Brooklyn Bridge by five times, recommended by the Board of Experts in 1887. In 1884–1887 he was an editor of the *Railroad Gazette;* and from 1887 until his death he was one of the editors and owners of the *Engineering News.* He was also active as a consulting engineer in many important public works, among them the plans for the Boston subway and the abolition of grade crossings in Buffalo. In addition to numerous articles, he published *Methods for the Computation from Diagrams of Preliminary and Final Estimates of Railway Earthwork* (1874); *The Economic Theory of the Location of Railways* (1877); *Field Work of Railway Location and Laying out of Works* (1889).

WELLINGTON, Arthur Wellesley, DUKE OF, British soldier and statesman: b. 1769; d. Walmer Castle, England, Sept. 14, 1852. He was the fourth son of the 1st earl of Mornington. His mother was the eldest daughter of the 1st Viscount Dungannan. He was educated at Eton, privately at Brussels, and finally at the Military College of Angers. On March 7, 1787 he received a commission as ensign in the 73d Foot. He was gazetted under the name of Wesley, the family name till changed by his brother to Wellesley. After a rapid series of changes and promotions he attained by purchase in September 1793 the command as lieutenant colonel of the 33d Regiment in which he had attained his majority in April of the same year. In 1790 he was returned to the Irish Parliament for the family borough of Trim, in the county of Meath. In May 1794 he sailed with his regiment for Flanders to join the army of the duke of York. In 1796 he joined his regiment at the Cape, arrived at Calcutta in February 1797, and was attached to the Bengal service. Later the 33d Regiment was attached to the Nizam's contingent in the Deccan with Wellesley in command. The army

entered Mysore in March 1799. An engagement took place at Mallavelly on the 27th, in which Wellesley, who commanded the left wing, turned the right of the enemy. He was subsequently employed to dislodge the enemy from their posts in front of Seringapatam and after the capture of that capital was appointed July 1799, to its command. During his administration he was compelled to take up arms against Dhundiah Waugh, a robber chief, who styled himself "King of the Two Worlds." Wellesley overtook and routed him with a small body of cavalry 10 Sept. 1800. In April 1802 Wellesley attained the rank of major-general. Early in 1803 he was appointed to the command of a force destined to restore the Peishwa of the Mahrattas, driven from his capital by Holkar. This operation successfully performed, the other Mahratta chiefs, Scindia and the Raja of Berar, showed hostile designs against the British and Wellesley was appointed to the chief military and political command in the operations against them. After an active campaign, in which he took Ahmednagar and Arungabad, he encountered a powerful Mahratta army, assisted by French officers, at Assaye (23 September) and entirely defeated it. The parallel successes of General Lake, and the defeat of the Raja of Berar by Wellesley at Argaum on 29 November, compelled the submission of the Mahrattas and peace was restored on conditions drawn up by the successful general. The fame of Wellesley's achievements had now spread over India. Before leaving Madras he received his appointment as K.C.B., and the thanks of both houses of Parliament. He sailed for England on 10 March 1805 and arrived in September.

On 10 April 1806 Wellesley married Lady Catherine Pakenham, third daughter of the Earl of Longford. He had previously been elected and distinguished himself in the House of Commons by the defense of his brother's administration in India. In April 1807 he was appointed chief secretary for Ireland and in August received the command of the reserve in the expedition to Copenhagen under Lord Cathcart and Admiral Gambier. He took Kioge 29 April, the only land operation of importance. On returning he resumed his duties as secretary and received the thanks of Parliament for his share in the expedition. On 25 April 1808 he attained the rank of lieutenant-general.

In June, Wellesley received the command of a force destined to operate in the north of Spain and Portugal in aid of the revolt against Napoleon. On 30 July he anchored in Mondego Bay, and landed his troops at Figueira. The English began their southward march on 8 August. Wellesley moved on the coast road to Torres Vedras. At Roliça he encountered about 5,000 men under Delaborde, whom Junot had sent in advance to arrest his progress. This corps, after a spirited resistance, was driven back and retired to Torres Vedras. Wellesley now drew nearer the coast, reaching Vimeiro on the 19th, where he was reinforced by two brigades from England, raising his force to 17,000. At the same time he was superseded in the command. The government had determined to increase their army in the Peninsula, and had appointed Sir Hew Dalrymple to the chief command, with Sir Harry Burrard as second and Wellesley, Moore, Hope, Paget and Fraser as divisional commanders. Junot determined to attack the English on the land side while they were in the immediate neighborhood of the sea. The attack was made on 21 August and Junot was beaten. After the battle Junot proposed an armistice, the result of which was the famous Convention of Cintra, by which the French agreed to evacuate Portugal on condition of being conveyed to France with their arms and baggage. Public feeling in England over the excessive liberality of the terms ran so high that the generals were recalled to be examined by a board of inquiry, but their conduct was approved of and commended. Wellesley proceeded to Ireland in December as chief secretary, and early in 1809 received the thanks of both houses of Parliament for his conduct of the campaign.

In the latter part of 1808 Napoleon overran Spain with 200,000 men, and Sir John Moore, pursued by Soult, carried the British army to Coruña, where it embarked for England. Lisbon was still held by Sir John Cradock and a British force occupied Cadiz, when Wellesley was appointed to assume the chief command in the Peninsula. He arrived at Lisbon 22 April 1809. He advanced againt Soult at Oporto and the French were thrown into confusion and retreated precipitately. Soult now retired to Galicia, followed by Wellesley to the frontiers of Portugal and harassed by the insurgent Portuguese. The Peninsula was at this time occupied by about 250,000 French troops; but after the departure of Napoleon the independence or insubordination of the French marshals prevented effective co-operation of the different armies, and the French command never extended beyond the districts occupied by their armies. The British commander had a series of difficulties to contend with. First was the smallness of the armies on which he could rely. The numbers of the British were always comparatively insignificant and reinforcements were slowly and scantily supplied. Almost as formidable was the difficulty of co-operating with his allies. Spain and Portugal were without regular governments. The Portuguese officers had mostly fled to Brazil, but the Portuguese troops carefully drilled by Beresford and placed under the command of British officers, soon became a tractable and efficient force. It was far otherwise with the Spaniards. The junta and the generals were alike ignorant, incompetent and self-conceited and with the raw levies which constituted the Spanish armies it was positively dangerous to co-operate. Even with the Portuguese government, Wellington (as he must now be called) had natural but formidable difficulties to contend with. The subsistence of the armies was a constant source of danger and embarrassment both in Spain and Portugal. The resources of the country were oppressed by the armies of three nations. The French took all they wanted and wasted much more. The Spanish armies, numerous and inefficient, were a sufficient weight for the junta, which always supplied with reluctance the wants of the British who had commonly much greater

difficulty in procuring provisions for money than either of the other armies had in seizing them. Through all these difficulties Wellington adhered with undeviating patience and constancy to the strict principles of discipline he had laid down. He remonstrated with herculean labor, and with admirable spirit, as his dispatches show, with authorities of all kinds; but he never under the great temptation took, or suffered others to take, violent means to supply his most pressing wants.

By a misunderstanding between Soult, who held the command in the north of Spain, and Ney, who was under him, Galicia was evacuated by both marshals and never afterward recovered, a valuable result of Wellesley's first campaign. To co-operate with the Spanish armies, Wellesley had determined to advance into Spain, which he did in July by the north of the Tagus. Nearly every important fortress in Spain was in the hands of the French.

The victory of Talavera, 27–28 July, earned Wellesley the titles of Baron Donro and Viscount Wellington. Next day the French retreated across the Alberche and broke up their army. The first invasion of Spain had resulted in nothing but a series of movements among the French troops. Wellington at this time surveyed the lines of Torres Vedras and formed his plan of fortifications for their defense. Anticipating that invasion would come from the north, he left General Hill to guard the Tagus and fixed his headquarters at Viseu.

The French in the meantime were largely reinforced. Soult was in Andalusia with 60,000 men threatening the south of Portugal, while in the north the army of Portugal was concentrating to the extent of 70,000 to 80,000, and the veteran Masséna was appointed to command it. Wellington was able to bring into the field from 50,000 to 60,000 British and Portuguese troops. The French invested the Spanish fortress of Ciudad Rodrigo early in June and took it on 10 July. They then advanced to the Coa, from which the British retired. Almeida was captured on 27 August. Wellington fell back on the valley of the Mondego. In the middle of September, Masséna began his march down the right bank of the river. At the Sierra de Busaco, a high ridge in front of Coimbra, Wellington made a stand and repulsed the French. After the battle, Masséna turned Wellington's position, who retreated to Leiria, where he halted two days. On 8 October he entered his lines, just as the autumnal rains were beginning to fall. A powerful fleet and a flotilla of gunboats on the Tagus contributed to their defense. Masséna was wholly unprepared for his reception and after some vain demonstrations he retired from their front. The Portuguese parties had cut off his communications with Spain and sickness was rapidly diminishing his numbers. On 15 November he fell back to Santarem.

Napoleon recommended to waste the English with continual engagements of advanced guards and sent Soult instructions to co-operate with Masséna. But Soult, with the blockade of Cadiz and with the Spaniards on his hands, could only spare a sufficient force to besiege Badajoz. In March 1811 Masséna was compelled to begin his retreat, which he conducted with great skill. The French crossed the Agueda on 6 April. Wellington estimated their loss in the campaign at not less than 45,000. Wellington blockaded Almeida and cantoning his army between the Coa and the Agueda, returned to Badajoz, which had been taken by Soult and invested by Beresford. He was speedily recalled by an aggressive movement of Masséna to relieve Almeida. Wellington took up a position to cover the fortress at Fuentes de Onoro, where he was attacked by Masséna with a superior force. In this battle he performed the exceedingly critical operation of changing his front in presence of the enemy. The manœuver was successful and Masséna was repulsed. Almeida surrendered a few days after the battle and Masséna was about the same time superseded by Marmont. Soult in the meantime had been defeated by Beresford at Albuera in an attempt to relieve Badajoz. Wellington returned to prosecute the siege and Marmont also moved south to join Soult, but afterward returned to Salamanca. This induced Wellington to push the siege of Ciudad Rodrigo in preference to that of Badajoz and he returned to the Agueda. Marmont, however, advanced with a superior force and he withdrew to the Coa. Marmont returned to Salamancas.

During the winter Wellington continued to occupy himself with preparations for this siege, collecting his stores at Almeida under pretext of repairing it. On 6 Jan. 1812, he moved his headquarters to Gallegos, invested Ciudad Rodrigo on the 8th and took it by assault on the 12th. An earldom, a pension and a Spanish dukedom awarded this achievement. Wellington now went south with his principal force to take Badajoz; and Marmont, who had collected his forces to raise the siege of Ciudad Rodrigo, invaded Portugal by Sabugal and ravaged the country. Badajoz was taken on 6 April, with a heavy loss. Having secured the frontier fortresses, Wellington determined again to invade Spain. Leaving Hill on the southern frontier he moved north with his main army and on 17 June reached Salamanca, Marmont retiring to Toro. The French general, when he had concentrated his forces, attempted by a series of pretentious manœuvres to surprise the British commander, his ultimate object being to cut him off from his communications. With this purpose he crossed the Tormes, followed by Wellington, who took up his position between the river and two hills called the Arapiles. Here Marmont's overdisplay of tactics recoiled on himself. Having gained the outer Arapile, in extending his left to attack the British right, he gave Wellington the opportunity he had long desired of attacking him. Marmont was wounded and the French left and centre broken. Clausel, who attempted to re-form the army, was routed. Numerous prisoners were taken by the cavalry in pursuit and the French retired to Burgos. Wellington reached Valladolid on 31 July and turning on Joseph, who had advanced to support Marmont, followed him to Madrid, which he entered on 12 August. Hill was now advancing to join Wellington and Joseph fell back from Toledo to Almansa in Murcia. These successes compelled Soult to abandon Andalusia and an Anglo-Spanish force from Cadiz took Seville. Wellington's next movement was against the army he had defeated under Clausel, which had been largely reinforced. He left Hill in Madrid (1 September) and advanced to Burgos, being joined on his

way by a body of Spaniards. The French retired, leaving a garrison in the castle, which Wellington deemed it necessary to take before advancing. The siege, for want of proper artillery, occupied him till 21 October. In the meantime the northern army under Souham was again advancing and Soult with a powerful army marching on Madrid, which Hill had abandoned to fall back on Salamanca. Wellington abandoned the siege and retreated, closely followed by the French, who repeatedly attacked his rear. At Palencia he was joined by a brigade from England. At Tudela, Souham halted to wait for Soult and Wellington proceeded to the Tormes, where he was joined by Hill, and when the French crossed the Tormes in force he took up his old position at the Arapiles. The united armies of Soult and Souham amounted to nearly 90,000 men. Wellington's strength was over 50,000. The enemy, instead of attacking, threatened his communications, upon which he retreated to the Agueda and established his headquarters at Ciudad Rodrigo. The French, not being prepared to invade Portugal, withdrew their armies to cantonments in Castile. General Hill's corps continued to occupy Estremadura and the rest of the British were cantoned on the Portuguese frontier.

The gains of this campaign were substantial. The French had not only been compelled to reinforce their Spanish armies largely at the expense of their operations elsewhere, but had lost Andalusia and given the British a footing in Estremadura. Wellington received (18 August) the title of marquis and Parliament voted him thanks and £100,000. The failure of the Russian campaign compelled Napoleon to recall Soult from Spain and Wellington was able to open the campaign of 1813 with a force of 70,000 British and Portuguese. He had also been appointed commander-in-chief of the Spanish armies. He opened the campaign in May by an advance in the former direction and on 12 June reached Burgos, the French retreating to the Ebro. Wellington turned their position by crossing the Ebro near its source and after some unsuccessful fighting they fell back on Vittoria. In a strong position commanding the principal roads through the town they were defeated by the British on 21 June. Being driven from the town, while the British left had seized the Bayonne road, by which they retreated, they were thrown into confusion and routed. Wellington now occupied the passes of the Pyrenees and besieged Pampeluna and San Sebastian. He was created field-marshal and received the Spanish title of Duke of Vittoria. Soult was dispatched by Napoleon, with the title of lieutenant of the emperor, to restore matters in the Peninsula. He had still a powerful army (80,000), but after a series of engagements, called the battles of the Pyrenees, he retreated into France. Some time being spent in pushing the sieges of Pampeluna and San Sebastian, the former of which surrendered 31 August, the latter 31 October, Wellington crossed the Bidassoa in October and in November the whole army descended from the Pyrenees into the French plains. Some severe fighting occurred before the armies went into winter cantonments. On 27 February Wellington defeated Soult at Orthez and the French retreated to Toulouse. Suchet had abandoned Catalonia and reached Narbonne. Another engagement took place in front of Toulouse on 10 April, in which the French after severe fighting were driven into the town. Next day, Soult evacuated Toulouse and Wellington entered it on the 12th. In the afternoon news arrived of Napoleon's abdication, but Soult declined to submit to the provisional government without further advice and Wellington refused an armistice. Advices having arrived from Berthier, Soult entered into a convention on 18 and Suchet on 19 April. In a sortie of the garrison of Bayonne, before the peace was known, the British suffered severely. On 30 April Wellington, leaving his army in quarters, set out for Paris. In May he had to visit Madrid to allay political differences among the Spanish generals and on 14 June he issued farewell orders to his army. He was created Marquis of Douro and Duke of Wellington in May, with an annuity of £13,000, commutable for £300,000, afterward £400,000. He received the thanks of both houses of Parliament. In July he went as Ambassador to France and he succeeded Lord Castlereagh as British representative in the Congress of Vienna. In April he took the command of the army assembled in the Netherlands to oppose Napoleon. (See FRANCE; NAPOLEON I; WATERLOO). On his return to England after the restoration of peace he received a vote of £200,000 for the purchase of the estate of Strathfieldsaye, to be held on presenting a colored flag at Windsor on 18 June each year. Numerous foreign honors were showered upon him; among others he was made field-marshal of the armies of France, Russia, Austria and Prussia.

With the return of peace he resumed the career of politics. He accepted the post of Master-General of the Ordnance with a seat in the Cabinet of Lord Liverpool in January 1819. In 1822 he represented Great Britain in the Congress of Vienna. In 1826 he was appointed high-constable of the Tower and went to Saint Petersburgh as Ambassador on the affairs of Greece. On 22 Jan. 1827 he succeeded the Duke of York as commander-in-chief of the forces. On the accession of Canning to office (April 1828) he set the bad example of resigning this post on political grounds. He resumed it again on the accession of Lord Goderich. On 8 Jan. 1828 he accepted the premiership and, resigning the command of the forces, gave it to Lord Hill. During his first year of office he carried the repeal of the Test and Corporation Acts. In January 1829 he was appointed governor of Dover Castle and lord warden of the Cinque Ports. This year he carried the Catholic Emancipation Bill. Both this and the repeal of tests were reforms which he had steadfastly opposed and which he yielded to necessity rather than conviction. He fought a duel in defense of his conduct on this bill with Lord Winchilsea on 21 March. In 1830 repeated motions for parliamentary reform were defeated, but the growing discontent throughout the country on this subject and a defeat in Parliament caused the resignation of the government in November. His opposition to reform made the duke so unpopular that he was assaulted by a mob on 18 June 1832 and his life endangered. He accepted the office of Foreign Secretary under Sir Robert Peel, 9 Dec. 1834, and retired with him, 8 April 1835. In the Peel ministry in 1841 he took a seat in the Cabinet without office. On 10 Dec. 1842, on the death of Lord Hill, he resumed the

command of the forces, which he held until his death. On the return of Peel to office in 1846 he supported him in carrying the repeal of the corn-laws, which up until then he had opposed. From this time his general policy in Parliament was to support the government of the day.

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WELLINGTON, wĕl'ĭng-tŭn, municipality, Australia, in New South Wales, situated 160 miles northwest of Sydney. It is a gold-mining center; also known for its dairy products, wool, and wheat. Pop. (1947 est.) 4,723.

WELLINGTON, urban district, England, in Shropshire, situated 10 miles east of Shrewsbury. It is in a coal-mining region; its manufactures are machinery, agricultural implements, toys and flour. Nearby is The Wrekin, an isolated volcanic hill, 1,335 feet. Pop. (1951) 11,412.

WELLINGTON, urban district, England, in Somersetshire, situated six miles west-southwest of Taunton. It is a market for agricultural products and has woolen mills; asbestos and bricks also are manufactured here. Notable is its 15th century church. Nearby is a monument to the duke of Wellington who took his title from the town. Pop. (1951) 7,132.

WELLINGTON, town, India, in Nilgiri district, southwest Madras. Formerly known as Jakatala, it is a suburb of Coonoor, a military convalescent station. Its manufactures are cordite and chemicals. It is also the site of an army college. Pop. (1951) 8,372.

WELLINGTON, city, Kansas, and seat of Sumner County, altitude 1,189 feet, is served by the Atchison, Topeka and Santa Fe, and the Chicago, Rock Island and Pacific railroads. It is located 27 miles south of Wichita, and is a railroad center with railroad repair shops. Situated in an agricultural region, it is a trade center for grain and other agricultural products, and also has grain elevators, flour mills and some manufactories. It is the seat of the Sumner County High School. Situated at a point where Chisholm Trail travelers paused to rest their teams, Wellington grew as a trading center and gained impetus with the discovery of oil in the vicinity in the 1930's. It was laid out in 1871 and incorporated in 1872. The city government is by a mayor and council. Pop. (1950) 7,747.

WELLINGTON, city and seaport, New Zealand, seat of Hutt and Makara counties, capital of Wellington provincial district, and capital city of New Zealand, altitude 10 feet, is situated on a mountainous site at the head of Wellington Harbor (formerly Port Nicholson). It is at the geographical center of the Dominion, on Cook Strait which separates the North and the South Islands. It is the southernmost railroad terminal on the North Island, and has an airport with modern transoceanic and internal service. The fine harbor, three miles wide at its mouth, and 12 miles long, has wharfage facilities, served by hydraulic machinery and railways, for ocean-going vessels. The city is situated 1,200 miles southeast of Sydney, Australia.

Industries and Manufactures.—Chief among its manufactures are woolens, rope, packed meats, matches, soap, and brick. Building stone and fish are produced, and an extensive export trade is carried on in wool, meat, hides, skins, butter, cheese, and hemp.

Principal Buildings.—The modern eight-story building which houses government departments contrasts strikingly with the old government building constructed entirely of wood in 1876 which is still in use. The parliament buildings include the Parliament House and the General Assembly Library. The fine townhall, the supreme court building, and the fine railroad terminal also are noteworthy.

Educational and Cultural Facilities.—The University of New Zealand, Victoria University College, and St. Patrick's College have faculties of arts, commerce, science and law; the Dominion Museum has rare biological collections, New Zealand antiquities, and examples of native Maori carvings; the National Art Gallery conducts a school of art and has valuable exhibits of paintings and sculpture; the public library, a fine modern institution, also has a lecture hall and music rooms; and the Alexander Turnbull Library has many rare manuscripts and books. The War Memorial of sculptured marble is the scene of annual Anzac Day commemorations. The Botanical Gardens and public parks, on elevated sites, command a splendid view of the city and port. Popular lectures on astronomical science are conducted from the Carter Observatory and the meteorological and seismological station.

Recreational Facilities.—The city has many reserves, golf clubs, and play centers for bowling, tennis, basketball and- football; also seashore facilities for boating and yachting, surfing, fishing and swimming. The scenic beauty of the harbor is particularly noteworthy.

History and Government.—The settlement of Britannia was established at Petone in 1840 by 2,000 emigrants from the United Kingdom. Out of this arose Wellington in the development of which city more than 300 acres have been reclaimed from the sea. The seat of the Dominion government, originally in Auckland, was transferred here in 1865. The city is an independent unit under a municipal government. Pop. (1945) 123,771; (1951) 133,400.

WELLINGTON, provincial district, New Zealand, one of the nine provincial districts of the dominion of New Zealand, is the southernmost of the four districts of the North Island; its area is 10,870 square miles. Parallel to the mountain range which extends through most of its length, and nearer the coast, is a series of lower ranges. Between these two mountain systems extends the Waiarapa Plain, merging northward into an undulating country. A considerable extent of fairly level country is also found along the west coast. The district is well watered by several

rivers and in the south are Lakes Waiarapa and Onoke. In the north is the Tongariro National Park, an area of 235 square miles which includes three intermittently active volcanoes: Tongariro (6,458 feet), Ruapehu (9,175 feet), and Ngauruhoe (7,515 feet).

The district is well wooded, and exports timber. Much of the surface is primarily sheep-grazing land and, in addition, cattle and horses. The main crops are grain, potatoes, and turnips. Little mineral wealth has been found in the district, but some gold has been worked. Railroads run from the capital city of Wellington to Napier and Auckland. Pop. (1945) 349,404.

WELLINGTON, village, Ohio, in Lorain County, altitude 856 feet, served by the New York Central, and the Wheeling and Lake Erie railroads, is 14 miles south of Elyria. It is located in a dairying and grain area; its manufactures are: castings, trucks, steel products, glass cloth, and livestock medicines. There is a public library. Archibald M. Willard, painter of *The Spirit of '76,* is buried here. Settled in 1818, incorporated in 1855, the village has a mayor and council form of government. Pop. (1950) 2,992.

WELLMAN, wĕl'măn, **Walter,** American journalist and explorer: b. Mentor, Ohio, Nov. 3, 1858; d. New York, Jan. 31, 1934. He was the founder of the Cincinnati *Post* (1879) and from 1884 to 1911 he was Washington correspondent of the Chicago *Herald* and *Record-Herald.* In 1892 he located the landing place of Columbus in the New World, on Watling Island (San Salvador) in the Bahamas, and built a monument on the spot as he had determined it. In 1894 he led an expedition to Spitzbergen, and in 1898–1899 to Franz-Josef Land.

WELLS, Carolyn, American writer: b. Rahway, N. J.; d. New York, N. Y., March 26, 1942. Miss Wells was the author of over 170 books, 70 of which were mystery stories. Most of her early writing was in the field of children's literature. The *Story of Betty* was the first of these to have wide success. In 1902 she published her first anthology—*A Nonsense Anthology*—which was enthusiastically received by humorous writers of the period. This was followed by *A Satire Anthology* (1905); *A Whimsey Anthology* (1906); *The Book of Humorous Verse* (1920); and the *Book of Limericks* (1925).

Miss Wells had little interest in the mystery story until 1910 but from then on the "puzzle story" captured her imagination. Many of her books in this field were noted for wit and cleverness of plot. She created the detective character Fleming Stone and in 1933 the *Fleming Stone Omnibus* was published. In 1929 she wrote a critical study—*The Technique of the Mystery Story* which writers in the field considered the most understanding study published up to that time. Her autobiography *My Life* was published in 1937.

WELLS, Charles Jeremiah (pseudonym H. L. Howard), English poet: b. probably London, Eng., about 1799; d. Marseilles, France, Feb. 17, 1879. He was a friend of William Hazlitt, noted essayist, and of John Keats, poet. His outstanding work was the pseudo-Jacobean drama in verse, *Joseph and His Brethren* (1824) which won the praise of Dante Gabriel Rossetti, and was reviewed by Swinburne. Reprinted in 1876, it brought a considerable meed of praise to the author in his last years.

WELLS, David Ames, American political economist: b. Springfield, Mass., June 17, 1828; d. Norwich, Conn., Nov. 5, 1898. He was graduated from Williams College in 1847. In 1848, on the staff of the *Springfield Republican,* he invented a folding device to be attached to printing presses. In 1851 he graduated from the Lawrence Scientific School at Cambridge, where he was a special pupil of Louis Agassiz, and appointed assistant professor. While there he collaborated with George Bliss (1850) in the publication of *The Annual of Scientific Discovery* which he continued until 1866. In 1856 he made some improvements in the manufacture of textiles.

In 1864 Wells attained distinction as a political economist by the issuance of a pamphlet entitled *Our Burden and Our Strength* of which 200,000 copies were distributed. It discussed the resources of the United States in regard to the nation's debt-paying ability. It was translated into German, French, Dutch and other languages and helped in restoring domestic and foreign confidence in greenbacks and bonds which had fallen to one half their face value. It attracted the attention of President Lincoln and brought to Wells the appointment as chairman of the national revenue commission. In 1866 he was made special commissioner of revenue and the bureau of statistics was established. *The Reports of the Special Commissioner of the Revenue,* 1866–1869, recommended the use of stamps in the collection of revenue on liquor and tobacco. In 1870 the office was abolished. Wells at first was an advocate of the protectionist policy, but after a visit to Europe and a study of the English system he changed his views and became an advocate of free trade, and the abolition of the tariff. Later, he was counsellor on tariff matters to presidents Garfield and Cleveland.

In 1870 Wells was appointed chairman of the New York State Tax Commission, and in 1878 he became a member of the board of arbitration of the Associated Railways. He took an active interest in politics; was several times a delegate to Democratic national conventions. He was also an unsuccessful candidate for Congress to represent Connecticut in 1876 and 1890. His chief interests were tariff questions, the theory of money, the currency question, and taxation. He was an effective writer against fiat money or depreciated monetary standards; in 1896 a stanch opponent of "free silver" advocated by William Jennings Bryan; and an opponent of income taxes. Always an advocate of the policy of *laissez faire,* he was adept in the adaptation of statistics to popular fancy. Throughout his life Wells was a versatile and effective writer.

In 1857–1858, while a partner in the publishing business, he compiled: *The Science of Common Things* (1857); *Wells's Principles and Applications of Chemistry* (1858); and, later, *Wells's First Principles of Geology* (1861); and *Wells's Natural Philosophy* (1863) which went through 15 editions. Among his many other writings are: *The Relation of the Government to the Telegraph* (1873); *The Silver Question* (1877); *Why We Trade and How We Trade* (1878); *Our Merchant Marine* (1882); *A Primer of Tariff Reform* (1884); *Practical Economics*

(1885); *The Theory and Practice of Taxation* (1900).

WELLS, Frederic Lyman, American psychologist: b. Boston, Mass., April 22, 1884. After taking his Ph.D. at Columbia University in 1908, he was connected with the faculty there from 1905–1907 and again in 1910–1911. He was also assistant pathological psychologist at McLean Hospital, Waverly, Mass., 1907–1910, 1918–1921. From 1921–1928 he was chief of the psychological laboratory of Boston Psychopathic Hospital and in 1931 joined the faculty of Harvard Medical School, first as instructor, then as medical adviser to the hygiene department, and from 1938 until his retirement in 1950 he was psychologist of the school. During 1941–1946 he was consultant in the Office of the Adjutant General of the United States War Department. He has carried on special research in the mental measurements of superior adults.

He is the author of *Mental Adjustments* (1917); *Pleasure and Behavior* (1924); *Mental Tests in Clinical Practice* (1927); *Mental Examiners' Handbook* (1945).

WELLS, Herbert George, English novelist, sociological writer, and historian: b. Bromley, Kent, Sept. 21, 1866; d. London, Aug. 13, 1946. Born of a lower middle class family, he was apprenticed to a draper at the age of 13. Three years later, by educating himself, he was able to become an assistant master at Midhurst Grammar School. With the aid of a government scholarship, he attended the Royal College of Science, where he studied with Thomas Henry Huxley, taking his B.Sc. degree in zoology from London University in 1888, and his doctorate in 1944. For a time he worked as a private tutor in science, but in 1893 definitely turned to journalism, and in 1895 his first book, *Select Conversations with an Uncle,* was published.

An idealist and social reformer, Wells was constantly preoccupied with the problem of how to create a better society, a world order of peace and progress under the guidance of the highest intelligence. His persuasive criticism of existing social problems and his suggestive perceptions of the possibilities of various social and scientific developments exercised a widespread influence upon his generation.

Wells' fiction may be divided into three categories: fantastic scientific romances, often with overtones of social prophecy—*The Time Machine* (1895); *The Island of Dr. Moreau* (1896); *The Invisible Man* (1897); *The War of the Worlds* (1898); *The First Men in the Moon* (1901); *The Food of the Gods* (1904); *In the Days of the Comet* (1906); *The War in the Air* (1908); *The World Set Free* (1914); realistic, often humorous and satirical, novels of character and contemporary life—*Love and Mr. Lewisham* (1900); *Kipps* (1905); *Tono Bungay* and *Ann Veronica* (1909); *The History of Mr. Polly* (1910); *Mr. Britling Sees It Through* (1916); *Christina Alberta's Father* (1925); *The Bulpington of Blup* (1933); and ideological novels, which serve mainly as vehicles for his social and political theories—*The Research Magnificent* (1915); *Joan and Peter* (1918); *Men Like Gods* (1923); *The World of William Clissold* (1926); *Meanwhile* (1927); *Mr. Blettsworthy on Rampole Island* (1928); *The Shape of Things to Come* (1933). From a literary point of view, the novels written before 1920, with their wit, invention, and vitality, are by far the most satisfactory; his later fiction became increasingly discursive and didactic. His most important work of nonfiction is *The Outline of History* (1920), which together with *The Science of Life* (in collaboration with Julian Huxley and G. P. Wells, 1929) and *The Work, Wealth and Happiness of Mankind* (1932) forms a trilogy which considers mankind historically, biologically, and economically.

Other works of nonfiction include: *Anticipations* (1901); *Mankind in the Making* (1903); *A Modern Utopia* (1905); *The Misery of Boots* (1907); *New Worlds for Old* and *First and Last Things* (1908); *An Englishman Looks at the World* (1914); *Russia in the Shadows* (1920); *The Salvaging of Civilization* (1921); *A Short History of the World* (1922); *The Book of Catherine Wells* and *The Open Conspiracy* (1928); *Experiment in Autobiography* (1934); *World Brain* (1938); *The Fate of Man* (1939); *The New World Order* (1940); *Guide to the New World* (1941); *'42 to '44* (1944); and *Mind at the End of its Tether* (1945). From his youth a Socialist, Wells joined the Fabian Society in 1903, but had broken with the group by 1906.

WELLS, Horace, American dentist: b. Hartford, Vt., Jan. 21, 1815; d. New York, New York, Jan. 24, 1848. He studied dentistry in Boston, and practiced there until 1836, when he went to Hartford, Conn. From 1840 he was interested in the anesthetic effects of nitrous oxide, commonly known as laughing gas. Gardner Q. Colton's demonstrations of the effects of nitrous oxide inspired him to use it in a dental case before the Harvard medical class (1845), but the result, because the patient was not completely anesthetized, was unsatisfactory. He nevertheless used nitrous oxide gas in his practice.

Wells' claims to priority in the discovery of anesthesia were controverted in the interest of G.Q. Colton, Charles T. Jackson, William T. Morgan, J. C. Warren, and C. W. Long (qq.v.) each of whom shared in the honors of its discovery, regarding which priority remains a moot question. Wells became mentally unbalanced while advocating his claims in New York, and committed suicide. A statue stands to his memory in Bushnell Park, Hartford, Conn. He published *A History of the Application of Nitrous Oxide Gas, Ether and Other Vapors to Surgical Operations* (1947). See also ANAESTHETICS.

WELLS, Horace Lemuel, American chemist: b. New Britain, Conn., Oct. 5, 1855; d. New Haven, Conn., Dec. 19, 1924. He was graduated from Yale in 1877, instructor there 1884–1888, assistant professor of chemistry 1888–1893, professor of analytical chemistry and metallurgy 1893–1923, and emeritus thereafter. He made numerous original investigations in inorganic chemistry, and was elected to the National Academy of Sciences in 1903. He was the author of *Studies from the Chemical Laboratory of the Sheffield Scientific School* (1901); *Chemical Calculations* (1903).

WELLS, Rolla, American capitalist: b. St. Louis, Mo., June 1, 1856; d. there, Nov. 30, 1944. He entered business in the employ of a street and railway company and became assistant superintendent and finally general manager. Giving up the latter position in 1883, he became iden-

tified with a number of manufacturing and commercial firms. A democrat in politics, Wells served as mayor of St. Louis two consecutive terms, 1901–1909. From 1919 to 1927 he was receiver for the United Railways Company of St. Louis.

WELLS, William Charles, British physician: b. Charleston, S. C., May 24, 1757; d. London, England, Sept. 18, 1817. The son of a Scottish printer who settled in South Carolina in 1753, he was graduated an M.D. at the Edinburgh University in 1780. A year later he returned to America and after 1782 he published for a time a weekly newspaper in St. Augustine, Fla. In 1784 he settled in London to practice medicine and from 1800 until his death he was chief physician at St. Thomas' Hospital. Wells was elected a Fellow of the Royal Society in 1793 and in 1814 received the society's Rumford Medal for his *Essay on Dew* (1814), the first exact explanation of the phenomenon. He wrote several medical papers, among them *On Vision* (1811). A selection from his papers and his autobiography were published in 1818.

WELLS, municipal borough of England, in Somersetshire, at the foot of Mendip Hills, 17 miles south of Bristol. The name is derived from St. Andrew's Well, thought in the Middle Ages to possess curative value. A Roman settlement, Wells was an important town of Wessex in Saxon times. In 909 it became the seat of a bishop, later transferred to Bath. Bishop Jocelin returned to Wells and after 1246 the bishop took the title of bishop of Bath and Wells. The cathedral, though comparatively small, is one of the finest in England. It is Early English and the west front, adorned with over 300 sculptured figures, is one of the finest examples of the style. Started in 1186, the church was mostly built in the 12th and 13th centuries; the central tower, 182 feet high, the chapter house in Decorated style, and the fine lady chapel are 14th-century additions. Beautiful examples of the 15th-century woodwork are the oak stalls and bishop's throne. The cathedral, the moated 13th-century bishop's palace, the deanery, the Vicar's Close consisting of two rows of medieval houses for the clergy, are all enclosed by medieval walls. A theological college is located in Wells. In the subterranean caves of Wookey Hole near Wells prehistoric remains were found. Pop. (1951) 5,835.

WELLS, town, Maine, in York county, on the coast 27 miles south-southwest of Portland. It lies in an agricultural area and includes the beach resorts of Wells Beach and Ogunquit, the latter a headquarters of a summer theater group. The town was founded about 1640 and was incorporated in 1653. Pop. (1950) 2,321.

WELLS, town, Nevada, in Elko County, 45 miles northeast of Elko, at an altitude of 5,626 feet, on the Southern Pacific and Western Pacific railroads and the southern terminus of the Union Pacific. It has an airport and lies on the transcontinental highways U.S. 40 and 93. There are limestone quarries. Wells, a supply center for the cattlemen of the upper Humboldt River Valley, was settled in 1870 and incorporated in 1927. West of Wells is the East Humboldt Range, now part of the Humboldt National Forest. Pop. (1950) 947.

WELLS COLLEGE, a private college of arts and sciences for women in Aurora, N. Y.; the 300-acre campus is located on Cayuga Lake, in the heart of the Finger Lakes District. It is undenominational and accredited by the Association of American Universities and by the Middle States Association of Colleges and Secondary Schools. The college was founded in 1868 by Henry Wells, who at that time deeded to the trustees the main building and 20 acres of land; it was chartered as Wells College for the Higher Education of Young Women, and took the present name in 1870. In 1888 the main building was destroyed by fire, but immediately rebuilt. A preparatory course, maintained at first, was abolished in 1896, when the range of elective system was also greatly increased. The A.B. and B.S. degrees are now conferred for the completion of the course, which is largely elective, specially in the last two years. The student enrollment averages 305 a year; the faculty numbers about 45; and the library contains about 110,000 volumes. The college buildings include the main hall, Morgan Hall, a dormitory, a gymnasium, a science hall, and the administration building; the College Boat Club has erected a boathouse for its members.

WELLS AND WELL-SINKING. Wells are excavations for water or other substances such as petroleum, gas, or salt; well-sinking is, therefore, the operation by which deep holes of comparatively small diameter are sunk into the earth. Similar holes are drilled in search of coal, iron ore, and other minerals; although in this case water is not the object in view, work of this character may properly be regarded as well-sinking. The process of well-sinking usually implies also the casing of the well either to guard against the choking of the well or to shut out liquids from all strata except that which the well is designed to tap. Wells are variously classified according to the method of sinking, a dug, bored, driven, drilled and jetted; a curb, case or tube wells according to the manner of lining them; as open, shallow or deep; and as artesian, flowing, non-flowing and pumping.

As regards the dug well, the method employed is to excavate it with pick, shovel, or drill shoring the sides with stout planking as the excavation proceeds.

Boring or drilling, however, differs essentially from digging in that all the operations are conducted from the surface, the hole being from 3 to 27 inches or more in diameter. Two distinct methods of well-sinking are commonly included under the terms well-drilling and well-boring by which a hole is made, viz., the grinding with a rotating motion, and the pounding or shattering of rocks with a churning motion. The two methods are represented on the one hand by the diamond drill and the rotary outfit, and on the other by the rope drill or cable tool outfit; the last two are seen in their highest development in the drilling of wells for oil and gas. The first cuts or bores a hole, either cylindrical or annual, at any desired inclination, and works under pressure, while the other two, depending on sheer weight, sink a vertical hole. The diamond drill may be used for testing formations, and finds its greatest utility in exploring the harder inclined rocks for deposits of coal, iron and copper ore, the precious metals, etc. There are variations of the diamond drill used in vertical exploration for the pur-

pose of obtaining a sample or core of the rock encountered. For drilling to shallow depths and up to 1,000-2,000 feet, with the object of securing a hole through which water or other liquids may be lifted, the common apparatus used is the drilling machine, which is a portable outfit of the rope or churn drill class. The method of operation is similar to that of the heavier drilling apparatus or string. The Standard rig for rope tools consists principally of a derrick, belt house and engine house. The derrick, which is the prominent feature of an oil field landscape is a skeleton framework from 72 to 110 feet in height. The actual drilling tools consist of a connected series of solid steel bars, the main unit of which is the stem. The stem, a long round bar fitted with a milled pin at the upper end and a complementary box at the other, is usually 40 to 60 feet in length, and 4 to 6 inches in diameter; it serves the double purpose of aligning the hole and giving weight to the blow of the bit. The bit by means of its pin is screwed into the box of the stem. At the lower end of the bit is the cutting or hammering edge dressed out to the size of the hole to be carried down. Bits themselves have considerable weight, in some cases approaching a ton. Above the stem for ordinary drilling the rope socket is attached and is itself suspended from the rope used for lowering and raising the drilling tools and constituting the drilling rope. At some stages of the drilling it may be necessary to add to the tools a set of jars, and they are placed between the stem and rope socket. The jars like two links of a chain afford some play, so that a quick lift of the rope will impart a jerk to a bit which may have become stuck in a tight formation, and ward off the necessity of fishing for tools.

The first stage in cable tool drilling is that of spudding. When the drilling tools are in position above the opening in the derrick floor, it is seen that the rope suspending them runs over a pulley, called the crown pulley, which is set in the crown block on top of the derrick, and that the rope at its free end is wound on the shaft of the bull wheels at the back side of the derrick. The spudding outfit is a jerk line connection between the drilling rope near the bull wheels and crank of the power connection. By this arrangement a pull is exerted on the drilling rope lifting the tools, followed by a slackening which permits them to fall and begin the work of making the hole. By releasing the bull wheel brakes momentarily the driller is able to let out rope as required. There is some elasticity or spring to a manila rope or cable in contrast with the stiffness of a steel wire rope or line that makes the former especially desirable for shallow drilling. As soon as the surface soil and water are gone through, a piece of pipe or casing of ample diameter is set in the hole making a seal and thereby keeping the hole dry. However, in drilling, a quantity of water is run into the hole in order that the cuttings or drillings may be mixed into a mud which can be removed from time to time by means of the bailer. The bailer is a tube ordinarily about 20 feet long which can be let into the hole by means of a wire rope called the sand line; at its upper end is the bale for attaching the line, and at the lower end a valve with a dart. The projecting dart strikes bottom and lifts the valve for the inrush of mudded water, and as the bailer begins to ascend, drops the valve into place. The sand line runs from the derrick top to the sand reel beyond the derrick floor. All power used in handling tools is derived through the medium of the band wheel, which is set about midway between the derrick and the engine in the belt house. Power from the engine pulley is transmitted by means of a belt to the band wheel which revolves on the crank shaft. The sand reel operates through a friction pulley coming into contact with the face of the band wheel. On the side of the band wheel opposite the crank is fitted a tug pulley from which the bull ropes extend into the derrick and, when in use, operate the bull wheels in order to bring the drilling tools out of the hole. The entire drilling apparatus with its belting, ropes, and general construction of wood, can be viewed as adapted to an elastic transmission of power. Of this nature is the great mounted wooden timber which forms the walking beam and comes into use as soon as the spudding operation is finished. At its outer end the walking beam is connected with the crank by means of a pitman; inside the derrick it makes connection with the drilling rope by means of a temper screw and clamps. While the clamps hold the rope, the temper screw, which is essentially a screw five to six feet long supported in a threaded box, can be let out as the hole is deepened.

When a water bearing formation is encountered in drilling for oil and the quantity of water interferes with drilling, it is customary to seal off this formation by setting pipe, called casing, in the hole. Casing is made of steel or iron usually in joints of about 20 feet in length, and about 4 inches to 16 inches in diameter. The joints are screwed together as they are lowered into the hole. For handling casing there are special pulleys and wire lines. In California where casing followed the tools closely on account of caving formations, it was customary before the rotary method became general to use a separate wheel with shaft, called the calf wheel, for operating the casing lines. Drilling was then largely a process of under-reaming, by which a special bit, called the under-reamer, expanded below the casing and enlarged the hole sufficiently to lower it. After a string of casing is set, drilling is resumed through it in a contracted hole. A string of casing is generally set just before penetrating the formation from which production is expected. If there is no suitable cap rock for insuring a perfect seal, cement is used. At this point when the rotary method of drilling has been used, a change is often made to the cable tool method, in order to avoid mudding the formation containing the oil and gas. In some localities gas pressure makes drilling impossible; the well may be allowed either to drill itself in or blow off until the pressure is reduced sufficiently. After drilling is finished, the well is tubed by means of pipe usually of two to four inches diameter; and when it ceases to flow it is operated with pumping equipment, artificial pressure, or other means.

The cable tool method has in many fields been replaced by the rotary method, which at first was adapted only to the softer formations. This objection was largely overcome by using heavier material and special cutting devices Great advantages are that it seals the formations as they are met, and thereby dispenses with considerable casing and the time and cost of

handling it. The rotary outfit consists mainly of a string of pipe rotated by means of a table on the floor of the derrick; power is transmitted to the table by means of a chain or shaft drive from the engine. The pipe is raised and lowered by means of the draw works which take the place of bull wheels. On the derrick floor is a set of pumps, which force a fine mud mixture down through the rotary pipe and up along the walls of the hole, effectually plastering them. By means of sump holes near the pumps the cuttings which are carried up in the mixture can settle out, and the consistency of the mud be regulated. The pumps work under pressures of as many hundreds of pounds as necessary to secure circulation and seal gas formations. There are water holes through the bit attached to the bottom of the lowest joint of pipe. Ordinarily the bit is one called the fishtail on account of its shape. When it becomes necessary to change bits or for any other reason to remove the pipe from the hole, the pipe is set in stands on the derrick floor. To allow for this, the rotary derrick is made 120-200 feet in height. The rotary method is generally used in the Mid-Continent, Gulf Coast and California fields, as well as abroad, for deep well drilling. In some countries, as Canada and Galicia, a string of rods took the place of the cable. Wells have also been secured by driving pipe or points to shallow depths. The deepest well in the world in 1925 fell short of 8,000 feet. Now there are wells which have passed 15,000 feet in drilling depth, and there is a constant effort to improve machinery, tools and technique, in order that lower productive horizons may be penetrated. See also ARTESIAN WELLS; PETROLEUM.

WELLSBORO, borough, Pennsylvania, Tioga County seat; altitude 1,311 feet; 38 miles north-northwest of Williamsport; on the New York Central Railroad. In addition to the products of the surrounding region of farms, timber, natural gas wells, and coal mines, it produces lightbulbs and evaporated milk. Nearby Pine Creek Gorge is a tourist attraction. Settled in 1799 and incorporated in 1830, Wellsboro is governed by a burgess and council. Pop. (1950) 4,215.

WELLSBURG, city, West Virginia, Brooke County seat; altitude 635 feet; 16 miles north-northeast of Wheeling; on the Ohio River, and the Pennsylvania, and the Pittsburgh and West Virginia railroads. It is in the coal region of the northern panhandle of the state; sheep, cattle, and apples are raised in the surrounding area. Its industries include oil cans, cement and flour bags, paper bags, and glassware. Wellsburg was founded in 1790, and is governed by a mayor and council. Pop. (1950) 5,787.

WELLSTON, town, Missouri, in St. Louis County and a suburb of St. Louis. A business and manufacturing center, Wellston was incorporated in 1949 and is governed by a mayor and council. Pop. (1950) 9,396.

WELLSTON, city, Ohio, in Jackson County; altitude 700 feet; 26 miles east-southeast of Chillicothe; on the Baltimore and Ohio, and the Chesapeake and Ohio railroads. In a region of iron, coal, limestone, and clay, it was formerly a coal mining and smelting center, but the manufacture of machinery, tools, clothing, and store fixtures is now more important. The site was first settled in 1871; the town is named after Harvey Wells who set up a blast furnace here in 1874. Incorporated in 1876, it is governed by a mayor and council. Pop. (1950) 5,691.

WELLSVILLE, village, New York, in Allegany County; altitude 1,517 feet; 20 miles southwest of Hornell; on the Genesee River, and the Erie, and Baltimore and Ohio railroads. A summer resort in an agricultural and dairying area, it is also a refining center for the Allegany County oil field. It manufactures oil and gas well supplies, turbines, and aircraft parts. Named after Gardiner Wells, one of the original settlers in 1795, it was incorporated in 1871 and is governed by a mayor and council. Pop. (1950) 6,402

WELLSVILLE, city, Ohio, in Columbiana County; altitude 708 feet; 16 miles north of Steubenville, on the Ohio River and the Pennsylvania Railroad. It is in a farming, dairying, fruit growing, and coal mining region. Valuable clay deposits in the vicinity make possible the manufacture of pottery, chinaware, and bricks, the city's chief industries. There are also machine and railroad shops. William Wells and others from Washington County, Pennsylvania, first settled here in 1797. Chartered in 1890, the city is governed by a mayor and council. Pop. (1950) 7,854.

WELSBACH LIGHT. See GAS ILLUMINATION, HISTORY OF.

WELSER, vĕl'zĕr, **Bartholomäus,** German merchant prince: b. Augsburg, 1488; d. Amberg, Swabia, 1561. Son of an important merchant of Augsburg, on his father's death he and his brother Anton formed the commercial and banking firm of Welser and Company. Their business prospered and they became bankers to the emperor Charles V, to whom they made large loans. In return, Bartholomäus was made a nobleman of the empire, given a general safe conduct and the privilege of exemption from some local courts. Finally, unable to repay his debts, Charles granted the firm (1528) exclusive rights to the exploitation of the Spanish colony of Venezuela. The Welsers monopolized the import and export trade and attempted to colonize the country. Disputes with the Spanish government, however, prevented the undertaking from proving profitable, and a legal decision in 1546 returned the colony to the Spanish crown. Bartholomäus retired from business in 1553.

WELSH, Herbert, American reformer: b. Philadelphia, Pa., Dec. 4, 1851; d. Montpelier, Vt., June 28, 1941. He was graduated from the University of Pennsylvania in 1871; studied art in Philadelphia and with Bonnat in Paris; and practiced as an artist in Philadelphia for several years. A visit to the Sioux reservation led him to begin a movement which resulted in the organization of the Indian Rights Association to secure just and consistent treatment of the Indians by the government. He was corresponding secretary for 34 years and for 11 years president of this association, which was instrumental in securing the passage of a bill providing for the individual ownership of land by Indians and for the

extension of the civil service law to the Indian service.

As an advocate of good government, he played a leading part in the revolt against "boss rule" in Pennsylvania which secured the election of Robert E. Pattison (q.v.) as governor in 1890. He lectured and wrote on municipal government and civil service reform, and in 1895 established *City and State,* a weekly periodical, which he edited until 1904. He was a champion of international arbitration, and strongly opposed the forceful acquisition of the Philippines, helping to expose the behavior of the army there.

He wrote *Four Weeks among Some of the Sioux Tribes, Civilization among the Sioux Indians, A Visit to the Navajo, Pueblo, and Hualapai Indians, The Other Man's Country,* and *The New Gentleman of the Road.*

WELSH, John, American merchant: b. Philadelphia, Nov. 9, 1805; d. there, April 10, 1886. He was educated in his native city, where he became prominent in business and was active in public affairs in many capacities, having large railroad and financial interests. He was a member of the sinking fund commission, president of the Philadelphia Board of Trade, etc., and rendered efficient service in promoting relief measures during the Civil War, especially in connection with the Philadelphia Sanitary Fair, in 1864, of which he was president, and which raised over $1,000,000 for army hospital work. In 1873 he became president of the board of finance of the Centennial Exhibition, receiving from the citizens of Philadelphia, at its close, a gold medal and the sum of $50,000, with which he endowed the John Welsh chair of history and English literature in the University of Pennsylvania. In 1878 he went as minister to England, but in the following year resigned.

WELSH, Robert E., Scottish clergyman and educator: b. New Cumnock, Mar. 20, 1857; d. Ayr, Scotland, Sept. 1, 1935. Educated at Glasgow and Edinburgh universities, he was ordained to the Presbyterian ministry in 1880. He was minister of churches in Yorkshire, London, and Hove. General secretary of the Canadian Bible Society (1905–1907), he was for many years thereafter professor of the history and philosophy of religion at McGill United Theological College, Montreal. His books include *Man to Man* (1905) and *Classics of the Soul's Quest* (1922).

WELSH CALVINISTIC METHODISTS, a designation sometimes given to the Calvinistic Methodists, because Wales is the great seat of the sect. The Calvinistic Methodists are distinguished by their Calvinistic sentiments from the ordinary Wesleyans, who are Arminian. Whitfield is regarded as the father and founder of Calvinistic Methodism. Members of this sect have been active in seeking to bring about the disestablishment of the Anglican Church in Wales. See also Presbyterian Church in the United States of America.—*The Welsh Calvinistic Methodist.*

WELSH LANGUAGE AND LITERATURE. See Celtic Languages.

WELWITSCHIA, wĕl-wĭch'ĭ-ȧ, a genus of plants of the family Gnetaceae, containing only one species, *W. mirabilis.* This species is confined to the deserts of Southwest Africa, where it was discovered in 1860 by Friedrich Welwitsch. It has a short and top-shaped stem which never grows much above the surface, but increases in thickness until it may be three feet in diameter, and bears a pair of large opposite leaves. These leaves last throughout the whole lifetime of the plant and become ultimately torn up longitudinally into long strips, which trail on the surface of the ground. Two cotyledons which are like short-lived leaves of much smaller size precede them. The flowers of the plant grow in cones like those of many conifers, the cones being arranged in panicles on the end of the stem between the two leaves. The female cones are much larger than the male ones and in fruit are of a scarlet color.

WEMYSS - CHARTERIS - DOUGLAS, Francis, 10th Earl of Wemyss: b. Edinburgh, Scotland, Aug. 4, 1818; d. London, England, June 30, 1914. Educated at Edinburgh Academy and Christ Church, Oxford, he became (1841–1846) member of Parliament for East Gloucestershire, then (1847–1883) member for Haddingtonshire. He was a lord of the Treasury 1852–1855. Thereafter, styling himself a liberal-conservative, he acted independently in the Commons, opposing the growth of state interference but championing a number of reform measures. An organizer of the volunteer movement of 1859, he was a vocal advocate and critic of military reforms until his death. He was made an aide-de-camp to Queen Victoria in 1881, and entered the House of Lords in 1883.

WEN, an encysted tumor, or sebaceous cyst varying in size, occurring in different parts of the body, but mostly on the scalp and neck; commonly situated immediately under the skin. The causes of their formation are not understood, but a strongly marked tendency to such swellings exists in particular individuals, leading to the belief in constitutional causes. At its commencement the wen is indolent, and it is often many years before it attains any considerable size. It is enclosed in a sac, its contents being sometimes sebaceous matter, in other cases serum, or a thin fetid brown or black fluid. Sometimes the sac contains cartilaginous or even osseous matter. Frequently the sac, especially when small, may be punctured, and its contents pressed out; but sometimes this gives rise to very severe inflammatory action. Another and safe mode of treatment is to dissect them out with the knife wherever their position will admit of it, care being taken to remove the whole of the cyst.

WENATCHEE, wĕ-năch'ē, city, Washington, Chelan County seat, is situated at the junction of the Columbia and Wenatchee rivers, 60 miles north-northeast of Yakima, at an altitude of 642 feet. It is served by the Great Northern Railroad and Northwest Airlines.

It is the site of Wenatchee Junior College, Chelan County Hospital, the Washington State College Fruit Tree Experiment Station, and the North Central Washington Museum. The region attracts many tourists; Wenatchee and Chelan National Forests are nearby.

Founded in 1888 and incorporated in 1900, the city has a commission form of government. Pop. (1950) 13,072.

WENATCHI. See Salishan Indians.

WENCESLAUS, wĕn'sĕs-lâs or -las, or **WENZEL,** emperor of Germany and king of Bohemia: b. 1361; d. Prague, Aug. 16, 1419. He was the son of Charles IV (q.v.), whom he succeeded in 1378. In 1394 the Bohemian nobility formed a conspiracy against him and held him prisoner at Prague, but later released him. Through the influence of the archbishop of Mainz, whose enmity he had aroused by demanding the resignation of the rival popes, Benedict XIII and Boniface IX, he was deposed by the Imperial electors, while the Elector Palatine Rupert was chosen to succeed him. In Bohemia he supported John Huss (q.v.) and the latter's party, and in 1409 compelled by a decree the departure of the Germans from the University of Prague. Shortly afterward he resigned the royal title. Consult Lindner, 'Geschichte des Deutschen Reiches unter König Wenzel' (1875–80).

WEND LANGUAGE. The language of the Wends is similar to the other branches of the northwestern stem of the Slavic languages, the Polish and the Bohemian. It is divided into the dialect of Lower Lusatia, which is but little developed, and that of Upper Lusatia. The latter is subdivided into the Evangelical dialect, near Bautzen; the Catholic dialect, near Kamenz, and in the northwest; and the northeastern dialect. The differences are mostly confined to shades of pronunciation. The stock of words in the present language of the Wends is largely mixed with German elements. Orthography has always been in a very unsettled condition. In their publications, the Wends have mostly made use of the German letters. There are eight vowels, *a, o, u, e, i,* all of which are pronounced as in German and Italian, *ó* (between *o* in *note* and *u* in *full*), *é* (like long English *e*), and *y* (approaching the German *ü*). There are 32 consonants. There is no article. Nouns ending in a consonant are mostly masculine, those in *a* and *i* feminine, and those in *o* and *e* neuter. There are seven declensions. The language has a dual number. There are seven cases. The adjectives end in *y, i* (masculine), *a* (feminine), *o* and *e* (neuter). The comparative is formed by the termination *isi,* and in order to form the superlative the syllable *naj* is placed before the comparative. The personal pronouns are irregular; the others are declined like adjectives. The verb has six tenses and five moods, besides a gerund; and three participles. Till about the middle of the 19th century Wendish literature consisted almost wholly of ecclesiastical and religious works, and works relating to the needs of peasant life, but there has since been a revival of national feeling, accompanied by a more extended literature. There are grammars of the Wendish language by Ticinus (Prague 1679); Matthäi (1721); Seiler (Bautzen 1830), and Jordan (Prague 1841)

WENDELL, Barrett, American educator and author: b. Boston, Mass., 23 Aug. 1855; d. 8 Feb. 1921. Graduated, Harvard 1877, studied, Harvard Law School, in 1880–88 was instructor in English at Harvard, in 1888–98 assistant professor, and in 1898 became professor. He was Clark lecturer at Trinity College, Cambridge, England, in 1902. Among his works are 'The Duchess Emilia' (1885); 'Rankell's Remains' (1897); 'English Composition' (1891); 'Cotton Mather' (1891); 'Stelligeri, and Other Essays Concerning America' (1893); 'William Shakespere' (1894); 'A Literary History of America' (1900; in the 'Library of Literary History), a scholarly work, though much criticized for its unjust attitude toward certain writers; and 'Raleigh in Guiana' (1902), an attempt at imitation of the Elizabethan drama; 'Liberty, Union and Democracy' (1906); 'The Mystery of Education' (1909).

WENDS, a former powerful Slavic tribe settled in Germany, now represented by the Slavic people of Upper and Lower Lusatia, who call themselves Serbs (*Serbjo*), whence the name Sorbs, often applied to them by German authorities. In the earliest historical times the Sorbs occupied the country from the Saale to the Bober, and from the latitude of Berlin south to the Erzgebirge; but the Wends are now confined to a small territory (about 1,270 square miles) in the upper Spree Valley, extending from south of Bautzen to north of Kottbus. The larger part of this Wendish region belongs to the Prussian provinces of Brandenburg and Silesia, the smaller southern part being included in the Free State of Saxony (circle of Bautzen). The Wends are completely surrounded by Germans, and being thus cut off from contact with the other Slavs, they are becoming slowly Germanized. Their language, known as Sorbian, falls into two dialects Upper and Lower Sorbian, which are spoken in the south and the north of the territory, respectively. (See WEND LANGUAGE). The total number of Wends is about 120 000, of whom about 50,000 live in Saxony and 70,000 in Prussia. About 12,000 are Roman Catholics, the remainder being chiefly Lutherans.

WENER, vā'nĕr, or **VENERN,** Sweden, the largest lake of the country, and after those of Ladoga and Onega the largest in Europe, situated centrally between the läns of Wermland, Dalsland and Wester Götland. It is 147 feet above sea-level, and of irregular shape. Its greatest length, northeast to southwest, is about 90 miles; and its breadth may average about 30 miles, though in its southern part, where two peninsulas stretch far into it from opposite directions, it is not more than 15 miles. This distance is still further narrowed by a group of small islands, and hence the part of the lake above these peninsulas is sometimes considered as Wener proper, while the part below is called Lake Dalbo. The area covered by both is about 3,000 square miles. By far the most important feeder is the Klar-elf, which pours in at its north end the accumulated water of a course of more than 250 miles. Its only proper outlet is at Wenersborg at its southwestern extremity, where its superfluous waters are received by the Göta-elf, flowing thence to the Cattegat. In summer steamers and other vessels ply regularly upon the lake; in winter it is frozen for several months, and crossed by sledges. It abounds with fish, particularly trout. The Göta Canal connects Lake Wener with Lake Wetter, and the Dalsland Canal connects it with Fredrikshald in Norway.

WENLEY, Robert Mark, American educator: b. Edinburgh, Scotland, July 1861. He

was graduated from the University of Glasgow in 1884, and later studied in Edinburgh and on the Continent. He was head of the philosophical department of Queen Margaret College, Glasgow, 1888–95 and thereafter head of the same department at the University of Michigan. Author of 'Socrates and Christ' (1889); 'Preparation for Christianity in the Ancient World' (1898); 'Kant and His Philosophical Revolution' (1910); 'The Anarchist Ideal' (1913); 'Robert Flint' (1914); 'G. S. Morris's Life and Work' (1917); 'Stoicism and Its Influence' (1924); 'Poetry of John Dryden' (1924). He was an associate editor of the 'Dictionary of Philosophy' and the 'Encyclopedia of Religion and Ethics.' Died, 29 Mar. 1929.

WENLOCK GROUP, a British formation of the Upper Silurian geological series. It includes shales and limestones, and is below the Ludlow group and above the Upper Llandovery group, these three comprising the Upper Silurian groups. The Wenlock formation is about 4,000 feet thick, and the fauna has been classed as consisting of 171 genera and 530 species, but many supposed vegetable remains are almost certainly not such. See SILURIAN.

WENSLEYDALE, wĕnz'lĭ-dāl, **James Parke,** BARON, English jurist: b. Highfield, near Liverpool, 22 March 1782; d. Ampthill Park, Bedfordshire, 25 Feb. 1868. Graduated from Trinity College, Cambridge, in 1803, he was called to the bar at the Inner Temple in 1813, went the northern circuit and became known for his wide knowledge of common law. In 1828 he was made a justice of the Court of King's Bench, in 1834 was transferred to the Court of the Exchequer. Here he remained strongly influential until his resignation in 1856, when he entered the Lords as Baron Wensleydale of Walton (Lancaster). In Parliament he spoke rarely, and chiefly on legal questions. His judgments were highly ranked. Consult Foss, 'The Judges of England' (1848–64), or the abridgment of the same, 'Biographia Juridica' (1870); Manson, 'Builders of Our Law' (1895).

WENTLETRAP, a gastropod mollusk, allied to the turret shells and of the genus *Scalaria,* in which the shell is turreted, spiral and ornamented with elevated rib-like processes, crossing the whorls lengthwise of the shell. In some species the spiral is closed; but in the "true" wentletraps the whorls are open, that is, separated. Of the former, some are found in northern seas, and the latter are all natives of warm seas. They are inhabitants of deep waters, but their shells are cast up in great numbers on sandy coasts. They are carnivorous in habits. The famous precious wentletrap, or royal staircase (*Scalaria pretiosa*), formerly brought prices ranging as high as $250 when purchased for the conchologist's cabinet, but its value in the present day is small. Its shell is about two inches long, and twisted in a wide spiral form, and is generally pale-yellow with white ribs.

WENTWORTH, wĕnt'wĕrth, **Benning,** English governor of New Hampshire: b. Portsmouth, N. H., 24 July 1696; d. there, 14 Oct. 1770. He was graduated at Harvard in 1715, became a merchant at Portsmouth, which town he frequently represented in the provincial assembly, was appointed a king's councillor in 1734, and when in 1741 New Hampshire was made a distinct province he became its governor. He so continued until 1767, when he resigned. He was authorized by the Crown to grant patents of unoccupied land, and in 1749 began making grants on the west side of the Connecticut River, in what is now southern Vermont. These grants were considered by the colonial government of New York as within its domain, and, as Governor Wentworth stoutly maintained for a time his authority, the collision so famous in the history of Vermont respecting the New Hamphshire grants ensued. (See VERMONT, *History*). Governor Wentworth exacted heavy fees for his grants of land, and thus accumulated a large property, and in all of them stipulated for the reservation of a lot for an Episcopal church. The town of Bennington, Vt., was named in honor of him. After his resignation as governor he gave to Dartmouth College 500 acres of land, on which the college buildings were erected. For an account of his second marriage, consult Longfellow's poem 'Lady Wentworth.'

WENTWORTH, Charles Watson. See ROCKINGHAM, 2D MARQUIS OF.

WENTWORTH, George, American mathematician, son of G. A. Wentworth (q.v.): b. 1868. He was graduated at Harvard University in 1888, and from 1894 was his father's assistant in the compilation of text-books. Since his father's death in 1906 he has collaborated with D. E. Smith (q.v.) in preparing the Wentworth-Smith mathematical series.

WENTWORTH, George Albert, American mathematician: b. Wakefield, N. H., 31 July 1835; d. Dover, N. H., 24 May 1906. He was graduated from Harvard in 1858, and in 1858–91 was professor of mathematics at Phillips Exeter Academy. With G. A. Hill he prepared a series of textbooks on algebra, arithmetic, geometry and physics, and he was author of the Wentworth Series of mathematical works comprising about 40 volumes, among which are 'Elements of Geometry' (1878); 'Surveying and Navigation' (1882); 'Higher Algebra' (1891), etc.

WENTWORTH, SIR **John,** English colonial governor of New Hampshire, and afterward of Nova Scotia: b. Portsmouth, N. H., 9 Aug. 1737; d. Halifax, N. S., 8 April 1820. He was a nephew of Benning Wentworth (q.v.). He was graduated at Harvard in 1755, being a classmate of John Adams, became a merchant, and in 1765 was the agent of New Hampshire to present petitions in England. While there he was appointed to succeed Benning Wentworth as governor of New Hampshire. At the same time he was made "surveyor of the king's woods" for all North America. Having landed at Charleston, S. C., in March 1767, he traveled through the colonies, registering in each his commission as surveyor, and arrived at Portsmouth in June. The office of governor was at that time an extremely difficult one by reason of the increasing discontent of the colonists. At the first, Wentworth's administration was very popular. He remonstrated against the taxes imposed by the English government, but sought to maintain the loyalty of the colony, and was successful in pre-

venting the assent of Portsmouth to the non-importation agreements until 1770. In this he was aided by the fact that the Portsmouth merchants were disinclined to forego such profits as they might still obtain despite the crippled state of commerce. When the last attempt was made to compel the colonies to receive East Indian tea, he took advantage of lack of instructions from the government, and had the consignee reship the cargo to Halifax. His authority ended, however, when it was learned that he had endeavored to comply with the request of Gen. Thomas Gage to obtain carpenters to construct barracks for the British troops at Boston, after Massachusetts workmen had refused the task. On Dec. 14, 1774, an armed attack was made on Fort William and Mary (now Fort Constitution) on Great Island, at the entrance to Portsmouth Harbor, and 100 barrels of powder and some cannon and muskets were taken. Wentworth finally found it advisable to withdraw to the fort, and then to a warship in the harbor. At the Isle of Shoals he prorogued the assembly, his last official act. He went to Boston, and thence, in 1775, to England. In 1783 he was reappointed surveyor of the king's woods, and in 1792 he was made lieutenant governor of Nova Scotia; he relinquished this office in 1808, but continued to reside in that country until his death. He was created baronet in 1795. As colonial governor, he chartered Dartmouth College in 1769, presenting it with 44,000 acres of land. His estate at Wolfeboro, N. H., was confiscated after his departure. Nine manuscript volumes of his correspondence are in the public records of Halifax, Nova Scotia.

WENTWORTH, John, American journalist: b. Sandwich, N. H., March 5, 1815; d. Chicago, Ill., Oct. 16, 1888. He was graduated from Dartmouth in 1836 and in the same year went to Chicago where for 25 years he was owner and editor of the *Democrat*. He studied law, was admitted to the bar in 1841, and in 1843 was elected to Congress, where he served six terms. He introduced the first steam fire engine into Chicago, was active in procuring the city charter, and was an earnest promoter of the public school system; and in 1857 and 1860 he was elected mayor. In 1861 he dissolved his connection with the *Democrat,* but did not retire from active life for many years. He gave $10,000 to Dartmouth College, and was president of its alumni in 1883; he wrote *Descendants of Elder William Wentworth* (1850) and *History of the Wentworth Family* (1878).

WENTWORTH, Thomas. See STRAFFORD, 1ST EARL OF.

WENTWORTH, William Charles, Australian patriot: b. Norfolk Island, New South Wales, Oct. 26, 1793; d. near Wimbourne, Dorsetshire, England, March 20, 1872. The son of the government surgeon at the penal colony on Norfolk Island, he was educated in England, after graduating at Cambridge University, studying law at the Middle Temple, and being admitted to the bar in 1822. Returning to Australia, he speedily gained a large law practice in Sydney, where he became a champion of the "emancipists" (liberated convicts) as against the "exclusivists" (officials) and "interlopers" (voluntary immigrants), and advocated self-government for Australia. In 1824 he was one of the founders of the *Australian,* a newspaper in which he put forth his views, and with others he formed the Patriotic Association, which campaigned against the colonial administration in both Australia and England. He was mainly responsible for the recall of the governor, Sir Ralph Darling, in 1831; and the Constitution Act of 1842, which secured self-government for the colony, was largely due to his efforts. In 1843 he became a member of the first legislative council, leading the "squatter" party. He founded Sydney University in 1852, and two years later he secured a new constitution for New South Wales. For several years thereafter he lived in England where, in 1857, he founded the General Association for the Australian Colonies, which advocated a federal assembly for all the Australian colonies. Visiting Sydney in 1861, he served briefly as president of the new legislative council. In 1862 he returned once more to England, where he continued to work for a federal parliament for all Australia until his death. His efforts were eventually culminated in establishment of the Commonwealth of Australia in 1901. His body was taken to New South Wales, the legislature unanimously according him a public funeral. He wrote *A Statistical Account of the British Settlements in Australasia* (1819); *Australasia,* a poem (1823).

WEREWOLF, wēr'wo͝olf, a human being transformed into a wolf, according to a belief which has prevailed in all ages among ignorant and superstitious communities. Herodotus, with great naïveté, tells us that when he was in Scythia he heard of a people which once a year changed themselves into wolves, and then resumed their original shape; "but," adds he, "they cannot make me believe such tales, although they not only tell them, but swear to them." But the lycanthropes of the Middle Ages, or *loups-garous,* as they were called by the French, were sorcerers, who during their wolfhood had a most cannibal appetite for human flesh. The Germans called them *Währwölfe.* Many marvelous stories are told by the writers of the Middle Ages of these wolf-men or *loups-garous,* and numerous authentic narratives remain of victims committed to the flames for this imaginary crime, often on their own confessions.

It is certain that faith in the power of witches to assume the shape of animals, such as wolves, dogs, cats, or horses, existed at a comparatively recent time. An old writer says that "the werewolves are certain sorcerers, who, having anointed their bodies with an ointment which they make by the instinct of the devil, and putting on a certain enchanted girdle, do not only unto the view of others seem as wolves, but to their own thinking have both the shape and nature of wolves, so lông as they wear the said girdle; and they do dispose of themselves as very wolves, in worrying and killing, and most of human creatures."

The werewolves were said to have in some instances a special hatred of religion and its devotees, and this, coupled with the charge of devouring human flesh, left no doubt as to the fate of anyone who fell under suspicion of being a werewolf. The superstition itself was doubtless due in part to the brutal and savage aspect of human beings who, owing to melancholia or other forms of insanity, went wild in the woods—an occurrence not infrequent in re-

mote districts in the Middle Ages. It was also in all probability connected with the belief, which was a prominent feature of mythology, in the power of the gods and inferior spirits to enter the bodies of animals, and with the doctrine of transmigration of souls, common alike to the ancient Egyptians, the followers of Pythagoras, and the Hindus. See WITCHCRAFT.

WERFEL, vĕr'fĕl, **Franz V.,** Austrian poet, novelist, and dramatist: b. Prague, Bohemia (later Czechoslovakia), Sept. 10, 1890; d. Hollywood, Calif., Aug. 26, 1945. The son of a wealthy Jewish industrialist, he was educated at the universities of Prague and Leipzig, and in 1910, because his father opposed his writing of poetry as foolishness, he left for Hamburg and secured work in a shipping house. It was at this time that he published his first book of poems, *Der Weltfreund* (1911), which was animated by the idea of the community of souls in all living things. Other poetical works followed, and he became recognized as the leader of Germany's militant group of youthful literary iconoclasts. At outbreak of World War I in 1914 he was employed as a reader by the Leipzig publishing house of Kurt Wolff. He fought in the Austrian army on the Russian front until 1917, when he was transferred to the war press bureau in Vienna. In 1918 he married Alma Marie Schindler, widow of Gustav Mahler, the composer, and after the war made his home in Vienna, where he turned to novel writing. His first work published in the United States was *Verdi* (1925), a biographical novel which was made into a motion picture in Italy. In 1926 two of his plays, *The Goat Song* and *Juarez and Maximilian,* were produced in New York City. His *Forty Days of Musa Dagh* (1933), a long novel of the heroic defense of a little band of Armenians against Turkish attempts to annihilate them, was a great success both in German and in English translation. Outspoken in his opposition to the Nazis, he was expelled from the Prussian Academy of Art in 1933; and when the Germans entered Austria in 1938 he moved to Paris. Delayed in leaving for Spain after the fall of France to the Germans in 1940, he found temporary haven at Lourdes, and there he first heard the story of Bernadette Soubirous, whose story he was inspired to write. Reaching the United States late in 1940, he turned out *Das Lied von Bernadette* (1941), translated by Ludwig Lewisohn as *The Song of Bernadette* (1942). It immediately won wide acclaim, the book being translated into seven languages, and the motion picture of it winning several awards. Another indirect result of his flight from the Nazis was a play, *Jacobowsky and the Colonel* (1944), written in collaboration with Samuel Nathaniel Behrman and produced in New York City.

Werfel's works of fiction translated into English include, besides those mentioned above, *The Man Who Conquered Death* (1927); *The Glass Reunion* (1929); *The Pure in Heart* (1929); *The Pascarella Family* (1932); *Twilight of a World* (1937); *Hearken Unto the Voice* (1938); and *Embezzled Heaven* (1940). Other dramas in English translation were *The Eternal Road* (1936) and *Paul Among the Jews* (1943). *Between Heaven and Earth* (1944) was a book of essays.

WERFF, vĕrf, **Adriaen van der,** Dutch historical and figure painter: b. near Rotterdam, Jan. 21, 1659; d. Rotterdam, Nov. 12, 1722. After studying in Amsterdam under Aart van der Neer he settled in Rotterdam where, in 1696, he attracted the notice of John William, the elector palatine; he became court painter, and in 1703 was ennobled. Among his celebrated paintings are the *Judgment of Solomon; Christ Carried to the Sepulchre; Ecce Homo; Abraham with Sarah and Hagar,* and *Magdalen in the Wilderness.* Van der Werff was particularly noted for his small historical pieces, which are most exquisitely finished, and are still in high request. His brother and pupil, PIETER VAN DER WERFF (1665–1718), painted portraits and domestic pieces.

WERGELAND, vĕr'gĕ-län, **Henrik Arnold,** Norwegian lyric poet and dramatist: b. Kristiansand, June 17, 1808; d. Kristiania (Oslo), July 12, 1845. He studied at Kristiania in 1836 became custodian of the university library, and in 1840 keeper of the Norwegian archives. He was one of the leaders of the Ultra-Norwegian party, waging war on all things Danish, but found opponents in Johan S. C. Welhaven and the latter's school. In 1830 he published the dramatic poem *The Creation, Man, and Messiah,* a work of formidable length and slight literary merit. His chief publications are the narrative poems, *Jan van Huysum's Flower-Piece* (1840); *The Swallow* (1841); *The Jew* (1842); *The Jewess* (1844), and *The English Pilot* (1844), which take high rank in Norwegian verse. His complete collected works appeared in 1852–1857, a selection in 1859.

WERGILD, in Anglo-Saxon law, a fine inflicted as a penalty for murder or maiming. The amount, which had to be paid to the next-of-kin or gild brethren, in case of death, varied according to status. The wergild for taking the life of the king was 7,200 shillings; for an eolderman, 2,400 shillings; a king's thegn, 600; and a ceorl, 200. In the Anglo-Saxon period an alderman or eolderman was a much more important personage than the alderman of today, the aldermen of all England being the first subjects of the realm, and other aldermen being governors of counties. Even kings were called aldermen. The thegn, or thane, was a minor noble, and the ceorl, or churl, a tenant-at-will of the thane, or he might be simply a serf or farm laborer. As the value of money, measured by its purchasing power, was far greater than today, the wergild for king and alderman, and even for thane, must have been prohibitory save for the wealthiest members of the community, or when the state assumed the burden of payment, as in the case of an enemy of high rank killed in war, whose relatives were able to wreak vengeance for his death.

WERNER, vĕr'nĕr, **Abraham Gottlob,** German mineralogist: b. near Bunzlau, Sept. 25, 1750; d. Dresden, June 30, 1817. In 1775 he was appointed inspector and teacher of mineralogy and mining in the Mining Academy at Freiberg, in which position he remained for the rest of his life. He was the first to separate geology from mineralogy, and to place the former on the basis of observation and experience. The geological theory with which his name is connected is that which attributes the phenomena exhibited by the crust of the earth to the action

of water, and is known as the Wernerian or Neptunian theory (q.v.), in contradistinction to the Huttonian or Plutonic. He was nominated counselor of the mines of Saxony in 1792, and had a great share in the direction of the Academy of Mining, and in the administration of public works. He published *Kurze Klassification und Beschreibung der Gebirsarten* (1787); *Neue Theorie über die Entstehung der Gänge* (1771).

WERNER, Alfred, Swiss chemist: b. Mulhouse, Alsace, Dec. 12, 1866; d. Zürich, Switzerland, Nov. 15, 1919. He was educated at the technical schools of Karlsruhe and Zürich, and became assistant at Zürich Polytechnic in 1889; later he was at the College of France, and from 1895 to 1919 he was professor at the University of Zürich. In 1913 he was awarded the Nobel Prize in chemistry. He developed an extension of the valence hypothesis, and introduced the concept "coordination number" of elements which led to valuable discoveries. He was joint author of *Ueber die räumliche Anordnung der Atome in stickstoffhaltingen Molekülen* (1891). His own works included *Beiträge Zur Theorie der Affintät und Valenz* (1891); *Beiträge zur Konstitution anorganishcher Verbindungen* (1893); *Lehrbuch der Stereocheime* (1904); *Uber die Konstitution und Konfiguration von Verbindungen hoherer Ordung* (1914).

WERNER, Anton Alexander von, German historical and portrait painter: b. Frankfurt-on-the-Oder, May 9, 1843; d. Jan. 5, 1915. He studied at the Berlin Academy at Karlsruhe, and later in Paris and Italy. He executed several state commissions after his return from Italy, and was commissioned to accompany the general staff of the Third Army corps in France during the Franco-Prussian War. He became professor at the Berlin Academy in 1875. His paintings, particularly those of the Franco-Prussian War, are of considerable historic value. Among his works are *The Capitulation of Sedan; Meeting of Bismarck and Napoleon III at Donchery; Proclamation of the German Empire at Versailles; The Congress of Berlin;* and several portraits of Emperor William II.

WERNERITE, an important rock forming mineral, occurring in cleavable-granular, indistinctly-fibrous or columnar masses, or often in large, coarse crystals. These are tetragonal prisms terminated by pyramids, and show good prismatic cleavage. The hardness is 5 to 6 and specific gravity about 2.7. The most common colors are white or gray; lilac is also quite abundant; occasionally greenish and brick red varieties are found. Wernerite is a member of the scapolite group (q.v.) and is intermediate in composition between meionite and marialite, being a silicate of aluminum, calcium, and sodium, with chlorine. It usually occurs in crystalline limestone. Among its many localities a few of the most important are Arendal, Norway; Bolton, Mass.; northern New York; Ontario and Quebec. The mineral was named in 1800 for Abraham Gottlob Werner (q.v.).

WERNHER, wûr'nĕr, Sir **Julius Charles,** British South African financier: b. Darmstadt, Germany, 1850; d. London, England, May 21, 1912. In 1871, after serving in the Franco-Prussian War, he went to South Africa on behalf of a German diamond merchant, and within a few years he became a leading figure in the Kimberley diamond-mining industry. His interests, and those of Cecil Rhodes and Alfred Beit, were amalgamated in a single firm which in 1889 became Wernher, Beit and Company. In 1898 he was naturalized a British subject, and in 1905 he was given a baronetcy. He was a liberal benefactor of educational institutions, including the South African University which, with Beit, he endowed with £500,000.

WERTENBAKER, Thomas Jefferson, American historian and educator: b. Charlottesville, Va., Feb. 6, 1879. He graduated at the University of Virginia in 1902, and after brief experience as journalist in Baltimore, Md., he taught history at the Agricultural and Mechanical College of Texas, 1907–1909, and the University of Virginia, 1909–1910. In 1910 he joined the faculty of Princeton University as instructor in American history, and successively became assistant and associate professor and, in 1925, Edwards professor of American history. From 1928 until 1936 he was also chairman of Princeton's department of American history. During 1939–1940 he was the Harold Vyvyan Harmsworth professor of American history at Oxford University. His historical works included *Virginia under the Stuarts* (1914); *Patrician and Plebeian in Virginia* (1916); *Planters of Colonial Virginia* (1922); *The American People—A History* (1926); *The First Americans* (1927); *The United States of America,* with Donald E. Smith (1931); *Norfolk—Historic Southern Port* (1931); *The Founding of American Civilization* (1938); *Torchbearer of the Revolution* (1940); *The Old South—The Founding of American Civilization* (1942); *The Golden Age of Colonial Culture* (1942).

WESCOTT, Glenway, American fiction writer: b. Kewaskum, Wis., April 11, 1901. He attended the University of Chicago during 1917–1919, and for some years thereafter he lived in Europe, principally in the south of France. He published *The Apple of the Eye* in 1924, and three years later he won the Harper prize novel contest with *The Grandmothers—A Family Portrait.* Volumes of short stories included *Good-Bye Wisconsin* (1928) and *Fear and Trembling* (1932). Subsequent novels were *A Calendar of Saints for Unbelievers* (1932) and *The Pilgrim Hawk* (1940). The poetic instincts which imbued him as a young man are reflected in the delicate prose of his later works.

WESEL, vā'zĕl, Germany, a town of Prussia, on the right bank of the Rhine at its confluence with the Lippe, 35 miles northwest of Düsseldorf. It is an important railroad and river traffic center. Most fortifications were demolished in 1890, and the remainder after World War I. The Berlin gate, with statues of Hercules and Minerva, dates from 1722. Wesel contains several ancient buildings. The Church of St. Willibrord, founded in the 12th century, took its present form in 1521; it was restored in 1883–1896. The town hall, with a Gothic façade, was completed in 1390. A former French church became the Lower Rhine Museum. Clothing, wire, machinery, and pianos are among the principal industries. The town, formerly known as Lippemünde, was a settlement of the early Saxons. It was incorporated in 1241, and later was a

member of the Hanseatic League. In 1540 it adopted the Reformation. The Spaniards, Dutch, and French occupied it at various periods, and in 1814 it passed into the possession of Prussia. Pop. 24,047.

WESER, vā'zĕr (Latin, *Visurgis*), a river of Germany, formed by the junction of the Fulda and Werra at Münden, Prussia. It flows tortuously first northwest, then northeast between Westphalia and Brunswick, and after a circuitous northwestern course it traverses the town of Bremen, forms the boundary between Hanover and Oldenburg, turns almost due north at Elsfleth, and falls by a wide mouth, incumbered with sandbanks, into the North Sea. With the Werra, it is about 465 miles in length; but the Weser proper has a length of 280 miles. The lower part of the river, from Bremen to Bremerhaven, has been deepened and improved for large vessels. It is navigable by barges to some distance up both head-streams; but Hameln is the practical limit of summer navigation.

WESLEY, Charles, English Methodist preacher and famous hymn writer: b. Epworth, Lincolnshire, Dec. 18, 1707; d. London, March 29, 1788. The 18th child of Samuel Wesley (q.v.), rector of Epworth, he was the youngest brother of John Wesley (q.v.). He was educated at Christ Church, Oxford, and there he began, he says, "to observe the method of study prescribed by the university," adding, "This gained me the harmless nickname of Methodist" —a word at first apparently without religious significance, and meaning one who affected method. Ordained priest in the Church of England in 1735, he accompanied his brother to Georgia to become secretary to Governor (James Edward) Oglethorpe. Failing health necessitated his return to England in 1736, and he was appointed unlicensed curate of Saint Mary's, Islington, London. On May 21, 1738, he experienced an evangelical conversion, and for some years thereafter he was an active itinerant preacher and undertook the writing of a large number of hymns. He differed from his brother on some doctrinal and other points, holding, for example, that perfection must be attained by a gradual process. Between 1756 and 1771 he labored chiefly in the vicinity of Bristol, and thereafter he lived in London. He is said to have written some 6,500 hymns, of which many came into general use; they included *Jesus, lover of my soul* and *Love divine, all love excelling.* Consult biographies by Thomas Jackson (1849) and John Telford (1866).

WESLEY, John, English evangelical preacher, founder of Methodism: b. Epworth, Lincolnshire, June 17, 1703; d. London, March 2, 1791. He was the 15th child of Samuel Wesley (q.v.), rector of Epworth, and elder brother of Charles Wesley (q.v.). From Charterhouse, he went to Christ Church, Oxford University, where he graduated in 1724. The next year he was ordained deacon in the Church of England and became a Fellow of Lincoln College, in which he was appointed Greek lecturer and moderator. He was of a serious and religious turn of mind, and books which impressed him powerfully were the *Imitatio Christi* and Jeremy Taylor's *Holy Living* and *Holy Dying.* He took priest's orders in 1728, and about the close of 1729 was called from acting as his father's curate to perform the duties of his fellowship in person. At Oxford he found an association of students of which his brother Charles was a member. It was known by various nicknames, among which were the Holy Club, the Bible Moths, the Sacramentarians, and the Methodists. It appears that all the association did at this time to earn these opprobrious epithets was to meet on Sunday evenings to read the Scriptures, and on other evenings to read secular literature. John Wesley joined this society, which gradually became exclusively religious in its object, and highly ascetic in its tone. Its members fasted twice and communicated once a week, visited prisons and the sick, and engaged frequently in prayer, meditation, and self-examination. Among the members were James Hervey and George Whitefield. At the time John Wesley joined it the society numbered very few members, but it gradually increased, though it never became a large body. This induced him to decline his father's living at Epworth, that he might continue to exercise his influence at the university. During his residence at Oxford he became acquainted with William Law, author of the *Serious Call to the Unconverted,* who exercised much influence over him. In 1735 he accepted an invitation from Governor (James Edward) Oglethorpe to preach to the colonists of Georgia. He sailed on December 10 with his brother Charles and a considerable body of German Moravians. During his visit to the colony he paid his addresses to Sophia Hopkey, niece of the chief magistrate of Savannah, or rather, as the story is told, received her advances with favor, but ultimately declined to marry her. Miss Hopkey married a Mr. Williamson, and Wesley, without assigning a reason, refused to admit her to the communion. Her husband threatened legal proceedings, which were not enforced, but Wesley, on account of this event, left the colony, "shaking the dust from his feet." He reached England Feb. 1, 1738, just as Whitefield, under whose preaching Methodism had made great progress, sailed for Georgia. At this time an important event took place in the inner religious life of Wesley. He was converted, according to his own account, about a quarter to 9 o'clock on the evening of May 24, 1738, at a meeting in Aldersgate Street, London, to which he had gone very unwillingly, while Martin Luther's *Preface* to the Epistle to the Romans was being read. On June 13 he set out for Germany to visit Herrnhut, the village in Saxony of Moravians from Bohemia. He met Count Nikolaus Ludwig von Zinzendorf at Marienborn, spent a fortnight at Herrnhut, and returned to England about the middle of September. Whitefield returned from Georgia soon after, and became intimately associated with Wesley. He began open air preaching near Bristol in the following February, and his example was soon followed by Wesley. On Nov. 11, 1739, Wesley first preached at the Foundry, a disused structure in Moorfields, London, formerly employed by the government for casting brass ordnance. This he enlarged and repaired, and until 1778 it remained the Methodist headquarters in London. Somewhat later he founded the "United Society," for week day meetings. From the beginning of this society the inception of Methodism is generally dated.

In July 1740 Wesley separated from the Mo-

ravians on account of doctrinal differences. He soon afterward separated from Whitefield, but without a permanent personal breach. Wesley had now sole control of the religious body which adhered to him, and he devoted his entire life without intermission to the work of its organization, in which he showed much practical skill and admirable method. His labors as an itinerant preacher were incessant. He had no permanent residence, and would ride horseback from 40 to 60 miles each day, never intermitting his journeys on account of the weather. Often he preached four or five times a day, using the simplest words but appealing overwhelmingly to the heart and conscience. Besides traveling throughout England, he made no less than 42 trips to Ireland and 22 to Scotland. He sent two of his preachers to the North American colonies in 1769, and two years later Francis Asbury crossed the Atlantic to become general superintendent of his work in America. In 1784 he completed a "deed of declaration" which placed the Methodist organization on a legal basis, and the same year he ordained presbyters and appointed Thomas Coke along with Asbury superintendent of the Methodist Church in America. He married in 1750 Mary Vazeille, a widow with four children, but his habits of life, which he did not attempt to accommodate to his wife, produced an alienation, and they finally separated. Wesley held strongly to the principle of episcopacy, though not a believer in the apostolic succession; and he never formally separated from the Church of England.

His writings were of the most miscellaneous character, including grammars, an English dictionary, biographies, and manuals of history, logic, and medicine. He also published 23 collections of hymns; they are included in the *Poetical Works of John and Charles Wesley* (1868–72). In 1780 he commenced a monthly, the *Arminian Magazine,* which he edited during his life and which, after his death, was merged in the *Methodist Magazine.* Against pre-Revolutionary troubles in America he directed *A Calm Address to Our American Colonies* (1775), *A Calm Address to the Inhabitants of England* (1777), and *A Serious Address* (1778). His itineraries and spiritual life were recorded in his remarkable *Journal* between 1735 and 1790; N. Curnock edited an 8-volume edition, 1909–16. E. H. Sugden edited Wesley's *Standard Sermons* (1921). Consult Telford, J., *Life of John Wesley* (1924); Simon, J. S., *John Wesley, the Master Builder* (1927); Thompson, D. D., *John Wesley as a Social Reformer* (1928). See also METHODIST CHURCHES OF THE WORLD.

WESLEY, Samuel, English clergyman and poet: b. Winterborne-Whitchurch, Dorsetshire, Dec. 17, 1662; d. Epworth, Lincolnshire, April 25, 1735. He was the father of Charles, John, and Samuel Wesley (qq.v.). He graduated from Exeter College, Oxford, in 1688, and was ordained priest in 1690; he became rector of South Ormsby, Lincolnshire, in that year, and in 1695 of Epworth in the same county. He wrote *Life of Christ: An Heroic Poem* (1693); *Eupolis's Hymn to the Creator* (1778); and other works, including the posthumous *Dissertationes in Librum Jobi* (1735). He is best known by the two hymns to be found in Methodist hymn books, *Behold the Saviour of Mankind* and *O, Thou, Who, When I Did Complain.*

WESLEY, Samuel, English classical scholar and poet: b. Spitalfields, London, Feb. 10, 1691; d. Tiverton, Devonshire, Nov. 6, 1739. He was the eldest son of Samuel Wesley (q.v.) and brother of Charles and John Wesley (qq.v.). After graduating at Christ Church, Oxford University, in 1715, he became head usher at Westminster School. He was ordained in the Church of England, and in 1732 he was appointed headmaster of Blundell's School, at Tiverton, where he served until his death. Although he did not embrace Methodism with his brothers, writing of it as "a spreading delusion," many of his hymns appear in the Methodist hymnal. His *Poems on Several Occasions* (1736) was reprinted in 1808 and 1862. Other volumes included *The Christian Poet* (1735). Consult Tyerman, *Life and Times of Samuel Wesley* (1866).

WESLEYAN COLLEGE, Macon, Ga., an institution of higher learning for women, founded in 1836 as the Georgia Female College. It is owned and controlled by the Georgia and Florida Conferences of the Methodist Episcopal Church of the South. It claims to be the first college in America to confer a degree upon a woman (1840). It offers courses for the B.A. and the B.S. degrees. About 600 enroll annually.

WESLEYAN METHODIST CONNECTION OF AMERICA, known commonly as the Wesleyan Methodist Church. See METHODIST CHURCHES OF THE WORLD.

WESLEYAN METHODISTS. See METHODIST CHURCHES OF THE WORLD, section on *Wesleyan Methodist Church.*

WESLEYAN UNIVERSITY, located at Middletown, Conn., was established in 1831 under the auspices of the Methodist Episcopal Church, being the first educational institution of collegiate grade established by that church in the United States. The institution, however, has no organic relation with any church, and its charter provides that it shall be absolutely nonsectarian. The founders of the university were offered the buildings of the American Literary, Scientific, and Military Institute (from which Norwich University, in Vermont, developed) if an endowment of $40,000 were raised; the gift was accepted and its condition complied with. During 1868–1878 the university's material resources were largely increased and several new buildings erected; and in 1903–1916 several additional buildings were erected and the endowment funds doubled; in 1919–1920 a campaign for $3,000,000 for endowment and buildings was launched. In the last decade the gifts for endowment and equipment have exceeded the total gifts received in the university's first century. Resources now exceed $15,000,000. The university offers courses leading to the degrees of B.A. and M.A. Requirements for generalization, applying in the first two years of the undergraduate course, provide that the student shall pursue introductory courses in several departments. For the work of the last two years a concentration requirement prescribes that the student shall select the major portion of his studies in a closely related group of departments in order to acquire a considerable mastery of at least one field of study. Distinction work is also

provided to encourage still greater thoroughness and to develop the student's initiative. In 1937–1938 the Honors College was established to direct and make more effective this work for distinction. There are five fellowships, and the trustees supplement the income from a large number of endowed scholarships by a special budget appropriation, making possible scholarship awards amounting to about $60,000 to students considered worthy of such assistance. There are a John Wesley Club and 12 Greek letter fraternities, which have their own houses, where many of the students live. The university has a campus of more than 50 acres on high ground at the western edge of the city, overlooking the Connecticut River. The buildings include North College, Clark Hall, Harriman Hall, and two smaller buildings used as dormitories; South College, the administration building, and the only one surviving from the old military academy; Memorial Chapel in honor of the students who gave their lives in the Civil War; '92 Theatre-Rich Hall; Olin Library; Hall Laboratory of Chemistry; Shanklin Laboratory of Biology; Van Vleck Observatory, with a 20-inch refracting telescope; Scott Laboratory of Physics; Judd Hall, which houses a valuable museum and the departments of Geology, Music, and Psychology; Willbur Fisk Hall, with recitation rooms; Fayerweather Gymnasium; Alumni Athletic Building, and Squash Racquets Building; Downey House with dining room, grill room, postoffice, Book Nook, and social rooms; Davison House, a homelike infirmary with modern medical equipment; Russell House, used by the Honors College; Winchester House, providing offices for student publications, the Alumni Council, Christian Association, modern language clubs, and the Outing Club; and other auxiliary buildings. The enrolment at Wesleyan is limited to about 900. The total resources of the university at the end of the fiscal year 1938–39 amounted to $13,475,115; the productive funds to $7,703,082; income to $864,814. Gifts for the year amounted to $452,144. Enrolment was 749 in the autumn of 1939.

James L. McConaughy,
President, Wesleyan University.

WESSEL or **WESSEL GANSFORT,** vĕs'ĕl gäns'fôrt, Dutch theologian and pre-Lutheran reformer: b. Groningen, 1420?; d. 1489. His first name may have been Johann (Johannes). He passed the latter part of his life in retirement in his native country, part of the time in convents. He was a decided opponent of the scholastic theology and was in intimate relations with some of the prominent humanists, as Agricola and Höck, yet in his own views he leaned strongly toward mysticism. He regarded Christianity as something entirely spiritual, confined to a man's own heart and God. The Scriptures, according to him, are the living source of all true faith; the church is based upon a compact; there is a general priesthood of the rational universe; faith is to be reposed only in an orthodox pope and not in every council; sin can be forgiven by none but God; excommunication has only an external influence; indulgences refer only to ecclesiastical penalties; the true satisfaction for sin is a life in God; and purgatory is nothing but the purifying influence of a longing after God. After his death some of his works were burned as heretical; his *Farrago Rerum Theologicarum* was published with a preface by Luther (1522). The most complete edition of his works is that edited by Lydius (1617). Consult Muusling, *Commentatio Historica-Theologica de Wesseli* (1831); Ullmann, *Reformatoren vor der Reformation* (1847).

WESSEX, wĕs'ĕks, a kingdom of Anglo-Saxon England, one of the most important of the heptarchy (q.v.). It covered the country between the valley of the Thames and the south coast, excepting the kingdoms of Kent and Sussex. Wessex, signifying West Saxons, was founded by Cerdic, who landed near Southampton in 495 and with the aid of his son, Cynric, established his rule in the southern part of what later became Hampshire. Later kings extended Wessex to the north and south, and Egbert, who became king in 802, overthrew the kingdom of Mercia and in 829 was recognized as bretwalda (q.v.). Attacks on England by Danes or Northmen gradually developed, until by 870 they had practically mastered the northern kingdoms and East Anglia. Then began the struggle for Wessex, in which Alfred the Great, who had become king of Wessex in 871, proved victorious. At his death in 899 the king of Wessex was in fact the master of all England west and south of a line drawn roughly from Chester to London, and his sovereignty was also vaguely acknowledged over the rest of the country, known as the Danelagh (q.v.). It remained for Alfred's son, Edward (Eadward) the Elder, to translate this sovereignty into a definite mastery, the king of Wessex becoming king of England.

The Wessex which is the scene of the novels of Thomas Hardy (q.v.) is the southwestern area of England, principally the county of Dorsetshire. See Egbert; England.

WEST, Andrew Fleming, American philologist: b. Allegheny, Pa., May 17, 1853; d. Princeton, N. J., Dec. 27, 1943. In 1874 he graduated at Princeton University, and he served there as professor of Latin from 1883 until his retirement in 1928. He was largely instrumental in establishment of Princeton's graduate school in 1901, and he was also its dean until 1928. He planned the Graduate College of Princeton, which was opened in 1913. For many years he was chairman of the board of trustees of the American Academy in Rome. He edited Terence's *Andria* and *Heautontimoroumenos* (1888) and *The Philobiblon of Richard de Bury* (1889), and his numerous books included *Alcuin and the Rise of the Christian Schools* (1893); *Stray Verses* (1931); and *American General Education* (1932).

WEST, Benjamin, Anglo-American painter: b. Springfield, Pa., Oct. 10, 1738; d. London, March 11, 1820. After some instruction from William Williams, a painter of Philadelphia, he established himself in that city, but in 1759 moved to New York. In 1760 he sailed for Europe, and there he remained for the rest of his life. For three years he was in Italy, among the paintings he executed while in Rome being *Cimon and Iphigenia* and *Angelica and Medora.* He paid a visit to London in 1763, and there was so well patronized that he made it his permanent home. He painted *Agrippina Landing with the Ashes of Germanicus* for Archbishop Drummond

of York, who introduced him to George III. The king became his steadfast patron, and in 1772 appointed West his historical painter. He was one of four artists to submit to the king a plan for a royal academy, and became an original member of the institution. After the death in 1792 of Joshua Reynolds, his close friend, he was elected to succeed him as president of the Royal Academy. In his *Death of General Wolfe* (Grosvenor Gallery, London) the figures were in modern costume, this being a departure from the practice then current of depicting characters in Greek or Roman dress. West painted a series of historical works for Windsor Castle, and for its chapel a series on the progress of revealed religion; he had finished 28 pictures for the chapel and sketched the remainder when George III became insane and the order for painting the religious series was rescinded. Other pictures of the 400 which he painted included *Christ Healing the Sick* (National Gallery, London); *The Crufixion, The Ascension,* and *Death on the Pale Horse* (Pennsylvania Academy of Fine Arts, Philadelphia); *Departure of Regulus from Rome* (Hampton Court Palace, London); *Penn's Treaty with the Indians* (Independence Hall, Philadelphia); *King Lear* (Boston Museum of Fine Arts). One of the finest of his historical pieces was *The Battle of la Hogue.*

WEST, Rebecca, pseudonym of CICILY ISABEL FAIRFIELD, English novelist, critic, and essayist: b. County Kerry, Ireland, Dec. 25, 1892. After attending George Watson Ladies' College, Edinburgh, she was on the London stage for a short time, at that period adopting as her pseudonym the name of the heroine in *Rosmersholm,* the play by Henrik Ibsen. Turning to journalism in 1911, she was first a reviewer for the *Freewoman,* and subsequently contributed literary criticism and political articles to many English and American newspapers and magazines. Her comments on books, men, and affairs were sometimes none too kindly. In 1930 she married Henry Maxwell Andrews, a London banker. Her first book was *Henry James* (1916), and this was followed by a war novel, *The Return of the Soldier* (1918), which won high praise. Later novels included *The Judge* (1922), *Harriet Hume* (1929), and *The Thinking Reed* (1936). Besides studies of D. H. Lawrence (1930) and St. Augustine (1933), her works of non-fiction included *The Strange Necessity* (1928) and *Ending in Earnest* (1931), the latter published only in the United States. She also wrote the text for two books of cartoons by David Low—*Lions and Lambs* (1928) and *The Rake's Progress* (1934). During 1937 she visited Yugoslavia, and her impressions of that country she published in the two-volume *Black Lamb and Grey Falcon* (1942). A novel, *The Fountain Overflows,* was published in 1956.

WEST, Thomas, 3D (OR 12TH) BARON DE LA WARR. See DE LA WARR, THOMAS WEST.

WEST ALLIS, city, Wisconsin, in Milwaukee County, just west of Milwaukee, on the Chicago, Milwaukee, St. Paul and Pacific and Chicago and North Western railroads. It manufactures automobiles, trucks, tractors, engines (diesel and others), machinery, steel castings, turbines, and wheelbarrows. It has a mayor and council. Pop. (1950) 42,959.

WEST BEND, city, Wisconsin, Washington County seat, altitude 910 feet, on a western bend of the Milwaukee River; the Chicago and North Western Railroad, and one federal and two state highways; 35 miles north of Milwaukee, in a farming, dairying, and stock-raising region. The chief manufactures are aluminum ware, farm machinery, pocketbooks and other leather goods. About 1845 there was a settlement here with a sawmill and a gristmill. The city has a mayor and council. Pop. (1950) 6,849.

WEST BENGAL, state of the Republic of India, formed by the partition of the old province of Bengal when India became independent in 1947. Stretching from Nepal and the Himalayas in the north to the Bay of Bengal in the south it is bounded on the northeast by Assam and on the east by Eastern Pakistan. It comprises an area of 33,945 square miles. Except in the extreme north it is a flat thickly populated alluvial plain comprising most of the Gangetic delta. Calcutta (q.v.), the capital, is the largest city in India and an important port.

The climate is hot and humid. The staple crop is rice; other crops are wheat, pulses, oilseeds, potatoes, sugarcane, jute and tobacco. The principal industries are jute, tea, coal, cotton textiles, paper, rubber, and engineering, most of which are located in greater Calcutta. There are small scale silk, metal, paper and mat industries. Pop. (1951) 26,306,602.

WEST BROMWICH, brŭm'ĭch, a manufacturing town, England, in Staffordshire, between Wednesbury and Birmingham. The principal buildings include the town hall with a massive tower; a number of fine modern churches; several chapels of different denominations; public schools; an institute, art and technical schools, a free library and a hospital. There is a fine public park. West Bromwick has a share in the mining and manufacturing industries of this busy district and has grown largely of late years, carrying on the manufacture of iron goods of various kinds, such as smelting and brass founding. It was an important center of arms manufacture during World Wars I and II. Pop. (1951) 87,985.

WEST CHESTER, borough, Pennsylvania, Chester County seat, altitude 455 feet, on the Pennsylvania Railroad and two federal and three state highways, 25 miles west of Philadelphia and 16 miles north of Wilmington. A settlement here about 1713 was originally called Turk's Head, and the Turk's Head Inn (1762) is still standing. In 1784 the county was divided and the newly named West Chester became seat of the old county—Chester becoming county seat of Delaware County. West Chester became a town in 1788 and a borough in 1799. There was fighting hereabouts in the Revolutionary War—in 1777 at Brandywine, 7 miles to the south, and at Paoli, 8 miles to the northeast. The surrounding country is rich farm land with nursery and fruit farms, dairying, stock raising, and a large production of mushrooms. West Chester has a number of manufacturing establishments, and the major products include lumber and millwork, wheels, machinery and foundry products, gas engines, air compressors, cabinets, hosiery, paper boxes, tags, lead crayons, and canned goods. The West Chester State Teachers College was estab-

lished here in 1871. The borough is governed by a mayor and council. Pop. (1950) 15,168.

WEST CHICAGO, city, Illinois, Du Page County, 30 miles west of Chicago. In an agricultural area, the city has railroad shops as well as manufactures of portable buildings, builders' supplies, rare-earth chemicals, gas mantles, and lighting fixtures. One of the Lincoln-Douglas debates was held here in 1858. Settled in 1849, it was incorporated 1906. Pop. (1950) 3,973.

WEST COVINA, city, California, in Los Angeles County; 18 miles east of Los Angeles. It is situated in a farm area producing citrus fruits and walnuts. The city was incorporated in 1923. Pop. (1950) 4,499.

WEST DES MOINES, city, Iowa, in Polk County; altitude 814 feet; 5 miles west of Des Moines; on the Minneapolis and St. Louis, and the Chicago, Rock Island and Pacific railroads. Its industrial products are cement, cement tile, and clay pipe. The present name replaced the original one, Valley Junction, in 1938, by popular vote. Pop. (1950) 5,615.

WEST FLANDERS. See FLANDERS, WEST.

WEST FLORIDA, that part of the English possessions in Florida in 1763 west of the Apalachicola River, bounded on the west by Lake Pontchartrain, the Mississippi, and Lake Maurepas, and on the north by the 31st parallel of latitude. In 1763 it was made into a separate administration district. The governor had the power of convening general assemblies. Laws were made by the governor with the approval of an advisory council and the general assembly. During the Revolutionary War, West Florida sided with the British crown; in 1780 it was attacked by the Spaniards, and by 1782 the British were driven out. By the treaty of 1783, in which England acknowledged the independence of the United States, Spain was permitted to retain Florida but a secret clause of the treaty made the southern boundary of the United States the 31st parallel instead of the line 32° 28′ as had been fixed in February 1764. Spain refused to evacuate the portion between the two lines and a bitter dispute followed with the United States which nearly resulted in hostilities. Finally Thomas Pinckney succeeded in negotiating a treaty by the terms of which the 31st parallel was acknowledged as the boundary of West Florida, while the United States assumed all claims against Spain by citizens of Georgia for spoilation. A new disagreement with Spain developed in 1803 when the United States claimed that part of West Florida west of the Perdido River as part of the Louisiana Territory which it had just purchased from France. The dispute dragged on until in 1810 the part of West Florida between the Perdido and the Mississippi declared its independence of Spain and became the Republic of West Florida. This mushroom state was seized by the United States, and law and order were restored to the distracted region. The part west of Pearl River became part of the Territory of Orleans. In 1812 West Florida was added to Louisiana and the part between the Perdido and Pearl rivers was annexed to the Territory of Mississippi. In 1812 English troops had their base in the Floridas in their operations against the United States. Andrew Jackson drove them out in 1814 and took Pensacola. During the Seminole War, Jackson again occupied a part of West Florida. The province was administered by United States officials appointed by Jackson until 1819 when it was returned to Spain. In 1819–1821 negotiations for the purchase of Florida were undertaken by the government of the United States. On July 17, 1821, Spain ceded all her claims to the United States, and in 1822 the portion of West Florida east of the Perdido was incorporated in the Territory of Florida.

Consult Fairbanks, G. R., *History of Florida* (1871); Green, E. L., *History of Florida* (1898); Fuller, H. B., *Purchase of Florida* (1906).

WEST FRANKFORT, city, Illinois, in Franklin County; 305 miles southwest of Chicago; on the Burlington; Chicago and Eastern Illinois; and Illinois Central railroads. It is the center of a large coal mining area. The United Mine Workers of America maintain a hospital here. The city has a public library, a stadium for sports, and a choral club to promote musical interests. A stone marker here bears the legend, "Last Battle of the Kaskaskia and Shawnee Indians, 1802." Pop. (1950) 11,384.

WEST HAM, a county borough of England and an east suburb of London. It covers an area of 4,683 acres. Both West Ham and East Ham are important industrial centers. Pop. (1951) 170,987.

WEST HARTFORD, town, Connecticut, in Hartford County; altitude 100 feet; adjoins Hartford on the west; served by the New York, New Haven and Hartford Railroad. It is a shipping center for the surrounding district, which is interested in tobacco culture, dairying, and truck farming. Manufactures include nipples, steel balls, burial vaults, tools and dies, and sheet metal products. The public library is a memorial to Noah Webster (q.v.), who was born here. Pop. (1950) 44,402.

WEST HAVEN, town, Connecticut, in New Haven County, altitude 27 feet, adjacent to the city of New Haven on the southwest. It is chiefly a residential center, but has several industries including elastic fabrics, pipe organs, beer, and glazed paper. West Haven, separated from New Haven in 1822 and united with North Milford to form the town of Orange, was incorporated as a borough in 1873, returned to Orange town in 1911, and was chartered as an independent town in 1921. West Haven was the home of General Tom Thumb, the famous midget. The place was raided by the British under General Tryon in July 1779. Pop. (1950) 32,100.

WEST HAVERSTRAW, village, New York, in Rockland County, directly northwest of Haverstraw, near the west bank of the Hudson River. Chemicals, textiles, and clothing are manufactured. In the village is a state home for crippled children. The area was incorporated in 1883. Pop. (1950) 3,099.

WEST HAZLETON, borough, Pennsylvania, in Luzerne County; altitude 1,680 feet; a suburb of Hazleton (q.v.); on the Lehigh Valley Railroad. It is a residential borough, with small

local industries; nearby are anthracite mining regions. The borough was incorporated in 1889. Pop. (1950) 6,988.

WEST HELENA, city, Arkansas, in Phillips County; altitude 121 feet; three miles west-northwest of Helena; served by the Missouri Pacific Railway, and located on federal highways. Lumber milling is done here, as well as manufacturing of wood products. Founded 1909, the city was incorporated in 1917. Pop. (1950) 4,499.

WEST HOBOKEN, New Jersey, part of Union City in Hudson County; formerly a separate town; merged with Union Hill and incorporated as Union City in 1925. It adjoins the city of Hoboken, and stands on a rise of land a mile back from the west shore of the Hudson River. There are numerous small factories.

WEST HOMESTEAD, borough, Pennsylvania, in Allegheny County; altitude 852 feet; on the Monongahela River; adjacent to Homestead; on the Pittsburgh and Lake Erie, and the Baltimore and Ohio railroads, with yards of the Union Railroad (of Pittsburgh). There are steel mills and factories. Pop. (1950) 3,257.

WEST IN AMERICAN HISTORY, The, In its historical context, the American West must not be viewed as a fixed area, but as a series of westerly moving zones each representing a more advanced stage in the evolution of society from primitive to complex forms. Between 1607, when the first assault on the wilderness that is now the United States was made by Anglo-American pioneers, and 1890 when the director of the census announced that an unbroken line no longer separated the settled from the unsettled portions of the continent, these zones constantly receded, leaving behind them a fully developed civilization. During these three centuries of frontier experience the American people were endowed with many of the traits and institutions that distinguish them today.

Opportunity was the magnet that drew men from Europe or the eastern United States into the sparsely settled West, for there nature's bounties were so abundant that the individual needed only his own brawn, brains, and courage to improve himself economically and socially. This was present in a variety of forms, and these in turn accounted for the nature of the zones that were discernible within the frontier area. Far to the west, along the cutting edge of civilization, roamed trappers and fur traders seeking wealth in the form of deer or buffalo hides, and shiny packs of beaver pelts. Behind them, wherever conditions warranted, came the miners, searching streams and mountain slopes for the tell-tale glint of dull metal that might spell a fortune in gold or silver or lead. Not far to the rear of the prospectors were the cattlemen in quest of lush fields where they could fatten their roaming herds without the restraint of farmers' fences. These shock troops of civilization made little impression on the wilderness; instead they succumbed so completely to the forces of nature that they reverted to a primitive way of life resembling that of the Indians.

This was not the case with the next wave of settlers: the pioneer farmers. Restless nomads impelled westward by a desire for self-improvement or the search for adventure, they viewed the wilderness as an enemy of progress; to them every tree was a barrier between themselves and civilization. So they cut away the forests or broke the prairie sod, built their cabins, raised their crops, and then succumbed to restlessness again as neighbors pressed in on them. When they moved on to begin the process anew they sold their "improvements" to "equipped farmers" who were blessed with both stability and capital. These permanent settlers completed the forest clearings, fenced their fields, built homes, and financed roads that would connect their communities with eastern markets. As commercial activity quickened a final group of frontiersmen appeared as though by magic—merchants and millers and distillers and lawyers—to scatter villages through the back country. With their coming the region automatically became part of the East; to the westward their counterparts were already wresting a new West from nature.

When this process began in the early 17th century the "East" was Europe and the "West" the strip of coastal lowlands that hugged the Atlantic. From beachheads established at Jamestown in Virginia, St. Marys in Maryland, Plymouth and Boston in Massachusetts, and at other isolated points Anglo-American pioneers began their assault on the vast forests that extended limitlessly westward. For a time they seemed destined to lose their battle with nature; Englishmen died like flies at Jamestown as they went through the "seasoning" process which gave them immunity to America's disease and knowledge of the techniques needed to combat its wilderness. Yet within half a century the battle was won and the first West conquered, for by the 1670's the coastal plain and river bottoms were occupied by sturdy farmers busily producing tobacco in the South and cereals and livestock in the North.

So persuasive was the environmental influence that even within this short span a frontier pattern had evolved. That of Virginia was typical. Far to the west, beyond the "fall-line" where waterfalls checked direct navigation from the sea, lay an unoccupied wilderness where fur traders roamed in their perpetual quest for deer hides and beaver pelts. Along the fall-line herdsmen pastured their cattle in pea-vine marshes or fields cleared by the Indians, moving, as one traveler put it, "(like unto the ancient patriarchs or the modern Bedouins in Arabia) from forest to forest in a measure as the grass wears out or the planters approach them." East of cattle frontiers lay a band of small farms where half-cleared fields produced corn and other grains. Still farther eastward was a land of larger farms, owned by prosperous planters who lived in elaborate manor houses, grew tobacco with hired labor, and invested their profits in imported luxuries that would allow them to ape the English country gentry. Hugging the coastline were bustling towns where merchants fattened on the growing trade between the interior and Europe.

By the time this first West was won pioneers were beginning the conquest of a new West that lay beyond. The occupation of the hilly upland that comprised the Appalachian Mountain system and its foothills began in the 1670's when a growing population advanced lowland prices to the point that younger sons, freed servants, and new arrivals from Europe could no longer afford land there. As they moved they found themselves in a new environment, so distant from the coast

that the influence of their European heritage rapidly waned. Thus freed from tradition, they adopted practices adjusted to the strange new world in which they found themselves; they abandoned frame houses for log cabins, clothed themselves in deer skins rather than imported fabrics, developed the "long rifle" and the ax as essential tools, and became so familiar with the forest that they seemed more at home there than in the lanes of Boston or New York. Their divorce from the past was hastened with the arrival in the back country of two alien groups—the Scotch-Irish from Ulster and the Palatines from Germany—who migrated in large numbers during the early 18th century and moved directly to the interior in quest of cheap lands. As in all frontier communities, this mingling of racial strains strengthened the social order by allowing each to contribute something to the resulting civilization. The great "Palatine barns" of the Germans and the roving "circuit-riders" of the Scotch-Irish typified the contributions of these groups to the American way of life.

Frontiersmen from the outer fringes of this West were ready to push beyond the Appalachians by the mid-18th century, but for a time they were held back as England won the region from France (1763) and English statesmen struggled to devise a settlement policy that would not provoke Indian retaliation. In the end this system broke down, as would all designed to hold frontiersmen back when good lands lay ahead, and by 1775 pioneers were pouring through the mountain gaps to build their communities about the Forks of the Ohio, in modern West Virginia, in the Blue Grass country of Kentucky, and in eastern Tennessee. For a time they were driven back by Indian fighting during the Revolutionary War, but so compulsive was their eagerness to move westward that migration began with a lull in the warfare after 1778. By the close of the revolution some 25,000 persons lived in Kentucky, while settlements straggled westward from Pittsburgh and engulfed both eastern Tennessee and lands about Nashville.

A sympathetic government paved the way for the next major migrations by drafting the Ordinance of 1785 which allowed settlers to buy surveyed lands and the Ordinance of 1787 which provided for the eventual division of the West into states. Thus assured of clear land titles and political equality, pioneers swept westward in a mighty flood between the 1790's and 1810, filling western New York, peopling Ohio, Kentucky and Tennessee with enough newcomers to justify statehood, and forming a thin line of settlements in southern Indiana and Illinois. Only another war—the War of 1812—checked the flood as Indians seized the opportunity to fight back against usurpation of their hunting grounds. In the end the red men lost more than they gained, for their decisive defeat during the war so broke their spirit that they retreated once more, opening most of the Mississippi Valley to settlement.

The "Great Migration" that resulted after 1815 flowed in two directions. One was toward the fertile "Lake Plains" country where pioneers from the upper South, the Northeast, and Germany met and mingled to create a new society that showed the stamp of all of the civilizations that contributed to its strength. By the end of the 1840's the whole area north of the Ohio had been carved into states, while Missouri and Iowa were also sufficiently peopled to earn a place in the Union. In all self-sufficient, small-scale agriculture emphasizing cereals and livestock was the rule, while all reflected the democratizing influence of these economic units by constitutions barring slavery (save in Missouri), providing for manhood suffrage, and assuring popular control of the legislative, executive, and even judicial branches of government.

The civilization evolving from the second post-1815 migration—that into the plains that bordered the Gulf of Mexico between western Georgia and Louisiana—differed markedly. There newcomers were drawn almost solely from the Southeast, as the existence of slavery deterred the coming of Northerners or Europeans. There the objective of each pioneer was not self-sufficiency but the production of salable surpluses in the form of cotton. As this profitable crop could be most economically grown on large-scale agricultural units, there was a tendency in all-good soil areas to consolidate holdings into plantations of about one thousand acres, even along the fringes of settlement. This process meant a constant displacement of small farmers who were driven westward to virgin lands. The Gulf Plains were settled rapidly as a result—Alabama, Mississippi, and Louisiana were all states before the end of the 1820's and Arkansas followed in 1836—but the social system that evolved denied the pioneer his birthright by barring him from the best lands and foisting on him an aristocratic political philosophy geared to the defense of slavery.

The westward movement in both the Gulf States and Lake Plains came to a halt when settlers reached the western edge of the first tier of states lying beyond the Mississippi, for there they encountered a physical environment that their forest-adjusted frontier skills could not conquer. The Great Plains province, stretching limitlessly away to the Rockies, was a giant grassland where wood for housing, fencing, and fuel was nonexistent, and where a semiarid climate defied farmers whose techniques had been developed in the humid East. So the orderly march westward halted before this barrier, while a few of the more venturesome pioneers explored the possibilities of the unknown lands that lay beyond. These were the men who formed caravans of covered wagons and during the early 1840's defied nature by moving westward over the Oregon and California trails to the fertile farm lands that awaited them in the Willamette and Sacramento valleys. Although few in numbers, they played yeomen's roles in paving the way for later comers. Oregon pioneers helped force the settlement that added that disputed land to the United States, while their counterparts in California precipitated the crisis which led Mexico to surrender its hold on all the Southwest.

The occupation of this distant land would still have proceeded at a snail's pace had not the discovery of gold in a stream cascading westward from California's Sierra Nevada Mountains launched the fabulous rush of the Forty-niners (q.v.). Most of the 100,000 gold seekers who reached the West failed to "strike it rich" and turned to farming or shopkeeping instead, forming a staple population that allowed California to win statehood in 1850. Others, hopelessly infected with the prospecting fever, streamed out of the state in their search for wealth. Wherever they went—in Nevada and Arizona, across Idaho and Montana and Wyoming, into Colorado and the

Black Hills of South Dakota—strike after strike was made, and each attracted an influx of starry-eyed miners. During the two decades after 1849 their isolated mining camps blossomed into permanent settlements as farmers flocked in to produce food and politicians courted their favor by dividing all the trans-Rocky Mountain West into states or territories.

With the eastward thrust of the mining frontier, only the Great Plains province remained largely unsettled at the close of the Civil War. This last great West could be subdued in one of two ways: either by adapting economic practices to its unique environment or by conquering that environment with man-made devices. Both methods were tried, the first by cattlemen who transformed the Great Plains into a giant pastureland between 1865 and 1887, the second by small farmers whose fenced fields, relentlessly intruding from the East, gradually drove the ranchers westward as the open range diminished. Their advance was made possible by technological developments stemming from the wave of postwar industrialism; barbed wire fences, windmills, railroads, and efficient farm machinery were the tools used in the conquest of America's last West. So effectively did they allow the westward-sweeping farmers to transform barren grasslands into fertile fields that by 1890 the director of the census could announce that "there can hardly be said to be a frontier line" remaining in the United States. One era in history had drawn to a close.

Reactions varied greatly as Americans during the next decades adjusted themselves to a closed-space existence. Some feared that dwindling resources and a mounting population would usher in an era of starvation; the president of one western railroad prophesied that "in twenty-five years we shall have a nation-wide famine." Others, such as President Theodore Roosevelt, sought to awaken the nation to the need of conserving what was left of its natural heritage. Still others, with Presidents Woodrow Wilson and Franklin Delano Roosevelt in the van, advocated a positive role on the part of the federal government as a means of providing individuals with the security and opportunity formerly offered by the open frontier. "Today," wrote Franklin Roosevelt in 1935, "we can no longer escape into virgin territory: we must master our environment."

Less spectacular, but nonetheless important, was the impact of the passing of the West on the nation's historians and social scientists. Inspired by the writings of the pioneer historian of the frontier, Frederick Jackson Turner of Wisconsin, they began an appraisal of both past and future as viewed in the light of this unique national experience. Their findings indicated that much which was typically American in both the characteristics of the people of the United States and their institutions was traceable to the three centuries of expansion which had marked their history.

This expansion, historians concluded, had led to a constant rebirth of civilization in the West. As pioneers moved into a wilderness environment they found that habits as well as artifacts acquired in regions of compact settlement were no longer essential. Complex political institutions proved only burdensome in sparsely settled western communities; economic specialization was valueless in a region where each man provided for his own needs; social status based on inherited prestige vanished in a land where the individual's contribution was judged by his skill with rifle or ax; cultural pursuits seemed outmoded in a primitive social organism where so many material tasks demanded completion. Hence practices and institutions common in the East were discarded as life reverted toward simpler forms. Thus did man in the virgin West forsake much of his heritage, and prepare himself to develop new traits and devices suited to the environment in which he found himself.

These slowly evolved as new settlers flocked in to thicken the population of each frontier community. With social controls increasingly necessary, governmental activities were expanded, economic specialization set in, society developed along familiar hierarchal lines, and cultural activities quickened. Eventually a full-blown civilization emerged, but this differed significantly from those of the East on which it was based. The impact of the environment, the accidental divergences natural in areas of separate evolution, and the contributions of representatives from many cultures present among the founders, all helped mold each western community into a social organism that was similar to, but differed from, the many that had contributed to its growth. As this process went on, over and over again for three centuries, an "Americanization" of men and their institutions took place. This transformation, obviously, was not alone responsible for the distinctive nature of civilization in the United States. That stemmed from the European heritage, the mingling of peoples from many lands, the continuing impact of ideas from abroad, the Industrial Revolution, and other forces. But those features of life and thought that are usually considered to be most typically American can be traced in some degree to the influence of the West during the nation's formative period.

This is the case with certain individual traits or characteristics. The Americans are a mobile people, loosely bound to any one place and ready to move when opportunity beckons; the typical frontiersman drifted westward so often that his allegiance to any locality could not be deeply rooted. They are an inventive people who accept innovation unquestioningly and prefer change to adaptation; their pioneer ancestors acquired this frame of mind by constantly facing new situations where past precedents did not apply. They are a materialistic people, with less time for culture than most peoples of the Western World; Westerners could pay little attention to the arts in a primitive land where the battle against nature absorbed all of their energies. They are an individualistic people, resenting any attempt by the government to interfere with their economic activities; frontiersmen lived amidst such abundance that each man could care for his own needs without the aid or intrusion of society. With the passing of the West, American individualism, materialism, and mobility began to diminish, but they remain as noticeable characteristics among many people.

Equally notable was the frontier's effect on many institutions. Economic practices in the United States are geared to the need of constantly replacing artifacts and machines that would be carefully preserved in other countries of the world, for Americans have a tendency to discard the old as soon as a new model appears. This habit they acquired from their pioneer fore-

bears who lived amidst such an abundance of natural resources that waste became second nature to them. Political institutions also bear the stamp of the nation's formative years in their emphasis on democratic practices. Democracy did not originate in the forests of the New World, of course; it was well developed in European theory and practice when the Anglo-American frontier was in its infancy. Yet conditions in the West tended to deepen faith in democratic practices. There poverty served as a great leveler; there nature emphasized the equality of men by diminishing the importance of wealth and hereditary privilege; there the urge to self-rule was strong among men who realized that Eastern legislators did not understand their unique problems. On the frontier, as nowhere else in the new land, was born a deep-seated faith in democracy that has remained a part of the national heritage. See also AMERICAN EXPANSION POLICY; UNITED STATES—*40. Founding of the Nation.*

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WEST INDIES, the name given to the islands lying southeast of the United States, between southern Florida and northern Venezuela. The main island arc, from the Bahama Islands and Cuba in the north to Trinidad in the south, separates the Caribbean Sea from the Atlantic Ocean. Other islands, all of small size with the exception of Jamaica, lie in the Caribbean closer to the Middle and South American coasts. The islands are scattered over an area 2,000 miles from east to west and 1,500 miles from north to south, yet the total land area involved is only 91,300 square miles.

Various names are applied to certain groups of islands within the West Indies. The GREATER ANTILLES are the four larger islands, and the small ones adjacent to their shores, just south and east of Florida. From west to east, they are Cuba (44,218 square miles), Jamaica (4,411 square miles), Hispaniola (29,530 square miles), and Puerto Rico (3,435 square miles); geologically, the Virgin Islands (British and United States) also belong with this group. Defined in terms of geological origin, the LESSER ANTILLES are properly those islands stretching eastward and southward from Anegada Passage, the water opening just east of the Virgin Islands of the United States (64° west longitude). Among the principal islands in this group are the British Windward and Leeward Islands (excluding the Virgin Islands), St. Martin, Guadeloupe, Martinique, Margarita, Bonaire, Curaçao, and Aruba. In common usage, the Virgin Islands, Barbados, Trinidad, and Tobago are also included among the Lesser Antilles. Another grouping is that of the LEEWARD ISLANDS and WINDWARD ISLANDS. The British Leewards include the British Virgin Islands, Anguilla, Barbuda, St. Kitts, Nevis, Antigua, and Montserrat; in a broader sense, the Leewards are defined as comprising also the Virgin Islands of the United States, Guadeloupe, and neighboring islands, St. Eustatius, Saba, and St. Martin, although the Dutch designate the last three as Windward Islands. The British Windwards include Dominica, St. Lucia, St. Vincent, Grenada, and the Grenadines. The name is also applied in a broader sense to include the French island of Martinique. Dominica, transferred for administrative purposes to the Windwards in 1940, belongs geographically among the Leewards.

Geology.—The West Indies range in size from Cuba, which is slightly larger than the State of Ohio, to coral reefs only a few acres in extent. Some are mountainous; others lie barely above sea level. The Greater Antilles collectively have an area of 81,600 square miles, 89 per cent of the total for the West Indies. Structurally, they represent fragments of submerged mountains, to the flanks of which lowlands of various origins are attached. Extending westward from Anegada Passage, these mountain remnants form the backbone of Puerto Rico and eastern Hispaniola. On the latter island, the greatest elevation in the whole system occurs, the Cordillera Central of the Dominican Republic, which rises to 10,414 feet. There the mountain axis forks, one branch forming the northern peninsula of Haiti and the Sierra Maestra of southern Cuba, and the other the southern peninsula of Haiti and the Blue Mountains of Jamaica. Low limestone platforms fringe this mountain system, forming, for example, the main part of Cuba and most of the Bahama Islands.

The Lesser Antilles are primarily a string of volcanic cones. Two were violently active in May 1902—the Grande Soufrière on Guadeloupe and Mount Pelée on Martinique. While some cones are still considered to be growing actively, others are eroded away to low-lying remnants. Among the high or mountainous islands are western Guadeloupe (4,869 feet), Martinique (4,799 feet), Dominica (4,747 feet), St. Kitts (4,313 feet), and St. Vincent (4,075 feet). In contrast, low islands like Anguilla, Barbuda, and eastern Guadeloupe all have maximum elevations below 250 feet.

Farther south, the islands are of still different origins. In part, as in Tobago and northern Trinidad, they represent continuations of mainland mountain systems; elsewhere, as in Barbados, they represent upraised portions of the continental shelf. Throughout the West Indies, coral reefs in all stages of development add to the variety of island types.

Climate.—The West Indies have a tropical maritime climate. The principal controlling factors are the warm ocean currents of the surrounding seas and the easterly trade winds which blow all year off the Atlantic. Temperatures average between 70° and 85°F. in all months, and excessively high or low temperatures never occur. Rainfall varies considerably, depending largely on island elevation and exposure. The windward, or eastern, side of a mountainous island often receives from seven to eight times as much rain as the leeward, or western, side. Commonly, there are two rainy and two dry seasons; May through July and October through November are the rainy periods. The only adverse climatic features are hurricanes, most frequent in September and October. Originating east of the islands, these violent storms move westward and then re-

WEST INDIES

Acklins (island), 1,744.....C 2
Adjuntas, 3,856.....F 1
Aguadilla, 18,181.....F 1
Alto Cedro, 679.....C 2
Ambergris (cay) .....D 2
Añasco, 3,286.....F 1
Andros (island), 6,718.....B 1
Anegada (island), 274.....H 1
Anegada (passage).....F 3
Anguilla (island), 5,037.....F 3
Annotto Bay, 2,805.....C 3
Antigua (island), 40,778.....G 3
Antilla, 5,786.....C 2
Antilles, Greater.....D 3
Antilles, Lesser.....F 4
Arecibo, 28,500.....G 1
Arima, 8,069.....G 5
Arroyo, 4,290.....G 1
Artemisa, 13,081.....A 2
Aruba (island), 47,932.....E 4
Atwood (Samana) (cay).....D 2
Aves (Bird) (island).....F 4
Azua, 7,419.....D 3
Bahama (islands), 68,846.....B 1
Banes, 14,097.....C 2
Baní, 10,048.....D 3
Baracoa, 10,397.....C 2
Barahona, 14,690.....D 3
Barbados (island), 192,841...G 4
Barbuda (island), 979.....G 3
Bartlett Deep.....B 3
Basse Terre (cap.), Guad., 10,086.....F 4
Basseterre,Saint Kitts, 12,194.F 3
Batabano, 3,177.....A 2
Batabano (gulf).....A 2
Bayamo, 20,245.....C 2
Bayamon, 14,596.....G 1
Beata (cape).....D 3
Beata (island).....D 3
Bejucal, 8,319.....A 2
Bequia (island).....G 4
Bermuda (islands), 31,481....G 2
Berry (islands), 403.....B 1
Bimini, The (islands), 718.....B 1
Bird (Aves) (island).....F 4
Black River, 1,263.....B 3
Blue Mountain Peak (mt.)....C 3
Bolondron, 3,168.....B 2
Bonaire (island), 5,356.....E 4
Boquerón, Cuba.....C 3
Boqueron, P. R., 3,427.....F 1
Borinquen (point).....F 1
Bridgetown (cap.), Barb., 13,345 .....G 4
Cacocum .....C 2
Caguas, 33,733.....G 1
Caibarién, 21,382.....B 2
Caicos (bank).....D 2
Caicos (islands), 4,050.....D 2
Caicos (passage).....D 2
Caimanera, 4,035.....C 3
Camagüey, 80,509.....B 2
Camuy, 2,376.....F 1
Cannouan (island).....G 4
Cap-Haitien, 24,957.....D 2
Cárdenas, 37,059.....B 2
Caribbean (sea).....D 4
Carriacou (island).....G 4
Castle (harbor).....H 2
Castries St. Lucia, 7,056.....G 4
Cat (island), 3,870.....C 1
Cataño, 7,924.....G 1
Cay Sal (bank).....B 2
Cayey, 18,402.....G 1
Cayman (Jamaica) (islands), 6,670.....A 3
Cayman Brac (island), 1,296.B 3
Charlestown, Nevis, 1,437.....F 3
Charlotte Amalie (cap.), U. S. Virg. Is., 11,463.....H 1
Christiansted, 4,110.....H 1
Ciego de Avila, 23,802.....B 2
Cienfuegos, 52,910.....B 2
Ciudad Trujillo (cap.), Dom. Rep., 181,533.....E 3
Coamo, 11,561.....G 1
Cockburn Harbour, Caicos...D 2
Codrington, Barbuda.....G 3
Colon, 11,534.....B 2
Consolación del Sur, 5,392.....A 2
Crooked (island), 1,078.....D 2
Crooked Island (passage).....C 2
Cruces, 9,043.....B 2
Cruz (cape).....C 3
Cuba (island), 4,778,583.....B 2
Culebra (island), 860.....G 1
Curacao (island), 91,450.....E 4
Dame Marie (cape).....C 3
Dominica (island), 49,486....G 4
Dominican Republic, 1,479,417 .....D 3
Dragons Mouth (passage)....F 5
Eleuthera (island), 6,430.....C 1
Enriquillo .....D 3
Ewarton, 2,900.....C 3
Exuma (cays).....C 1
Exuma (island), 3,784.....C 2
Exuma (sound).....C 1
Falmouth, Antigua, 205.....F 3
Falmouth, Jam., 2,651.....C 3
Flamingo (cay).....C 2
Florida (strait).....B 1
Fort-de-France (cap.), Mart., 66,006.....G 4
Fort Liberté, 1,507.....D 3
Frederiksted, 1,925.....G 2
Galera (point).....G 5
Georgetown, Cayman Is., 1,462.....B 3
Georgetown, St. Vincent.....G 4
Gibara, 8,045.....C 2
Gonaïves, 13,534.....D 3
Gonave (island).....D 3
Gouyave, Grenada, 2,010.....F 4
Grand Bahama (isl.), 2,333...B 1
Grand Caicos (island).....D 2
Grand Cayman (isl.), 5,311..B 3
Great (sound).....G 3
Great Abaco (island).....C 1
Great Bahama (bank).....B 1
Great Inagua (island).....D 2
Great Isaac (island).....B 1
Grenada (island), 72,055.....G 4
Grenadines (islands).....G 4
Guacanayabo (gulf).....C 2
Guadeloupe (isl.), 278,864....F 3
Guanabacoa, 30,287.....B 2
Guanajay, 10,527.....A 2
Guane, 2,248.....A 2
Guanica, 3,636.....F 1
Guantanamo, 42,423.....C 2
Guayama, 19,367.....G 1
Guayanilla, 1,266.....F 1
Güines, 22,669.....B 2
Gun (cay).....B 1
Habana (Havana) (cap.), Cuba, 659,883.....A 2
Haiti, 3,000,000.....D 3
Hamilton (cap.), Bermuda, 2,978.....H 3
Harbour (island), 769.....C 1
Harrington (sound).....G 3
Havana (Habana) (cap.), Cuba, 659,883.....A 2
Hinche, 4,511.....D 3
Hispaniola (island).....D 2
Holguín, 35,865 .....C 2
Humacao, 10,823..... .....G 1
Ireland (island).....G 3
Isabela, 3,439.....F 1
Jacmel, 8,545.....D 3
Jaguey Grande, 4,374.....B 2
Jamaica (channel).....C 3
Jamaica (island), 1,237,063..C 3
Jardines de la Reina (islands) B 2
Jayuya, 1,808.....G 1
Jérémie, 11,138.....C 3
Jiguero (point).....F 1
Jost Van Dykes (island), 238 .....G 1
Jovellanos, 7,036.....B 2
Juncos, 5,009.....G 1
Kingston (cap.), Jamaica, 109,056.....C 3
Kingstown,St. Vincent, 4,831.G 4
Kralendijk, Bonaire.....E 4
La Romana, 11,587.....E 3
La Vega, 14,445.....D 3
Lares, 4,302.....F 1
Largo (cay).....B 2
Las Matas de Farfán, 1,818....D 3
Lascahobas, 2,191.....D 3
Ledge Flats.....G 2
Leeward (islands), 108,838...F 3
Léogane, 3,608.....D 3
Les Cayes, 11,835.....C 3
Little Cayman (island), 63...B 3
Little Inagua (island).....D 2
Long (cay), 101.....C 2
Long (island), 4,564.....C 2
Los Palacios, 4,008.....A 2
Maisí (point).....C 2
Manati, 10,075.....G 1
Manzanillo, 36,395.....C 2
Marianao, 120,163.....A 2
Marie Galante (isl.), 30,213..G 4
Marti, 2,640.....C 2
Martinique (island), 261,595.G 4
Matanzas, 54,844.....B 2
Mayaguana (island), 591.....D 2
Mayaguana (passage).....D 2
Mayaguez, 55,744.....F 1
Mira Por Vos (islands).....C 2
Mirabalais, 1,858.....D 3
Miragoâne, 2,499.....D 3
Misteriosa (bank).....A 3
Moca, 9,739.....D 3
Mona (island), 156.....E 3
Mona (passage).....E 3
Monte Cristi, 4,600.....D 2
Montego Bay, 11,500.....B 3
Montserrat (island), 14,333..G 3
Morant (point).....C 3
Moron, 13,954.....B 2
Mouchoir (passage) .....D 2
Naguabo, 4,185.....G 1
Nassau (cap.), Bahamas, 13,231.....C 1
Navassa (island).....C 3
Neiba, 2,131.....D 3
Nevis (island), 113,888.....F 3
New Providence (island), 29,391 .....C 1
Nicolas (channel).....B 2
Niquero, 5,437.....C 2
North East Breakers.....H 2
North East Providence (channel) .....C 1
North Rocks.....H 2
North West Providence (channel) .....B 1
Nueva Gerona, 2,935.....A 2
Nuevitas, 11,303.....C 2
Old Bahama (channel).....B 2
Oranjestad, Aruba.....D 4
Paria (gulf).....G 5
Pedro (bank).....B 3
Pedro (cay).....C 3
Pelee (volcano).....G 4
Peter (island).....H 1
Petit Goâve, 5,536.....D 3
Pinar del Rio, 26,241.....A 2
Pinos (island), 9,812.....A 2
Plana (cays).....D 2
Plymouth, Montserrat, 2,009..F 3
Pointe-à-Pitre, 41,823.....G 3
Ponce, 99,190.....F 1
Port Antonio, 5,482.....C 3
Port-au-Prince (cap.), Haiti, 142,840.....D 3
Port de Paix, 6,309.....D 3
Port Louis, 2,911.....G 3
Port Maria, 3,167.....C 3
Port of Spain (cap.), Trin., 92,793.....G 5
Portland (point).....C 3
Portsmouth, Dominica, 3,597.G 4
Providencia.es (island).....D 2
Puerto Padre, 6,949.....C 2
Puerto Plata, 14,419.....D 3
Puerto Rico (isl.), 1,869,255..G 1
Ragged (island), 417.....C 2
Redonda (island).....F 3
Remedios, 10,485.....B 2
Rio Piedras, 132,369.....G 1
Road Town, 684.....H 1
Rojo (cape) .....F 1
Romano (cay).....C 2
Roseau, Dominica, 9,812.....G 4
Rum (cay), 219.....C 2
Saba (island), 1,203.....F 3
Sabana de la Mar, 2,780.....E 3
Sagua la Grande, 24,044.....B 2
St. Ann's Bay, 3,133.....C 3
St. Barthelemy (isl.), 2,231..F 3
St. Croix (island), 12,902.....H 2
St. Davids (island).....H 2
St. Eustatius (island), 945.....F 3
St. George, 1,259.....H 2
St. Georges (cap.), Wind. Is., 5,774.....F 5
St. George's (island).....H 2
St. John (island), 722.....H 1
St. Johns (cap.), Lee. Islands, 10,965.....G 3
St. Kitts (island), 29,818.....F 3
St. Lucia (island), 69,091.....G 4
St. Marc, 10,485.....D 3
St. Martin (island), 1,697.....F 3
St. Martin, Guad. (island), 6,786.....F 3
St. Pierre, 6,218.....G 4
St. Thomas (island), 11,265..G 1
St. Vincent (island), 61,660..G 4
Salinas, 3,176.....G 1
Samaná, 2,477.....E 3
Samaná (bay).....E 3
Samana (Atwood) (cay).....D 2
San Antonio (cape).....A 2
San Antonio de los Banos, 16,512 .....A 2
San Felipe (cay).....A 2
San Fernando, Cuba.....B 2
San Fernando, Trin., 28,842...G 5
San Francisco de Macorís, 16,152 .....E 3
San German, 6,446.....F 1
San Juan (cap.), P. R., 223,949 .....G 1
San Juan (cape).....G 1
San Lorenzo, 5,181.....G 1
San Luis, 9,873.....C 2
San Pedro de Macorís, 19,994 .....E 3
San Salvador (Watling) (island), 693.....D 1
Sánchez, 3,135.....D 3
Sancti Spíritus, 28,262.....B 2
Sangre Grande.....G 5
Santa Clara, 53,981.....B 2
Santa Cruz del Sur, 2,571.....B 2
Santa Fe, 1,098.....A 2
Santaren (channel).....B 1
Santiago de Cuba, 118,266.....C 3
Santiago de los Caballeros, 56,192 .....D 3
Saona (island).....E 3
Savanna la Mar, 4,046.....B 3
Scarborough, Tobago.....G 5
Seibo, 3,164.....E 3
Serpents Mouth (passage).....G 5
Silver (bank).....E 2
Silver Bank (passage).....D 2
Siparia, 37,251.....G 5
Sombrero (island).....F 3
Somerset (island).....G 3
Soufriere, St. Lucia, 3,081.....G 4
South Negril (point).....B 3
Spanish Town, 12,028.....C 3
Speightstown, 2,129.....G 4
Tarafa .....C 2
Tiburon (cape).....C 3
Tobago (island), 27,208.....G 5
Tongue of the Ocean, (channel) .....C 1
Tortola (island), 5,423.....H 1
Tortue, La (island).....D 2
Trinidad, 15,453.....B 2
Trinidad (island), 530,762....G 5
Tunas de Zaza, 475.....B 2
Turks (islands), 2,088.....D 2
Turks Island (passage).....D 2
Union (island).....G 4
Utuado, 4,430.....F 1
Vaches (island).....D 3
Verde (cay).....C 2
Vieques, 2,678.....G 1
Vieques (island), 10,362.....G 1
Vieux Fort, St. Lucia, 2,484..G 4
Vinales, 1,400.....A 2
Virgin Is. (British), 6,505.....H 1
Virgin Is. (U. S.), 24,889.....H 1
Virgin Gorda (island), 504....H 1
Watling (San Salvador) (island), 693.....D 1
West Ledge Flats.....G 3
Willemstad (cap.) Curacao, 40,597 .....E 4
Windward (islands), 262,083.G 5
Windward (passage).....C 3
Yauco, 9,985.....F 1

WEST INDIES

A
B
C
D
82°
78°
74°
24°
20°
16°
12°
GULF OF MEXICO
UNITED STATES
L. Okeechobee
W. Palm Beach
Miami
Cape Sable
Dry Tortugas
Key West
FLORIDA KEYS
Florida Str.
New Orleans — Havana 602
227
BAHAMA ISLANDS
Grand Bahama
Great Abaco
1213
962
N.W. Providence Channel
N.E. Providence Channel
Nassau — New York
New York — Kingston 1,474
Great Isaac
The Biminis
Berry Is.
Gun Cay
191
Harbour I.
Eleuthera
Nassau
New Providence I.
Andros I.
Tongue of the Ocean
Great Bahama Bank
Santaren Channel
Old Bahama Channel
Exuma Sound
Exuma Cays
Cat I.
Watling I. (San Salvador)
Rum Cay
Tropic of Cancer
Exuma (U.S. Leased Base)
Long I.
Samana (Atwood Cay)
Crooked Island Passage
Crooked I.
Long Cay
Flamingo Cay
Plana Cays
Mayaguana Passage
Mayaguana
Ragged I.
Acklins I.
Caicos Passage
Caicos Is.
Grand Caicos I
Providenciales
Caicos Bank
Cockburn Har.
Turks Island Passage
Turks Is.
Ambergris Cay
Little Inagua
Great Inagua
Mouchoir Passage
Silver Bank
Mira Por Vos
Cay Verde
Havana — San Juan 978
Veracruz — Havana 814
HAVANA
Marianao
Guanabacoa
Matanzas
Cárdenas
Cay Sal Bank
Nicolas Chan.
San Antonio de los Baños
Guanajay
Artemisa
Los Palacios
Consolación del Sur
Pinar del Río
Viñales
Guane
Cabo San Antonio
Batabanó
Bejucal
Güines
Jovellanos
Colón
Bolondrón
Jaguey Grande
Cruces
Sagua la Grande
Remedios
Caibarién
Cayo Romano Chan.
Santa Clara
Cienfuegos
San Fernando
Morón
Ciego de Avila
Sancti Spiritus
Trinidad
Tunas de Zaza
Cayo Largo
Nueva Gerona
Cayos San Felipe
I. of Pines
Santa Fé
(I. de Pinos)
G. de Batabanó
Tampico — Kingston 1,252
Camagüey
Nuevitas
Tarafa
Puerto Padre
Manatí
Gibara
Holguín
Banes
Antilla
Cacocum
Bayamo
Alto Cedro
Guantánamo
(U.S. Base)
Baracoa
Pta. Maisí
La Tortue
Manzanillo
Jardines de la Reina
Sta. Cruz del Sur
G. de Guacanayabo
Niquero
San Luis
C. Cruz
Boquerón
Camangera
Windward Passage
CAYMAN IS.
(Jamaica)
Little Cayman
Cayman Brac
Grand Cayman
Georgetown
Misteriosa Bank
Bartlett Deep
Santiago de Cuba
Cap Haitien
Monte Cristi
Puerto Plata
Port-de-Paix
Fort Liberté
Hinche
Gonaïves
St. Marc
Santiago de los Caballeros
Moca
La Vega
San
HAITI
Bánica
Lascahobas
DOMINICAN REPUBLIC
Mirebalais
Las Matas
Île de la Gonâve
Port-au-Prince
C. Dame Marie
Navassa I. (U.S.)
Jérémie
Miragoâne
Léogane
Petit Goâve
Neiba
Azua
Bani
Barahona
Jacmel
Les Cayes
C. Tiburon
Jamaica Channel
Île à Vache
Enriquillo
I. Beata
C. Beata
Montego Bay
Falmouth
St. Ann's Bay
Port Maria
Annotto Bay
S. Negril Pt.
Savanna la Mar
Black River
Ewarton
Port Antonio
Blue Mountain Pk. 7,388
Spanish Town
Kingston
Portland Point
Morant Point
JAMAICA (Br.)
(U.S. Leased Base)
Pedro Bank
Pedro Cays
Swan Is. (U.S. & Hond.)
Rosalind Bank
Cay Gorda
HOND.
Half Moon Reefs
C. Gracias a Dios
CARIBBEAN SEA
Serrana Bank
Quita Sueño Bank
NICARAGUA
Puerto Cabezas (Bragmans Bluff)
Prinzapolca
I. de Providencia (Col.)
Roncador Bank
I. de San Andrés
Corn Is.
Bluefields (U.S. Lease)
Cayos de Albuquerque (Col.)
Kingston — Barranquilla 437
Colón — Kingston 551
Colón — Jacmel 683
Barranquilla — Jacmel 462
Colón — Liverpool 4,545
Port au Prince — Curaçao 669
Colón — San Juan 992
Pta. Gallinas
Oranjestad
C. San Román
Amuay
Puerto Salinas
Ríohacha
Pen. de Guajira
C. de la Aguja
Santa Marta
Sa. Nevada de Sta. Marta
G. de Venezuela
Barranquilla
Ciénaga
Fundación
Maracaibo
Altagracia
Ciudad Ojeda (Lagunillas)
L. de Maracaibo
La Ceiba
Encontrados
Santa Bárbara
El Vigía
Mérida
Cordillera de Mérida
Cartagena
Is. del Rosario
Calamar
Magdalena
Is. de San Bernardo
Puerto Limón
Cartago
COSTA RICA
L. de Chiriquí
CANAL ZONE (U.S.)
Colón
Pta. Manzanillo
Cristobal
Balboa
Panamá
Gatun L.
Belén
David
G. Dulce
Arch. de las Perlas
La Palma
G. de Darién
Lorica
Magangué
Mompós
Montería
Ayapel
S. Jorge
Cauca
El Banco
Catatumbo
COLOMBIA
PANAMA
Longitude

THE WEST INDIES

CONIC PROJECTION

0 50 100 200 300

SCALE OF KILOMETRES

0 50 100 200

SCALE OF MILES

Capitals ☆ Railroads

Distances are given in Nautical Miles

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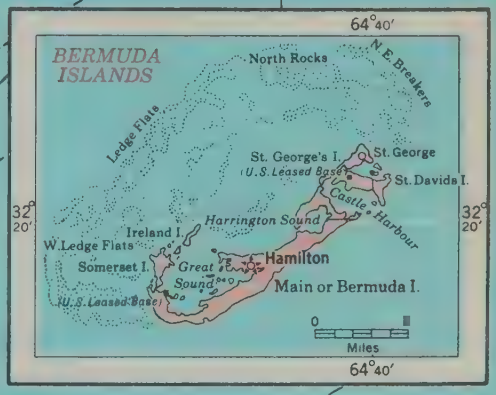

Passage
Silver Bank
Mona Passage
San Francisco de Macorís
Samaná
B. de Samaná
Sabana de la Mar
Seibo
San Pedro de Macorís
La Romana
Ciudad Trujillo
I. Saona
Mona I.
Agua dilla
Arecibo
Caguas
Culebra (P.R.)
Charlotte Amalie (U.S. Base)
Vieques I. (P.R.)
Humacao
Guayama
Frederiksted
St. Croix (U.S.)
Christiansted
Anegada (Br.)
VIRGIN IS.
Virgin Gorda (Br.)
Sombrero (Br.)
Anguilla (Br.)
St. Martin (Fr. & Neth.)
St. Barthélemy (Fr.)
Saba (Neth. Ant.)
St. Eustatius (Neth. Ant.)
Barbuda (Br.)
Codrington
St. Kitts (Br.)
Basseterre
Nevis
Charlestown
St. Johns
Antigua (Br.)
Falmouth
Redonda
Montserrat (Br.)
Plymouth
Port Louis
Guadeloupe (Fr.)
Basse Terre
Pointe-à-Pitre
Marie Galante
Aves I. (Bird I.) (Ven.)
Portsmouth
Roseau
Dominica (Br.)
Mt. Pelée
St. Pierre
Fort-de-France
Martinique (Fr.)
Castries
Soufrière
St. Lucia (Br.) (U.S. Leased Base)
Vieux Fort
Georgetown
Kingstown
Bequia
St. Vincent (Br.)
Speightstown
Bridgetown
Barbados (Br.)
Cannouan
Union
Carriacou
Gouyave
Grenada (Br.)
St. George's
Curaçao
Aruba
Bonaire
Kralendijk
Los Roques
La Orchila
I. Blanquilla
Pen. de Paraguana
Coro
La Vela
Cayo Grande
Los Frailes
Ia. Testigos
Isla de Margarita
La Asunción
Pamatar
La Tortuga
Carúpano
Dragons Mouth
Río Caribe
Scarborough
Tobago (Br.)
Port of Spain (U.S. Leased Base)
Galera Pt.
Sangre Grande
Arima
TRINIDAD (Br.)
San Fernando
G. of Paria
Serpents Mouth
Siparia
Puerto Cabello
La Guaira
Tucacas
Aroa
San Felipe
Nirgua
Turiamo
Carenero
Río Chico
Maracay
CARACAS
Cumaná
Guanta
Barcelona
Valencia
L. de Valencia
Villa de Cura
La Victoria
Ocumare del Tuy
Camatagua
Maturín
San Carlos
Ortiz
Onoto
Aragua
Zaraza
Orinoco Delta
Orinoco
Calabozo
Obispos
Colón—Liverpool 4,545
Charlotte Amalie—Plymouth 3,527
Charlotte Amalie—Hamburg 4,077
Charlotte Amalie—Azores 2,269
New York—San Juan 1,399
New York—La Guaira 1,847
Anegada Passage
Pointe-à-Pitre—Bordeaux 3,541
Ponce—Fort de France 981
Port au Prince—Bridgetown 1,070
Ciudad Trujillo—La Guaira 501
La Guaira—Charlotte Amalie 479
Curaçao—Port of Spain 467
Bridgetown—Southampton 3,622
Bridgetown—Georgetown 389
Port of Spain—Georgetown 376
883
209
618
0° West of Greenwich
66°
62°
58°
12°
16°
20°
86124

curve toward the northeast. Great damage and loss of life occur when they move directly onto an island.

Political Status.—There are three independent nations in the Greater Antilles: Cuba, and Haiti and the Dominican Republic on Hispaniola. The United States holds Puerto Rico, acquired from Spain in 1898, and part of the Virgin Islands, purchased from Denmark in 1916. Venezuela controls a few small islands near her northern coast. The remaining islands are possessions of European nations. Among the British islands are Jamaica, the Bahama Islands, the Leewards, the Windwards, Barbados, and Trinidad. French islands include part of St. Martin, St. Barthélemy, Guadeloupe, Marie Galante, and Martinique. Netherlands holdings include part of St. Martin (Sint Maarten), Saba, St. Eustatius, and the group close to the Venezuelan coast, Curaçao, Aruba, and Bonaire.

Population and Economy.—Total population of the West Indies was estimated (1955) as 17,532,000. The Greater Antilles supported 88 per cent of this number: Cuba with 5,807,000; Haiti, 3,506,000; the Dominican Republic, 2,347,000; Puerto Rico, 2,229,000; and Jamaica, 1,518,000. Despite this, the greatest density of population is on Barbados, where an essentially rural, dominantly Negro population of 225,000 is limited to an area of 166 square miles, a density of 1,355 per square mile.

Tropical crop production dominates the economy within the West Indies. Sugar, long the principal trade product of the islands, is still grown on many of them, though the main concentration is now in Cuba. Coffee, cacao, tobacco, bananas, and vegetable fibers, notably henequen and cotton, are among the common crops. Cuba has significant mineral wealth in chromium, manganese, copper, and iron. The Dutch islands, Curaçao and Aruba, are important refining and transshipment centers for Venezuelan petroleum. For history and other information, see separate articles on the individual islands and the island groups.

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WEST LAFAYETTE, city, Indiana, in Tippecanoe County; 60 miles northwest of Indianapolis, on the Wabash River, opposite Lafayette with which it is connected by bridge. The city is the site of Purdue University (q.v.), and nearby is located the state soldiers' home. Incorporated in 1924, West Lafayette is governed by mayor and council. Pop. (1950) 11,873.

WEST LOTHIAN (formerly LINLITHGOW), county in southeastern Scotland, bordering for about 15 miles on the Firth of Forth; area 120 square miles; capital Linlithgow. Besides being a good farming and dairying region, it has important coal, oil-shale, and iron mining industries. The county is noted for its historic sites which include prehistoric and Roman remains. The Forth Bridge unites the county with that of Fife. Pop. (1951) 88,576.

WEST MEMPHIS, city, Arkansas, in Crittenden County; altitude 210 feet; on the Mississippi River, 5 miles west of Memphis, Tenn. It is served by the Chicago, Rock Island and Pacific, the Missouri Pacific, and the St. Louis-San Francisco railroads. Situated in an agricultural region, its chief industries include the processing of cotton, cottonseed oil, and soybeans. There are also lumber mills and distilleries. First settled in 1914, West Memphis was incorporated as a community in 1929 and as a city in 1935. Government is by a board of aldermen. Pop. (1950) 9,112.

WEST MIFFLIN, borough, Pennsylvania, in Allegheny County; altitude 700 feet. It lies southeast of Pittsburgh and north of McKeesport, and is partially bounded by the Monongahela River. It is served by the Pennsylvania, the Baltimore and Ohio, the New York Central, and the Pittsburgh and West Virginia railroads; also a county municipal airport. There are many important industries which include steel and coal plants, and those turning out automobile bodies, cans, and luggage; also a General Electric atomic plant. The township of Mifflin was created in 1788; the borough of West Mifflin was incorporated in 1944. Government is by mayor and council. Pop. (1950) 17,985.

WEST MILWAUKEE, village, Wisconsin, in Milwaukee County. It comprises a suburban area just west of Milwaukee. The village was incorporated in 1906. Government is by mayor and council. Pop. (1950) 5,429.

WEST MONROE, city, Louisiana, in Ouachita Parish; altitude 75 feet; on the Ouachita River and located just west of Monroe; served by the Illinois Central and the Tremont and Gulf railroads. It lies in an agricultural area which specializes in fruit and livestock. Manufactures include cottonseed oil, paper and wood products, chemicals, clothing, and meat products. The city was incorporated in 1926. Government is by mayor and council. Pop. (1950) 10,302.

WEST NEW YORK, town, New Jersey, in Hudson County; on the Hudson River, four miles north of Jersey City. Its mile-long waterfront has docks and grain elevators. Manufactures include textiles, embroideries and clothing, radio parts, leather goods, and toys. The town was incorporated in 1898 and has a commission government. Pop. (1950) 37,683.

WEST NEWTON, borough, Pennsylvania, in Westmoreland County; altitude 770 feet; on the Youghiogheny River, 20 miles southeast of Pittsburgh; served by the Pittsburgh and Lake Erie and the Baltimore and Ohio railroads. Local industries produce metal products, lumber, and beverages. The borough was incorporated in 1842. It has a mayor and council. Pop. (1950) 3,619.

WEST ORANGE, town, New Jersey, in Essex County, altitude 190 feet; 5 miles northwest of Newark, on the Erie Railroad. It is at the base and on the slopes of Watchung Mountains. Eagle Rock (650 feet) affords a splendid view. Llewellyn Park (750 acres) has fine residences and scenery. Here Thomas A. Edison lived after 1887, and the main industries are those

connected with his laboratory—the manufacture of electrical equipment. Other manufactures are machinery, metal products, tiles and clothing. Separated from Orange in 1862 as Fairmount, the place was named West Orange in 1863, and was incorporated as a town in 1890. It has a commission government. Pop. (1950) 28,605.

WEST PALM BEACH, city, Florida, port of entry and seat of Palm Beach County; altitude 15 feet; 67 miles north of Miami; on the Florida East Coast and the Seaboard Air Line railroads; with airline service. The city is a distributing point for agricultural produce. Manufactures include air-conditioning equipment, prefabricated buildings, concrete products, and beverages. There are music, art, and garden clubs; a memorial library; a marine museum, and an alligator and ostrich farm. The city was incorporated in 1894; it has city manager government. Pop. (1950) 43,162.

WEST PATERSON, borough, New Jersey, in Passaic County; altitude 190 feet. It comprises a suburban area adjoining Paterson on the southwest; on the Passaic River and served by the Delaware, Lackawanna and Western Railroad. Primarily it is a residential community. It was incorporated in 1917 and has a mayor and council. Pop. (1950) 3,931.

WEST PITTSTON, borough, Pennsylvania, in Luzerne County; altitude 577 feet; on the Susquehanna River; opposite Pittston (q.v.); on the Delaware, Lackawanna and Western, and the Lehigh Valley railroads. It is mainly residential, but has silk mills and machine shops. It was incorporated in 1857 and has mayor and council. Pop. (1950) 7,230.

WEST PLAINS, city, Missouri, seat of Howell County, altitude 955 feet; 90 miles southeast of Springfield, on the St. Louis-San Francisco Railroad. It is an agricultural region in the Ozarks, and is a shipping center for livestock, dairy products, lumber, and grain. It was laid out in 1858 and is governed by a commission. Pop. (1950) 4,918.

WEST POINT, city, Georgia, in Troup County; altitude 580 feet; on the Chattahoochee River, 14 miles southwest of La Grange; served by the Atlanta and West Point and the Western Railway of Alabama, and Chattahoochee Valley railroads, and by federal and state highways. In the midst of a cotton-raising region, the city's chief manufactures are textiles, textile machinery, and dyes.

West Point was incorporated in 1831. During the Civil War it was a supply depot for the Confederate Army. Pop. (1950) 4,076.

WEST POINT, city, Mississippi, seat of Clay County, altitude 240 feet; 16 miles northwest of Columbus, on the Columbus and Greenville, the Gulf, Mobile and Ohio, and the Illinois Central railroads. It has food-processing plants, cottonseed oil and lumber mills, and it manufactures textiles, clothing, and farm machinery. The city has a Carnegie library and is the seat of Mary Holmes Seminary, a junior college for Negroes. West Point was incorporated in 1858 and is governed by mayor and council. Pop. (1950) 6,432.

WEST POINT, United States military post, located in Orange County, New York; altitude 167 feet, on the west bank of the Hudson River; about 50 miles north of New York City on the New York Central Railroad. The site is very picturesque. The eastern end of the point slopes abruptly to the river. On the northern side, the slope is more gradual. To the northwest are Crow's Nest and Storm King mountains, and to the south is the town of Highland Falls. The government reservation, including Constitution Island, contains about 15,000 acres. It was occupied as a military post by the Americans during the Revolutionary War and was strongly fortified. An iron chain was stretched across the river to Constitution Island to prevent British vessels from ascending. In 1780 the point was under the command of Benedict Arnold whose plan to betray it to the enemy was frustrated by the capture of Major John André. West Point was a military post after the revolution, and a military school was established there in 1794. On March 16, 1802, the United States Military Academy (q.v.) was authorized by Congress.

WEST POINT, town, Virginia, in King William County; altitude 16 feet; at the junction of three rivers, the Pamunkey, Mattaponi, and York; 38 miles east of Richmond; on the Southern Railroad. At the head of navigation on the York River, it has steamboat connections, and is a shipping point for the cotton growers of the surrounding area. Its industrial history includes oyster packing, cotton processing, and the manufacture of fertilizers from the phosphatic marl and potash deposits on the Pamunkey. There is a pulp and paper plant. Founded in colonial times, the place was named for the four West brothers: Thomas, Francis, John, and Nathaniel, of whom three were governors. In 1691 the General Assembly made the town a port of entry; in 1705, a free borough. George Washington frequently stopped here on his way between Mount Vernon and Williamsburg, and nearby is Martha Washington's birthplace. Pop. (1950) 1,919.

WEST POINT, or ELTHAM'S LANDING (Va.), **Engagement at.** When Yorktown (q.v.) was abandoned May 4, 1862, it was intended by Gen. George B. McClellan that William B. Franklin's division, followed by Sedgwick's, Porter's and Richardson's, should be moved in transports up York River to a place opposite West Point and, striking across to the main roads, cut off the retreat of such bodies of Gen. J. E. Johnston's army as might be below, making their way to New Kent Court House. But the day before the evacuation of Yorktown, Franklin had received permission to land his men, who had been on the transports several days, and it was not until the morning of May 6 that he could get them on board again. That afternoon he landed his men above West Point and sent the transports back for Gen. John Sedgwick's division. He had no instructions except to wait for orders. He encamped his division on high wooded ground, over which ran a road from the landing to Barhamsville and thence toward New Kent Court House. Franklin's presence threatened this road on which part of the Confederate Army was retreating from Yorktown and Williamsburg, and under General Johnston's orders Whiting's and Hampton's brigades had been put in position to

protect the road. On the morning of May 7, Whiting was ordered to advance and drive Franklin back to his landing place. By noon Franklin had been pushed back under cover of the gunboats. The Confederates then attempted to shell the transports in York River, but the range was too great, while the fire from the Union gunboats was effective, and compelled the Confederates to withdraw about 3 P.M., and resume their position near Barhamsville. Franklin's troops resumed their former position.

WEST POINT MILITARY ACADEMY. See UNITED STATES MILITARY ACADEMY.

WEST READING, borough, Pennsylvania, in Berks County; situated opposite Reading. On the Schuylkill River, it is served by Reading Company Railroad and a state highway. There are manufactures of fabrics, hats, hoisery, knit goods, and paper. Settled in 1748, West Reading was incorporated in 1907. It has a council-manager plan of government. Pop. (1950) 5,072.

WEST RIVER, China. See SI KIANG.

WEST RUTLAND, town, Vermont, in Rutland County; altitude 500 feet; in the valley of Otter Creek; 68 miles southeast of Burlington; served by the Delaware and Hudson; the Clarendon and Pittsford; and the Rutland railroads. It is the center of the state's marble industry, quarrying and working the stone. West Rutland was set off from the old township of Rutland in 1886. Its high school and library are built of local marble. Pop. (1950) 2,487.

WEST SAINT PAUL, city, Minnesota, in Dakota County, altitude 703 feet, west of St. Paul on a state highway; a residential suburb. Area six square miles. It has a mayor and six aldermen. Pop. (1950) 7,955.

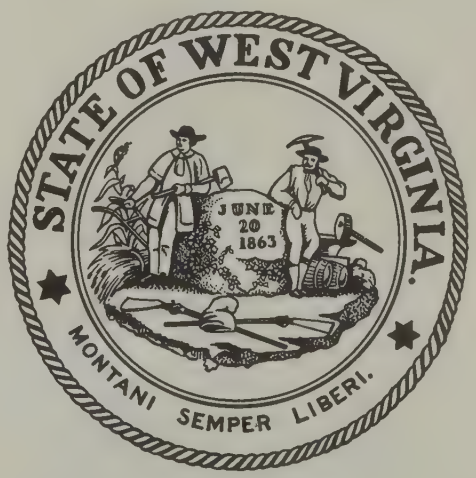
WEST SPRINGFIELD, town, Massachusetts, in Hampden County; altitude 103 feet; on the Connecticut River; on the Boston and Albany Railroad; opposite Springfield, many of whose business people have their homes here. There are several industrial establishments, among which are paper works, chemical, machine and railroad repair shops, magneto and gasoline pump manufactures, and an electric generating plant. Many of the townspeople are interested in market gardening. The Eastern States Exposition is held here. The Day House, built in 1754, is now a historical museum. Pop. (1950) 20,438.

WEST TERRE HAUTE, city, Indiana, in Vigo County, on the Wabash River, on the western outskirts of Terre Haute, on the Pennsylvania Railroad. Its industries include the working of extensive deposits of coal and clay, and there is a paving-brick plant. Pop. (1950) 3,357.

WEST VIRGINIA, one of the South Atlantic states of the United States, known as the Trans-Allegheny Region of Virginia prior to its separation from the mother state. The state is bounded on the north by Ohio, Pennsylvania, and Maryland; on the south by Virginia and Kentucky; on the east by Virginia and Maryland; and on the west by Ohio and Kentucky. The narrow strip of land at the north between Ohio and Pennsylvania is called the Northern Panhandle, and that at the east is called the Eastern Panhandle. The latter is almost entirely surrounded by Maryland and Virginia and is joined to the rest of West Virginia by a narrow neck of land only 15 miles wide.

State flag.

Because of its natural character the state boundary is perhaps the most irregular in the Union. The West Virginia-Ohio line is low water mark on the western bank of the Ohio River, thus throwing the islands within West Virginia. The center of the Big Sandy and of Tug Fork of that stream is the boundary between West Virginia and Kentucky. The Virginia-West Virginia line is made up of portions of the boundaries of border counties and generally follows the crest of meandering mountain ridges. The West Virginia-Maryland line is the south bank at low water mark of the Potomac and its North Branch to the source of the latter at Fairfax Stone, thence by a line due north about 35 miles to the Mason and Dixon line, which forms the boundary between West Virginia and Pennsylvania to its western terminus at a point about 20 miles east of the Ohio River. Thence the Pennsylvania boundary extends due north 61 miles to the northern bank of the Ohio.



State seal (obverse).

Total area (40th in national rank)	24,181 square miles
Land area	24,080 square miles
Inland water area	101 square miles
Latitude	37° 10′—40° 40′ N.
Longitude	70° 40′—82° 40′ W.
Altitude	247—4,860 feet
Population (1950)	2,005,552
Estimate, July 1, 1956	1,983,000
Capital—Charleston; population (1950)	73,501
Admitted to Union as 35th state	June 20, 1863
State bird	Cardinal
State flower (adopted Jan. 23, 1903)	Big rhododendron

State motto *Montani Semper Liberi*
(Mountaineers are always freemen)
State nicknames.."Mountain State"; "Panhandle State"; "Switzerland of America"
State song (unofficial) *West Virginia Hills*
State tree Sugar maple

State seal (reverse).

A discussion of West Virginia's geography, government, and history is presented under the following headings:

1. Physical Features and Resources
2. Population and Political Divisions
3. Government and Politics
4. Education and Social Welfare
5. Economic Activities
6. Places of Interest
7. Famous Men and Women
8. History

1. PHYSICAL FEATURES AND RESOURCES

Topography.—The average elevation above sea level of the surface of West Virginia is about 1,500 feet. The range in altitude is 4,613 feet, the lowest point being Harpers Ferry at 247 feet and the highest being the summit of Spruce Knob, Pendleton County, at 4,860 feet. The lowest point in the Mississippi Valley drainage is at Kenova (500 feet). Of the total area, over 20,635 square miles drain into the Ohio either directly or indirectly; nearly 3,500 square miles drain into the Potomac; and about 80 square miles in Monroe County drain into the James. The predominant feature of West Virginia topography is ruggedness. There are no natural lakes or pools of considerable size, and the areas of poorly drained land are few and small. The surface has been scientifically described:

". . . as an elevated, somewhat rolling plain, which has been dissected by the action of running water into an intricate system of hills and valleys. The varying degree to which this dissection has been affected, as well as differences in the underlying rocks, has resulted in the variety of topography to be seen in the State. This ranges from a slightly rolling plateau, intersected by the narrow, steep-walled valleys of scattered, swift, steeply descending streams; through regions in which the original plateau has been dissected into a series of flat-topped hills and ridges separated by narrow valleys; to a stage in which the hills are no longer flat-topped but sharply crested, while the valleys have grown wider, and the streams assumed meandering courses." (Price, Tucker, and Haught, *Geology and Natural Resources of West Virginia,* p. 13).

To the west of a somewhat irregular line called "Allegheny Front," passing from Keyser to Bluefield through Green Bank and White Sulphur Springs, the beds of rock in which the valleys have been carved lie practically horizontal. As the valleys extend in general southeast and northwest directions, they are not therefore related to these beds of rock which extend from northeast to southwest. In other words, the streams have, through countless ages, worn their beds through the Allegheny Highland of about 6,000 square miles, the Cumberland Plateau of about 6,500 square miles, and the Ohio Valley region proper of about 8,000 square miles, at respective mean elevations of about 4,000 to 2,000, 2,000 to 1,000, and 1,000 to 500 feet. East of this drainage system (the dendritic) the folds of the elevations are much sharper and control to a great extent the courses of the valleys. Here the parallel courses of the main streams contrast strongly with the irregular courses of streams in the Trans-Allegheny area, particularly in the Cumberland Plateau where they are featured by numerous rapids. Regardless of the great differences in these two drainage systems, each has its origin in a common center in the northern portion of Pocahontas County. Here are the sources of the South Branch of the Potomac, Gauley, Elk, Cheat, Greenbrier, and Tygart rivers.

In recent years the drainage system has been modified somewhat by the use of locks and dams and artificial reservoirs. Through use of the former the Ohio has a nine-foot stage throughout its entire course and the Kanawha from its mouth to the falls about 40 miles east of Charleston. Lake Lynn, otherwise known as "Cheat Lake," on Cheat River, is used primarily for power; Tygart River Reservoir near Grafton is used primarily for flood control; and Bluestone Reservoir on New River near the mouth of the Greenbrier is for a similar purpose. Still other reservoirs are being projected with a view to eliminating flood menaces.

Climate.—Because of the range in altitude, which is equivalent to about 10 to 15 degrees of latitude, West Virginia has a great diversity of climate. As only the Eastern Panhandle is affected perceptibly by the Atlantic Ocean, the climate of the major part of the state is decidedly continental and thus subject to great and frequent changes in temperature. The mean annual temperature ranges from 56°F. in the southwestern counties to 48° in the mountain counties. For the greater part of the state the mean annual temperature is between 52° and 53°F., and the range is from —15° to 100°F., but temperatures as low as —35° and as high as 107°F. have been recorded. In the low counties the growing season is about six months and in the highest about five months. The prevailing winds are from the southwest. The annual precipitation varies from well over 50 inches in a few of the highest counties to 35 and 40 inches in counties of the panhandles. The mean for the greater part of the state is between 45 and 50 inches and is usually fairly evenly distributed, but some seasons are very dry.

Natural Resources.—*Plant Life.*—Before the first white settlers came, present West Virginia was almost completely covered by a mixed hardwood growth known to botanists as the "Appalachian Hardwood Forest." About 1800 it was visited by André Michaux (from France) and other botanists who generally agreed that this forest was then richer than that which had covered China five to six thousand years before. Among the growths which they found that were unknown to either modern Europe or China were tulip or "poplar," locust, hickory, ash, oak, maple, walnut, beech, chestnut, cherry, sycamore, elm, birch and mulberry. These and other growths, including about 130 varieties, grow in West Virginia, which 30 years ago contained more different

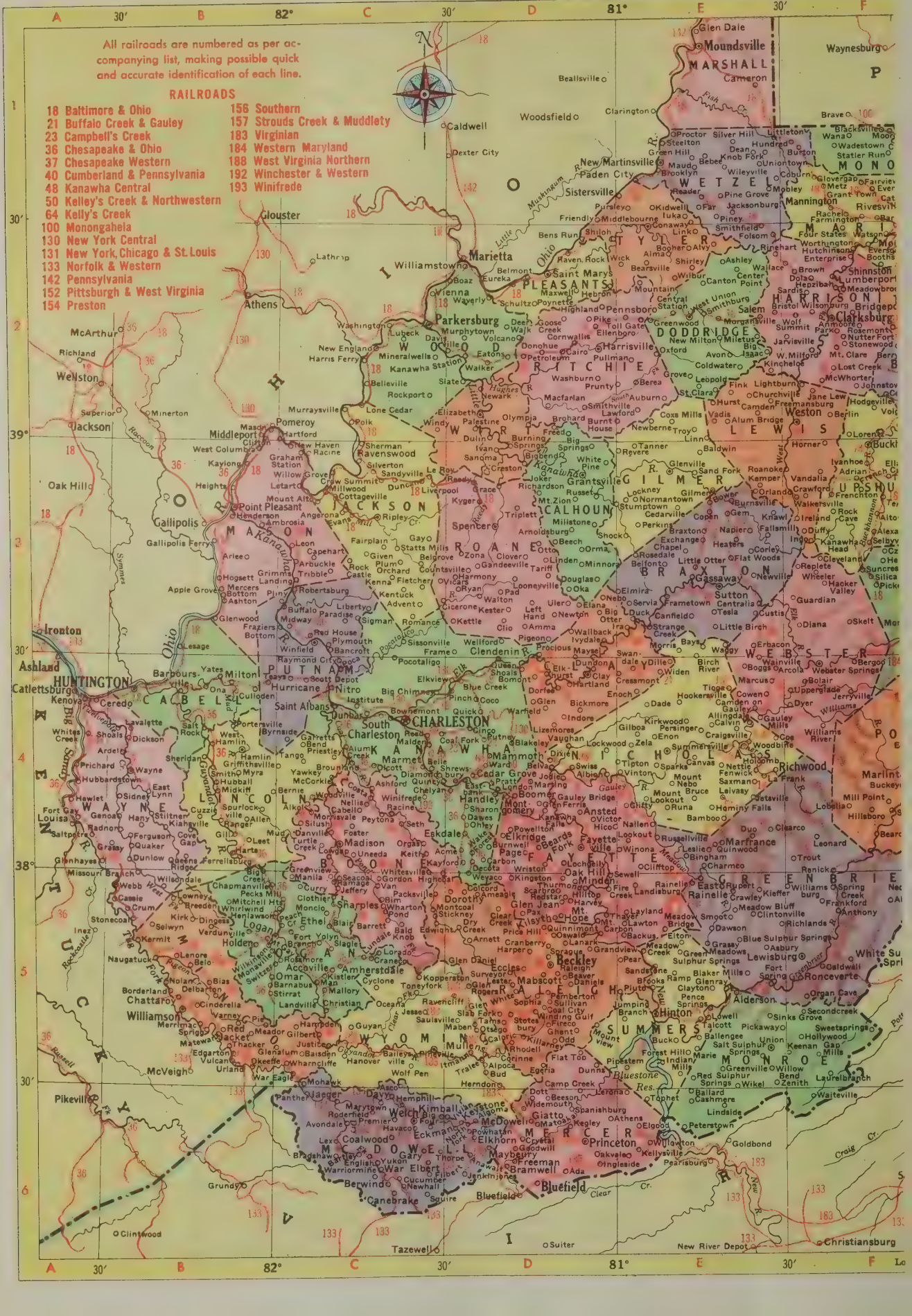
WEST VIRGINIA

1950 Total Population 2,005,552

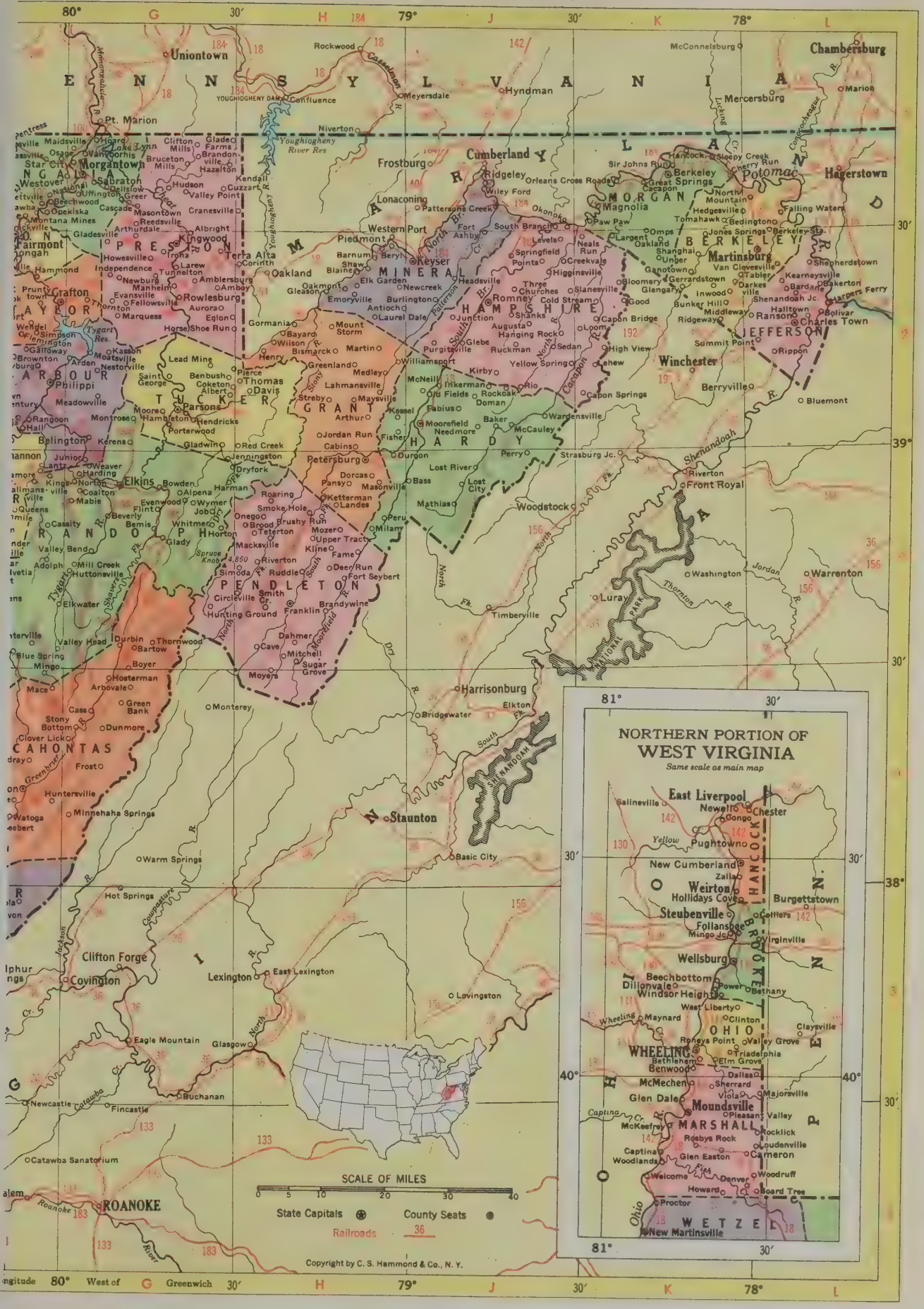
Accoville (C5).....1,400
Acme (D4)..... 430
Ada (D6)..... 300
Addison (Webster Springs) ◉(F4)....1,313
Adolph (F3)..... 85
Adrian (F3)..... 400
Advent (C3)..... 100
Albright (G1)..... 396
Alderson (E5).....1,489
Alexander (F3)..... 250
Algoma (D6)..... 625
Alkol (C4)..... 125
Alpena (G3)..... 125
Alpoca (D5)..... 550
Alton (F3)..... 156
Alum Bridge (E2)... 125
Alum Creek (C4)..... 249
Alvon (F5)..... 100
Alvy (E2)..... 155
Amboy (G2)..... 75
Ambrosia (C3)..... 100
Ameagle (D5).....
Amherstdale (C5)....2,000
Amma (D3)..... 500
Anawalt (D6).....1,383
Anmoore (F2).....1,388
Ansted (D4).....1,543
Anthony (F5)..... 82
Antioch (H2)..... 50
Arbovale (G4)..... 80
Arbuckle (C3)..... 50
Arcola (F4)..... 125
Ardel (A4)..... 200
Arden (G2)..... 250
Arlee (B3)..... 100
Arnoldsburg (D3).... 130
Arthur (H2)..... 30
Arthurdale (G1)..... 900
Asbury (E5)..... 320
Asco (C6)..... 200
Ashford (C4)..... 350
Ashley (E2)..... 90
Ashton (B3)..... 66
Athens (E6)..... 935
Auburn (E2)..... 149
Augusta (J2)..... 250
Aurora (G2)..... 337
Avon (E2)..... 50
Avondale (C6)..... 975
Backus (E5)..... 200
Baileysville (C5).....1,127
Baker (J2)..... 75
Bakerton (L2) 300
Bald Knob (C5)..... 500
Baldwin (E3)..... 95
Ballard (E6)..... 300
Bancroft (C3)..... 700
Barboursville (B4)...1,943
Bardane (L2)..... 120
Barnabus (C5).....1,500
Barnum (H2)..... 95
Barrackville (F1).....2,500
Bartley (C6).....1,275
Bartow (G3)..... 200
Bath (Berkeley Springs) ◉(K1)....1,213
Bayard (H2)..... 589
Beard (F4)..... 50
Beards Fork (D4).... 750
Bearsville (E2)..... 30
Beaver (Glen Hedrick) (D5).....1,484
Bebee (E1)..... 200
Beckley ◉(D5)..... 19,397
Bedington (L1)..... 150
Beech (D3)..... 41
Beechbottom (K5)...1,100
Belington (F2).....1,699
Belle (C4).....2,350
Belleville (C2)..... 101
Belmont (D2)..... 215
Belo (B5)..... 150
Belva (D4)..... 301
Bemis (G3)..... 75
Benbush (G2)..... 135
Bens Run (D2)..... 135
Benwood (K5).....3,485
Berea (E2)..... 66
Bergoo (F4)..... 800
Berkeley Springs ◉ (K1) 1,213
Berkeley Station (L2) 75
Berlin (F2)..... 66
Berryburg (F2)..... 200
Berwind (C6).....1,354
Beryl (H2)..... 150
Bethany (L5).....1,063
Bethlehem (K5).....1,146
Beverly (G3)..... 515
Big Chimney (C4)... 500
Big Creek (B5)..... 500
Big Four (C6)..... 200
Big Isaac (E2)..... 30
Big Otter (D3)..... 200
Big Sandy (riv.)(A4)
Big Springs (D3)..... 150
Bigbend (D3)..... 100
Bim (C5)..... 750
Bingham (E4) 90
Birch River (E4)..... 200
Blacksville (F1)..... 241
Blaine (H2)..... 300
Blair (C5)..... 624
Blaker Mills (E5).... 115
Blue Creek (D4)..... 140
Blue Sulphur Spgs. (E5) 400
Bluefield (D6).....21,506
Bluestone (res.) (E5) .....
Boggs (E4)..... 211
Bolair (F4)..... 300
Bolivar (L2)..... 637
Bomont (D4)..... 206
Boothsville (F2)..... 200
Borderland (B5)..... 270
Bowden (G3)..... 150
Bownemont (C4)..... 400
Boyer (G3)..... 150
Bradshaw (C6).....1,062
Bramwell (D6).....1,587
Brandonville (G1).. 100
Brandywine (H3)..... 150
Braxton (E3)..... 67
Breeden (B5)..... 300
Bridgeport (F2).....2,414
Bristol (F2)..... 300
Brohard (D2)..... 400
Brooklyn (E1)..... 500
Brounland (C4)..... 50
Brown (F2)..... 250
Brownton (F2)..... 928
Bruce (E4)..... 175
Bruceton Mills (G1) 165
Brushy Run (H3)..... 300
Buck (E5)..... 50
Buckeye (F4)..... 40
Buckhannon ◉(F3).6,016
Buckhannon (riv.) (F3) .....
Bud (D5)..... 500
Buffalo (C3)..... 333
Bunker Hill (K2).... 350
Burlington (J2)..... 300
Burnsville (E3)..... 731
Burnt House (D2)... 40
Burnwell (D4)..... 1,000
Burton (F1)..... 219
Cabins (H2)..... 120
Cacapon (riv.) (J2).
Cairo (D2)..... 500
Caldwell (F5)..... 600
Caloric (D5)..... 320
Camden (E2)..... 150
Camden on Gauley (E4) 373
Cameron (L6).....1,736
Camp Creek (D5)... 150
Canebrake (C6)..... 568
Canfield (E3)..... 65
Canvas (E4)..... 500
Capon Bridge (K2). 223
Capon Springs (K2) 220
Captina (K6)..... 200
Carbon (D4)..... 500
Cascade (G1)..... 200
Cashmere (E6)..... 100
Cass (G4)..... 417
Cassie (B5)..... 350
Cassity (G3)..... 250
Cave (H3)..... 50
Cedar Grove (D4)...1,738
Cedarville (E3)..... 103
Center Point (E2)... 200
Central Station (E2) 350
Century (F2)..... 500
Ceredo (B4).....1,399
Chapel (E3)..... 50
Chapmanville (B5)..1,349
Charles Town ◉ (L2) 3,035
CHARLESTON (D4) 73,501
Charmco (E4)..... 700
Chattaroy (B5).....1,484
Cheat (riv.) (G1).....
Chelyan (C4).....1,500
Cherry (riv.) (E4)...
Cherry Run (L1)..... 150
Chester (L4)..... 3,758
Churchville (E2)..... 125
Cinderella (B5)..... 600
Circleville (H3)..... 250
Clarksburg ◉(F2)..32,014
Clay ◉(D4)..... 500
Clayton (E5)..... 135
Clear Fork, Guyandot (riv.) (C5).....
Clearco (F4)..... 120
Clendenin (D3).....1,475
Cleveland (F3)..... 150
Clifftop (E4)..... 400
Clifton (B3)..... 355
Clifton Mills (G1)... 51
Clothier (C5)..... 636
Clover Lick (F4)..... 324
Coal (riv.) (C4).....
Coal City (D5).....1,000
Coal Fork (D4).....1,185
Coalton (G3)..... 407
Coalwood (C6).....1,310
Coco (D4)..... 200
Coketon (G2)..... 200
Colcord (D5)..... 1,800
Cold Stream (J2)..... 50
Colliers (L5)..... 425
Congo (K4)..... 100
Copen (E3)..... 309
Corinth (H2)..... 175
Cornwallis (D2)..... 124
Costa (C4)..... 168
Cottageville (C3)..... 250
Cove Gap (B4)..... 125
Cowen (E4)..... 632
Coxs Mills (E2)..... 50
Cranberry (D5)..... 750
Craneco (C5)..... 596
Crawford (F3)..... 100
Crawley (E5)..... 150
Creekvale (K2)..... 30
Crum (B5)..... 350
Crystal (D6)..... 400
Cucumber (C6)..... 350
Culloden (B4)..... 250
Cuzzart (H1)..... 75
Cuzzie (B4)..... 100
Cyclone (C5)..... 265
Dahmer (H3)..... 125
Dallas (K5)..... 110
Daniels (D5)..... 800
Danville (C4)..... 544
Darkesville (L2)..... 275
Davis (H2).....1,271
Davisville (C2)..... 45
Davy (C6).....1,650
Dawes (D4)..... 700
Dawson (E5)..... 100
Decota (D4).....1,300
Deer Walk (D2)..... 75
Delbarton (B5).....1,353
Denver (K6)..... 50
Dille (E4)..... 500
Dingess (B5)..... 400
Dixie (D4)..... 50
Dola (F2)..... 110
Doman (J2)..... 50
Donohue (D2)..... 75
Dorcas (H3)..... 60
Dorothy (D5).....3,000
Dott (D6)..... 400
Dry Creek (D5)..... 489
Dryfork (H3)..... 200
Duffy (F3)..... 40
Dunbar (C4).....8,032
Duncan (C3)..... 50
Dundon (D4)..... 125
Dunlow (B4)..... 125
Dunmore (G4)..... 65
Dunns (D5)..... 35
Durbin (G3)..... 540
Durgon (J3)..... 50
East Lynn (B4)..... 300
East Rainelle (E5)...1,695
Eastbank (D4)..... 735
Eccles (D5).....1,885
Eckman (C6).....1,574
Edgarton (B5)..... 500
Edray (F4)..... 32
Egeria (D5)..... 300
Eglon (G2)..... 110
Elana (D3)..... 145
Elbert (C6).....1,565
Elgood (E6)..... 75
Elizabeth ◉(D2)..... 755
Elk (riv.) (D4).....
Elk Garden (H2)..... 318
Elkhorn (D6).....1,035
Elkhurst (D4)..... 66
Elkins ◉(G3).....9,121
Elkridge (D4)..... 475
Elkview (C4)..... 400
Elkwater (G3)..... 75
Ellamore (F3)..... 600
Ellenboro (D2)..... 307
Elm Grove (K5).....8,000
Elmira (E3)..... 200
Elton (E5)..... 200
Emoryville (H2)..... 100
English (C6)..... 890
Enoch (E4)..... 282
Enterprise (F2).....1,200
Erbacon (E3)..... 210
Ethel (C5).....1,032
Eureka (D2)..... 125
Evans (C3)..... 150
Evansville (G2)..... 45
Everettville (F1)..... 750
Everson (F2)..... 50
Fabius (J2)..... 30
Fairmont ◉(F2)....29,346
Fairview (F1)..... 775
Falling Springs (Renick) (F4)..... 307
Falling Waters (L1). 75
Fallsmill (E3)..... 50
Farmington (F1)..... 824
Fayetteville ◉(D4)..1,952
Fellowsville (G2)..... 120
Fenwick (E4)..... 500
Ferrellsburg (B4)..... 275
Filbert (C6).....1,214
Fire Creek (E5)..... 30
Fish (creek) (K6)....
Flat Top (D5)..... 150
Flat Woods (E3)..... 288
Flemington (F2)..... 572
Follansbee (K5).....4,435
Folsom (E2)..... 485
Forest Hill (E5)..... 45
Fort Ashby (J2)..... 800
Fort Gay (A4)..... 714
Fort Seybert (H3).... 200
Fort Spring (E5)..... 225
Foster (C4).....
Four States (F2)..... 470
Frame (C3)..... 98
Frametown (E3)..... 500
Frankford (F5)..... 185
Franklin ◉(H3)..... 777
Fraziers Bottom(B3) 75
Freeman (D6)..... 400
French Creek (F3).. 175
Frenchton (F3)..... 221
Friendly (D1)..... 216
Frost (G4)..... 99
Gallipolis Ferry (B3) 100
Galloway (F2).....1,000
Gandeeville (D3)..... 328
Ganotown (K2)..... 75
Garretts Bend (C4). 125
Gary (C6).....1,600
Gassaway (E3).....1,306
Gauley (riv.)(D4)...
Gauley Bridge (D4)1,134
Gauley Mills (E4).... 200
Gerrardstown (K2). 205
Ghent (D5)..... 488
Giatto (D6)..... 550
Gilbert (C5)..... 722
Gilboa (E4)..... 275
Gill (B4)..... 50
Gilmer (E3)..... 250
Given (C3)..... 250
Gladesville (G2)..... 100
Glady (G3)..... 300
Gleason (H2)..... 40
Glebe (J2)..... 50
Glen (D4)..... 200
Glen Dale (K5).....1,467
Glen Easton (K6)... 200
Glen Ferris (D4)..... 500
Glen Hedrick (Beaver) (D5).....1,484
Glen Jean (D5).....1,600
Glen Rogers (D5)....1,593
Glen White (D5)..... 300
Glenalum (C5)..... 600
Glengary (K2)..... 50
Glenhayes (A4)..... 300
Glenray (E5)..... 75
Glenville ◉(E3).....1,789
Glenwood (B3)..... 150
Glovergap (F1)..... 150
Good (K2)..... 100
Goodwill (D6)..... 800
Goose Creek (D2).. 100
Gordon (C5)..... 800
Gormania (H2)..... 185
Grafton ◉(G2).....7,365
Grandview (D5)..... 175
Grant Town (F1)....1,273
Grantsville ◉(D3).... 959
Grassy Meadows (E5) 100
Great Cacapon(K1) 550
Green Bank (G4)..... 200
Green Hill (E1)..... 175
Greenbrier(riv.)(F4)
Greenview (C4)..... 400
Greenville (E5)..... 65
Greenwood (E2)..... 366
Griffithsville (B4)... 500
Grimms Landing (B3) 420
Guardian (F3)..... 600
Guyan (C5)..... 300
Guyandot (riv.)(B4)
Hacker Valley (F3) 150
Hall (F2)..... 43
Halltown (L2)..... 250
Hambleton (G2)..... 283
Hamlin ◉(B4)..... 841
Hammond (F2)..... 102
Hampden (C5)..... 50
Hancock (K1)..... 131
Handley (D4).....1,007
Hanging Rock (J2).. 75
Hanover (C5)..... 500
Hany (B4)..... 350
Harding (G3)..... 250
Harman (G3)..... 146
Harper (D5).....1,700
Harpers Ferry (L2). 822
Harrisville ◉(E2)....1,387
Hartford (C2)..... 366
Hartland (D4)..... 50
Harts (B4)..... 160
Harvey (D5)..... 503
Hazelton (G1)..... 80
Headsville (J2)..... 240
Hebron (D2)..... 50
Hedgesville (K1)..... 419
Heights (B3)..... 300
Helvetia (F3)..... 94
Hemphill (C6).....2,300
Henderson (B3)..... 483
Hendricks (G2)..... 492
Henlawson (B5)..... 1,750
Hepzibah (F2).....1,800
Herndon (D5)..... 500
Hewlet (A4)..... 75
Hico (D4)..... 300
Higginsville (J2)..... 150
High View (K2)..... 50
Highcoal (C5)..... 500
Highland (D2)..... 100
Hillsboro (F4)..... 241
Hilltop (D5)..... 615
Hinton ◉(E5) 5,780
Hodgeville (F2)..... 100
Holcomb (E4)..... 50
Holden (B5).....2,000
Hollywood (F5)..... 75
Hominy Falls (E4).. 310
Horner (F3)..... 97
Horse Shoe Run (G2) 125
Howesville (G2)..... 250
Hubball (B4)..... 200
Hubbardstown (A4) 400
Hughes (riv.) (D2)..
Hundred (E1)..... 587
Huntersville (G4).... 80
Hunting Ground (H3) 75
Huntington ◉(A4).86,353
Hurricane (C4).....1,463
Hutchinson (F2)..... 600
Huttonsville (G3).... 227
Iaeger (C6).....1,271
Independence (G2).. 175
Indian Mills (E5).... 65
Indore (D4).....1,000
Ingleside (E6)..... 200
Ingo (F3)..... 32
Institute (C4) 500
Inwood (K2)..... 375
Ireland (F3)..... 60
Itmann (D5)..... 500
Iuka (E1)..... 30
Ivanhoe (F3)..... 150
Jacksonburg (E1).... 350
Jane Lew (F2)..... 491
Jarvisville (F2)..... 150
Jeffery (C5).....2,000
Jenkinjones (D6).....1,859
Jennington (H3)..... 30
Jerryville (F4)..... 300
Jesse (C5)..... 150
Jetsville (E4)..... 108
Jodie (D4)..... 600
Johnstown (F2)..... 650
Joker (D3)..... 50
Jones Springs (K2).. 100
Jordan Run (H2).....1,000
Jumping Branch (E5) 500
Junction (J2)..... 35
Junior (G3)..... 729
Justice (C5)..... 405
Kanawha (riv.)(C3)
Kanawha Falls (D4) 149
Kanawha Head(F3) 150
Kanawha Station (C2) 50
Kasson (G2)..... 45
Kayford (C4).....1,050
Kearneysville (L2).. 500
Keenan (F5)..... 60
Keith (C4)..... 310
Kellysville (E6)..... 150
Kemper (E3)..... 55
Kenna (C3)..... 85
Kenova (A4).....4,320
Kermit (B5)..... 964
Keyser ◉(J2).....6,347
Keystone (D6).....2,594
Kiahsville (B4)..... 85
Kidwell (E1)..... 65
Killarney (D5)..... 300
Kilsyth (D5)..... 500
Kimball (C6).....1,359
Kincheloe (F2)..... 33
Kingston (D5).....1,098
Kingsville (F3)..... 85
Kingwood ◉(G2).....2,186
Kirby (J2)..... 45
Kistler (C5).....1,072
Kline (H3)..... 30
Knob Fork (E1)..... 50
Kopperston (C5).....1,112
Kyger (D3)..... 300

◉ County Seat

WEST VIRGINIA



WEST VIRGINIA

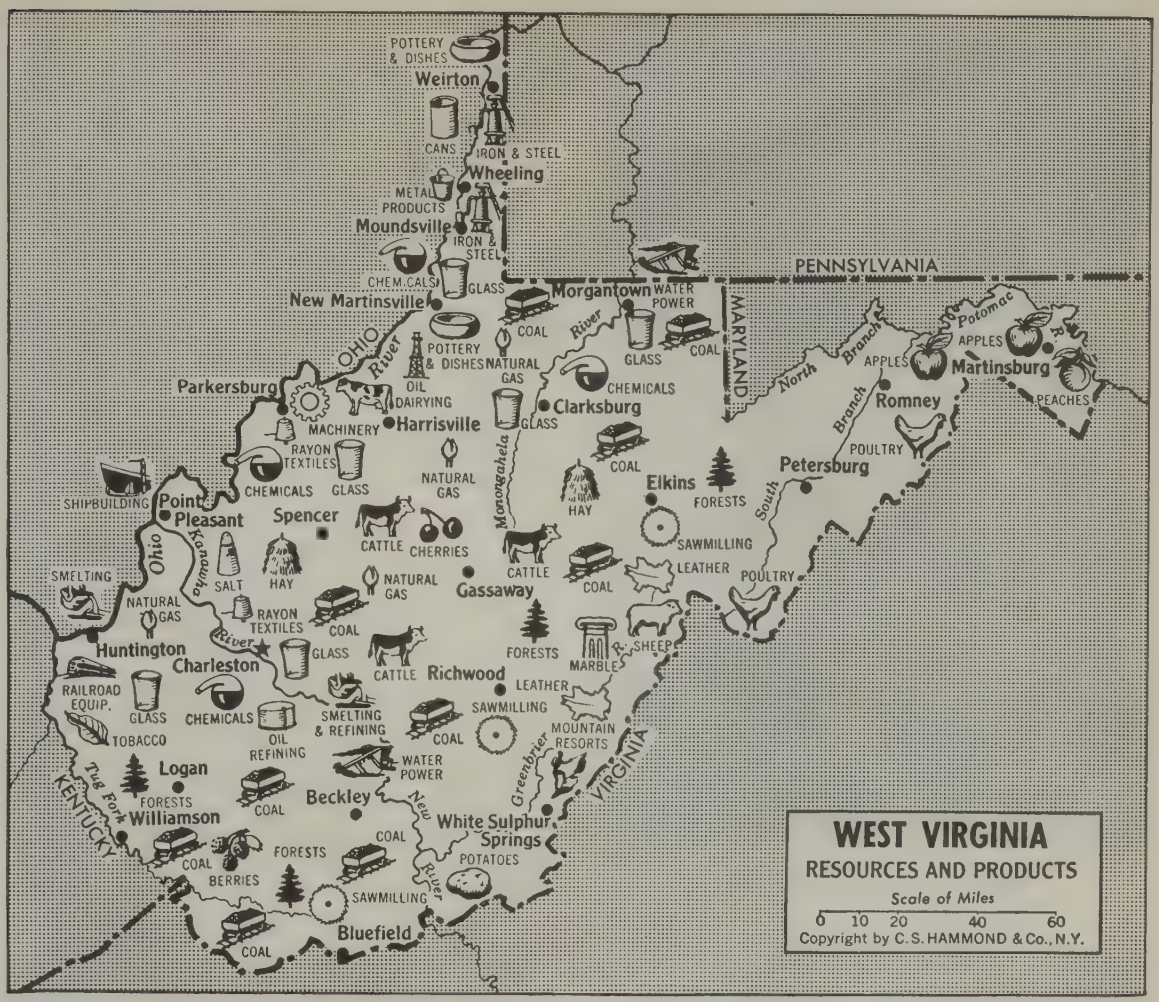


WEST VIRGINIA (Continued)

1950 Total Population 2,005,552

La Frank (F4)..... 150
Lahmansville (H2).. 50
Lanark (D5).....
Landes (H3)..... 125
Landisburg (E5)..... 150
Landville (C5)..... 400
Lantz (F3)..... 50
Lawton (E5)..... 800
Layland (E5)..... 900
Layopolis (Sand Fork) (E3)..... 273
Le Roy (C3)..... 54
Leet (B4)..... 40
Left Hand (D3)..... 500
Lehew (K2)..... 200
Lenore (B5)..... 350
Leon (C3)..... 244
Leopold (E2)..... 38
Lerona (D6)..... 200
Lesage (B3)..... 60
Leslie (E4).....
Lester (D5)..... 780
Letart (C3)..... 150
Lewisburg ◉(E5)....2,192
Lex (C6)..... 250
Liberty (C3)..... 60
Lightburn (E2)..... 40
Lindside (E6)..... 100
Link (E2)..... 45
Linn (E2)..... 53
Little Birch (E3)..... 350
Little Kanawha (riv.) (D3).....
Little Otter (E3)..... 200
Littleton (F1)..... 448
Liverpool (C3)..... 60
Lochgelly (D4)..... 650
Lockney (E3)..... 46
Lockwood (D4)..... 500
Logan ◉(B5).....5,079
London (D4)..... 350
Lookout (E4)..... 950
Loom (K2)..... 50
Lorado (C5).....1,087
Lorentz (F2)..... 250
Lost City (J3)..... 125
Lost Creek (F2)..... 798
Loudenville (L6)..... 40
Lowell (E5)..... 150
Lowgap (C4)..... 30
Lubeck (C2)..... 35
Lumberport (F2).....1,198
Lundale (C5)..... 500
Lynn (lake) (G1)....
Mabie (G3)..... 750
Mabscott (D5).....1,665
Mace (F4)..... 100
Macfarlan (D2)..... 200
Madison ◉(C4).....2,025
Maidsville (F1)..... 500
Majorsville (L5)..... 75
Malden (C4)..... 600
Mallory (C5).....1,286
Mammoth (D4).....1,000
Man (C5).....1,632
Manheim (G2)..... 270
Manila (C5)..... 500
Mannington (F1).....3,241
Marcus (E4)..... 400
Marie (E5)..... 150
Marlinton ◉(F4).....1,645
Marmet (C4).....2,515
Martin (H2)..... 35
Martinsburg ◉ (K2).....15,621
Marytown (C6).....1,268
Mason (B2)..... 924
Masontown (G1)..... 941
Masonville (H3)..... 30
Matewan (B5)..... 989
Mathias (J3)..... 100
Matoaka (D6).....1,003
Maxwell (D2)..... 50
Maybeury (D6).....1,000
Maysel (D3)..... 200
Maysville (H2)..... 105
Mc Cauley (J2)..... 50
Mc Corkle (C4)..... 225
Mc Dowell (D6).....
Mc Keefrey (K6)..... 150
Mc Mechen (K5).....3,518
Mc Neill (J2)..... 50
Mc Whorter (F2)..... 277
Meadow (riv.) (E4)
Meadow Bluff (E5). 55
Meadow Bridge(E5) 597
Meadow Creek (E5) 500
Meadowbrook (F2). 500
Medley (H2)..... 51
Merrimac (B5)..... 150
Metz (F1)..... 350
Middlebourne ◉ (E1)..... 741
Middleway (K2)..... 350
Midkiff (B4)..... 121
Midway (C3)..... 150
Milam (H3)..... 70
Mill (creek) (C3)....
Mill Creek (G3)..... 800
Mill Point (F4)..... 50
Millwood (C3)..... 82
Milton (B4).....1,552
Minden (D5).....2,200
Mineralwells (C2).... 50
Mingo (F3)..... 200
Minnehaha Springs (G4)..... 100
Minnora (D3)..... 57
Missouri Branch (A5)..... 100
Mitchell Hts. (B5)... 185
Moatsville (G2)..... 110
Mohawk (C5)..... 225
Monaville (B5).....1,275
Monclo (C5)..... 500
Monongah (F2).....1,622
Monongahela (riv.) (G1).....
Montana Mines (F1) 300
Montcoal (D5).....
Montgomery (D4)...3,484
Montrose (G2)..... 79
Moorefield ◉(J2)....1,405
Moorefield (riv.) (H3).....
Morgansville (E2)... 50
Morgantown ◉ (G1).....25,525
Morris (E3)..... 37
Moundsville ◉ (K6).....14,772
Mt. Alto (C3)..... 70
Mt. Carbon (D5)..... 500
Mt. Clare (F2).....1,236
Mt. Gay (C5)..... 676
Mt. Hope (D5).....2,588
Mt. Lookout (E4)... 575
Mt. Nebo (E4)..... 75
Mt. Storm (H2)..... 150
Mountain (E2)..... 165
Mountview (D5)..... 230
Moyers (H4)..... 78
Mud (riv.) (B4) .....
Mullens (D5).....3,470
Murphytown (D2)... 75
Murraysville (C2).... 30
Myra (B4)..... 128
Napier (E3)..... 115
National (G1)..... 500
Naugatuck (B5)..... 400
Needmore (J2)..... 75
Nellis (C4).....1,200
Nestorville (G2)..... 200
Nettie (E4)..... 600
New (riv.) (E5).....
New Cumberland ◉ (K4).....2,119
New England (C2).. 75
New Haven (C3)..... 969
New Martinsville ◉ (E1).....4,084
Newark (D2)..... 70
Newberne (E2)..... 55
Newburg (G2)..... 657
Newell (K4).....2,101
Newhall (C6)..... 750
Newton (D3)..... 375
Newville (E3)..... 175
Nitro (C4).....3,314
Nolan (B5)..... 600
Normantown (E3).. 89
N. Branch, Potomac (riv.) (J2).....
N. Mountain (K1).. 175
Northfork (D6)..... 994
Norton (G3)..... 600
Nutter Fort (F2).....2,285
Oak Hill (D4).....4,518
Oakland (K2)..... 50
Oakmont (H2)..... 125
Oakvale (D6)..... 239
Oceana (C5).....1,373
Ohio (riv.) (B3).....
Ohley (D4)..... 250
Okeefe (B5)..... 150
Okonoko (J1)..... 30
Olcott (C4)..... 550
Old Fields (J2)..... 100
Omar (C5).....1,575
Omps (K2)..... 100
Ona (B4)..... 100
Opekiska (G1)..... 100
Organ Cave (F5)..... 500
Orgas (C4)..... 175
Orlando (E3)..... 300
Orleans Cross Roads (J1)..... 75
Osage (F1)..... 800
Oswald (D5)..... 350
Oxford (E2)..... 41
Packsville (C5)..... 365
Paden City (D1).....2,588
Page (D4)..... 800
Palestine (D2)..... 348
Panther (C6)..... 475
Paradise (C3)..... 78
Parkersburg ◉ (D2).....40,492
Parsons ◉(G2).....2,009
Pattersons Creek (J1)..... 100
Paw Paw (K1)..... 820
Pax (D5)..... 561
Peach Creek (C5).... 800
Pecks Mill (B5)..... 810
Pemberton (D5).....1,000
Pence Spgs. (E5)..... 85
Pennsboro (E2).....1,753
Pentress (F1)..... 500
Perry (J3)..... 80
Petersburg ◉(H3)...1,898
Peterstown (E6)..... 571
Petroleum (D2)..... 100
Peytona (C4)..... 650
Philippi ◉(G2).....2,531
Pickaway (E5)..... 100
Pickens (F3)..... 300
Pie (B5)..... 250
Piedmont (H2).....2,565
Pierce (H2)..... 288
Pike (D2)..... 87
Pine Grove (E1)..... 877
Pineville ◉(C5).....1,082
Piney (E1)..... 150
Pipestem (E5)..... 132
Pliny (B3)..... 55
Plymouth (C3)..... 300
Poca (C4)..... 465
Pocatalico (C4)..... 150
Pocatalico(riv.) (C3)
Point Pleasant ◉ (B3).....4,596
Pond Fork, Coal (riv.) (C4).....
Porterwood (G2)..... 100
Potomac (riv.) (L1)
Powellton (D4).....1,477
Power (K5)..... 558
Powhatan (D6)..... 550
Pratt (D4)..... 457
Premier (C6).....1,000
Price Hill (D5)..... 350
Prichard (A4)..... 400
Priestley (C4)..... 50
Princeton ◉(D6).....8,279
Procious (D3)..... 900
Proctor (E1)..... 217
Prunty (D2)..... 51
Pruntytown (F2)..... 300
Pughtown (K4)..... 250
Pullman (D2)..... 210
Pursley (D1)..... 110
Quaker (B4)..... 150
Queen Shoals (D4).. 150
Queens (F3)..... 300
Quincy (C4)..... 360
Quinnimont (D5)..... 250
Quinwood (E4)..... 838
Rachel (F1).....1,200
Racine (C4)..... 700
Radnor (A4)..... 70
Rainelle (E5)..... 853
Raleigh (D5).....1,164
Ramage (C5)..... 100
Ramp (E5)..... 100
Ranger (B4)..... 275
Rangoon (F2)..... 100
Ranson (L2).....1,436
Raven Rock (D2).... 83
Ravencliff (C5)..... 150
Ravenswood (C3)....1,175
Raymond City (C4) 300
Reader (E1)..... 600
Red Creek (H2)..... 150
Red House (C3)..... 250
Red Jacket (B5).....1,575
Red Sulphur Springs (E5)..... 100
Reed (C4)..... 750
Reedsville (G1)..... 321
Reedy (D3)..... 352
Renick (F4)..... 307
Revere (E3)..... 75
Rhodell (D5)..... 829
Richardson (D3)..... 46
Richlands (F5)..... 83
Richwood (F4).....5,321
Ridgeley (J1).....1,754
Ridgeway (K2)..... 100
Rinehart (E2)..... 150
Rio (J2)..... 150
Ripley ◉(C3).....1,813
Rippon (L2)..... 130
Riverton (H3)..... 300
Rivesville (F1).....1,343
Roanoke (E3)..... 250
Roaring (H3)..... 162
Robertsburg (C3).... 120
Rock Cave (F3)..... 175
Rocklick (L6)..... 150
Rockoak (J2)..... 75
Rockport (C2)..... 200
Romney ◉(J2).....2,059
Ronceverte (F5).....2,301
Roneys Point (K5). 150
Rosbys Rock (K6). 135
Rosedale (E3)..... 400
Rosemont (F2)..... 300
Rossmore (C5)..... 554
Rowlesburg (G2).....1,299
Ruddle (H3)..... 103
Runa (E4)..... 175
Rupert (E5)..... 952
Russellville (E4)..... 225
Russet (D3)..... 50
Ryan (D3)..... 150
St. Albans (C4).....9,870
St. George (G2)..... 210
St. Marys ◉(D2).....2,196
Salem (E2).....2,578
Salt Rock (B4)..... 200
Saltpetre (A4)..... 75
Sand Fork (E3)..... 273
Sandstone (E5)..... 500
Sandyville (C3) ... 450
Scarbro (D5)..... 244
Schultz (D2)..... 75
Scott Depot (C4)..... 500
Seacoal (C5)..... 100
Secondcreek (F5)... 100
Seebert (F4)..... 156
Selbyville (F3)..... 240
Selwyn (B5)..... 200
Servia (E3)..... 175
Seth (C4).....1,033
Shanghai (K2)..... 75
Shanks (J2)..... 200
Sharon (D4)..... 650
Sharples (C5)..... 465
Shavers Fork, Cheat (riv.) (G3).....
Shaw (H2)..... 225
Shenandoah (riv.) (K2).....
Shenandoah Jct. (L2)..... 400
Shepherdstown (L2).....1,173
Sheridan (B4)..... 75
Sherrard (K5)..... 500
Shinnston (F2).....2,793
Shirley (E2)..... 129
Shoals (B4)..... 550
Silverton (C3)..... 56
Simpson (F2)..... 375
Sinks Grove (F5).... 120
Sir Johns Run (K1). 50
Sissonville (C3)..... 200
Sistersville (D1).....2,313
Slab Fork (D5)..... 824
Slagle (C5)..... 625
Slanesville (K2)..... 50
Slate (D2)..... 150
Sleepy Creek (K1)... 300
Smith (B4)..... 100
Smith Creek (H3).... 300
Smithburg (E2)..... 350
Smithfield (E2)..... 390
Smithville (D2)..... 250
Sophia (D5).....1,430
S. Branch, Potomac (riv.) (J2).....
S. Charleston (C4).16,686
Spanishburg (D6).... 200
Sparks (E4)..... 158
Spencer ◉(D3).....2,587
Sprague (D5).....2,626
Sprigg (B5)..... 450
Spring Creek (F5)... 101
Springfield (J2)..... 500
Spruce Knob (mt.) (G3).....
Spurlockville (B4)... 100
Squire (C6).....1,240
Star City (F1).....1,205
Statler Run (F1)..... 300
Steelton (E1)..... 200
Stickney (D5)..... 250
Stiltner (B4)..... 400
Stirrat (C5)..... 700
Stonewood (F2).....2,066
Stony (riv.) (H2).....
Stony Bottom (F4).. 92
Stotesbury (D5)..... 950
Strange Creek (E3).. 75
Stumptown (E3)..... 92
Sugar Grove (H3).... 125
Summersville ◉(E4)1,628
Summit Point (K2). 280
Surveyor (D5)..... 125
Sutton ◉(E3).....1,070
Swandale (E3)..... 354
Sweetsprings (F5).... 100
Swiss (D4)..... 150
Switzer (B5)..... 940
Tabler (L2)..... 125
Talcott (E5)..... 600
Tango (C4)..... 200
Tanner (E3)..... 88
Teays (B4)..... 300
Tenmile (F3)..... 300
Terra Alta (H2).....1,649
Tesla (E3)..... 400
Thacker (B5)..... 400
Thayer (E5)..... 400
Thomas (H2).....1,146
Thornton (G2)..... 250
Thornwood (G3)..... 75
Thorpe (D6).....1,362
Three Churches(J2) 50
Thurmond (D5)..... 219
Tioga (E4)..... 200
Tipton (D4)..... 65
Toll Gate (E2)..... 75
Tomahawk (K1)..... 65
Toneyfork (C5)..... 265
Triadelphia (L5)..... 741
Trout (F4)..... 100
Tug Fork, Big Sandy (riv.) (B5).....
Tunnelton (G2)..... 544
Twelvepole (creek) (A4).....
Tygart (res.) (G2)...
Tygart (riv.) (F3)....
Uler (D3)..... 164
Uneeda (C4)..... 550
Unger (K2)..... 50
Union ◉(E5)..... 300
Urland (B5)..... 50
Vadis (E2)..... 200
Valley Bend (F3).... 500
Valley Head (G3)... 800
Valley Point (G1)... 150
Van Clevesville(L2). 65
Vandalia (F3)..... 150
Vanvoorhis (G1)..... 82
Vaughan (D4)..... 215
Victor (D4)..... 200
Vienna (D2).....6,020
Viola (K5)..... 45
Virginville (L5)..... 90
Volcano (D2)..... 50
Volga (F2)..... 565
Wadestown (F1)..... 61
Wainville (E4)..... 175
Wake Forest (D4)... 200
Walker (D2)..... 75
Walkersville (F3).... 180
Wallace (E2)..... 600
Walton (D3)..... 350
Wana (F1)..... 203
War (C6).....3,992
War Eagle (C5)..... 500
Ward (D4).....2,055
Wardensville (J2)..... 171
Warriormine (C6).... 500
Washburn (D2)..... 50
Washington (C2)..... 50
Watoga (F4)..... 35
Watson (F2).....1,200
Waverly (D2)..... 325
Wayne ◉(B4).....1,257
Weaver (G3)..... 73
Webster Springs ◉ (F4).....1,313
Weirton (K5).....24,005
Welch ◉(C6).....6,603
Wellford (D3)..... 105
Wellsburg ◉(K5).....5,787
Wendel (F2)..... 233
W. Columbia (B3)... 200
W. Fork, Monongahela (riv.) (E3)....
W. Hamlin (B4)..... 793
W. Liberty (K5)..... 600
W. Milford (F2)..... 401
W. Union ◉(E2).....1,341
Weston ◉(F2).....8,945
Westover (F1).....4,318
Wevaco (D5)..... 200
Wharncliffe (C5)..... 250
Wharton (C5)..... 881
Wheeling ◉(K5)....58,891
White Pine (D3)..... 50
White Sulphur Springs (F5).....2,643
Whites Creek (A4). 100
Whitesville (C4).....1,017
Whitmer (G3)..... 250
Widemouth (D6)..... 500
Widen (E4).....1,274
Wilbur (E2)..... 75
Wiley Ford (J1)..... 400
Wilkinson (B5)..... 750
Williamsburg (F5).. 200
Williamson ◉(B5)..8,624
Williamstown (C2).2,001
Willowton (E6)..... 300
Wilson (H2)..... 40
Wilsondale (B5)..... 450
Winding Gulf (D5) 989
Windsor Hts. (K5)..1,230
Winfield ◉(C3)..... 346
Winifrede (C4)..... 100
Winona (E4).....1,050
Wolf Summit (F2).. 200
Womelsdorf (Coalton) (G3)... 407
Woodbine (E4)..... 30
Woodlands (K6)..... 100
Worthington (F2).... 544
Yates (B4)..... 150
Yellow Spring (J2).. 100
Zalia (K4)..... 45

◉ County Seat



kinds of hardwood than any other state in the United States. In the year 1953, West Virginia forests yielded approximately 382 million board feet of lumber, largely hardwood. Some idea of the primeval forest of West Virginia may be had from the Mingo Oak, located near the Mingo-Logan county line. At the time of its death in 1938 this tree was said to be the largest and the oldest living thing in the state. It was about 600 years old and had attained a height of 145 feet and a circumference of 30 feet and 9 inches.

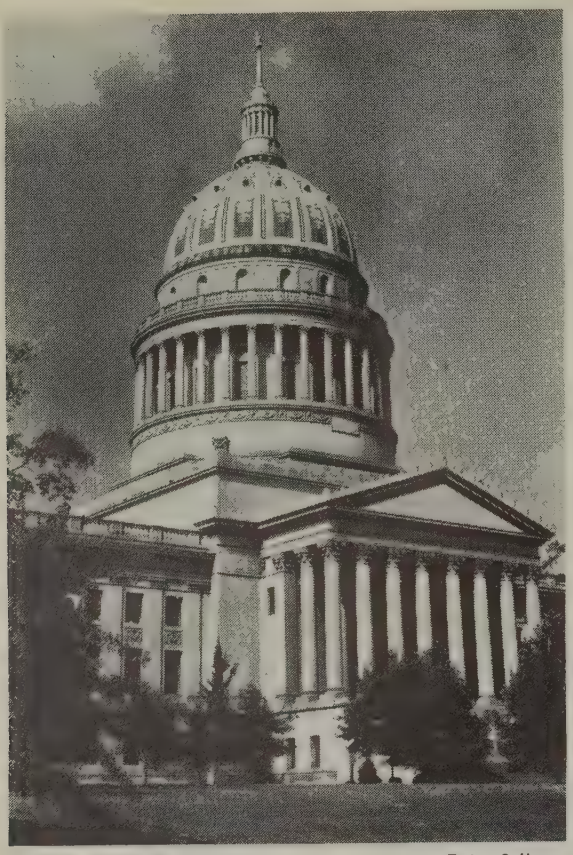
Because of the greed of the "lumber kings" and the absence of a conservation policy, very little of the virgin forest is now standing. Meanwhile blights, rusts, and insects took their toll. Consequently the chestnut and certain kinds of pines are all but gone. Until recently little was done toward reforesting the cutover and waste timber lands. Much is now being done to that end in both the state and the national forests. In 1949 the maple was adopted as the state tree. The oaks, the elm, and the walnut are also favorites.

Because of its abundant plant life, West Virginia is a botanist's paradise. Among rare plants are coltsfoot, sundew, and bog rosemary. Because of the varied climate and wide drainage system, the more common plants include many of those found in Canada and in the subtropical areas of the Appalachian Highlands. Among favorite shrubs are azalea (wild honeysuckle), rhododendron (big laurel), kalmia (laurel), and the American wisteria. Box huckleberry may be older than the Mingo Oak, and a lone hawthorn tree in the Cranberry Glades of Pocahontas County has attained a height of 40 feet.

Animal Life.—Animal remains found here and there indicate that West Virginia was once inhabited by many kinds of huge, clumsy sloth-like animals. They indicate also that the climate has at times been much colder and at other times much hotter than at present. Otherwise neither the musk ox nor the peccary, former inhabitants, could have lived here. The first white settlers found deer, wolves, bears, pumas, beaver, and elk in large numbers, and there were a few buffalo in the Kanawha Valley. Except protected deer, these animals are now almost extinct, but smaller animals, such as foxes, skunks, raccoons, and opossums, are tending to increase in numbers, and beavers are being rehabilitated and trapped under regulations.

In recent years wastes from mines and sawmills have destroyed most of the game fish, but, through restockings, many streams still contain bass, trout, and pike of several varieties. There are several kinds of frogs, toads, waterdogs, turtles, and snakes, but only two species of snakes, rattlers and copperheads, are poisonous. There are about 300 species and subspecies of birds, and in 1949 the cardinal became the state bird. The robin, the wren, and the tanager are favorites.

Much is being done to conserve fish and game



Ewing Galloway

The State Capitol at Charleston.

life through the use of hatcheries and refuges. Of the former the state conservation commission maintains five: Ridge Bass Hatchery of 31.30 acres in Morgan County; Palestine Bass Hatchery of 127.40 acres in Wirt County; Marlinton Trout Hatchery of 28.612 acres in Pocahontas County; Petersburg Trout Hatchery of 9 acres in Grant County; and Spring Run of 41.03 acres in Grant County. In addition, there are two federal hatcheries, one at White Sulphur Springs and one at Leetown. There are also six game refuges: State Game Farm, of 329.85 acres in Upshur County; Hornor, of 189 acres in Lewis County; Elk River, of 6,908.78 acres in Braxton County; Nathaniel Mountain, of 8,876 acres in Hampshire County; Short Mountain, 7,754 acres in Hampshire County; and Bear Rock Lakes, of 173.18 acres in Ohio County.

Minerals.—Coal, a carbonaceous substance formed from vegetable remains, first as peat, then as lignite, and then as bitumen, is found in large quantities in the last named stage, but there is little in the still more final form of anthracite. There are 17,280 square miles of coal area, and the total minable acreage, including all seams, is 24,015,381. West Virginia ranks first among the states in bituminous coal production.

West Virginia also ranks high in the production of oil and gas and their byproducts. Other minerals found include salt brine and rock salt, which are widely distributed west of the Alleghenies. The former is now used extensively in the Kanawha Valley for the manufacture of a variety of products. Among still other minerals are barite, found in Mercer County and used in making white lead; bromine, found in Mason County and used as a medicine, and in the synthetic chemical and color industries; celestite, found on the western slope of Knobly Mountain and used in making fireworks and in medicine; various cement materials used in construction works; clays (brick, fire, and stoneware); dolomite, found in the Eastern Panhandle and in Monroe County, used as a substitute for limestone; fluorspar, found in Jefferson County, used in the manufacture of chemicals, preservatives, and opalescent glass; grahamite; gravel; grindstone; hematite, both red and fossil; limestone; niter (saltpeter); ocher; Devonian black shale; sand (building, glass, and molding); shale; and siderite. The state is famous for its mineral springs, those at White Sulphur and Berkeley Springs (formerly Bath) being widely known. See also sect. *5. Economic Activities.*

Soils.—From the northeast corner of the state, extending south and southwest to the Big Sandy River, the country is mountainous, with narrow valleys. The soil is generally fertile and the land productive. Clay soil is found in some of the higher sections, alluvial soil in the upland valleys, and sandy soils in the northeast. In the extreme northeastern counties the soil is of rich limestone. The surface near the Ohio River is gently rolling and there, too, the soil is rich.

2. POPULATION AND POLITICAL DIVISIONS

In 1950, the population was 2,005,552, as compared with 1,901,947 in 1940. Of the 1950 total, 114,867 were Negroes, McDowell County having the largest number. Other counties with large Negro populations were Kanawha, Fayette, Raleigh, Mercer, Logan, Mingo, Jefferson, and Ohio. Among the foreign-born white residents (34,586), Italians (8,557) outnumbered all others. The next largest numbers, in the order named, were Poles, English, Hungarians, Germans, Greeks, Yugoslavians, Czechoslovakians, Austrians, and Russians. Of the state's 55 counties, 49 gained in population between 1930 and 1940, but only 27 between 1940 and 1950. All but two of the counties losing population between 1940 and 1950 were predominantly rural, and 19 had no urban population at all. In 1950, West Virginia's 214 incorporated places comprised 60 cities, 149 towns, and 5 villages.

The Capital City.—The present capital, Charleston, with a population of 73,501 (1950), has not always been the seat of government. From June 20, 1863, to April 1, 1870, and again from May 23, 1875, to May 1, 1885, it was Wheeling. As the removals were made by steamboat, the seat of government was frequently described as the "Capital on Wheels." Because of the several removals, and the fire of Jan. 3, 1921, there have been several capitol buildings. The present one, as designed by Cass Gilbert and dedicated on June 20, 1932, is one of the most beautiful in the United States.

Other Cities.—In the order of their population (1950) the other leading cities are Huntington (86,353), Wheeling (58,891), Clarksburg (32,014), Parkersburg (29,684), Fairmont (29,346), Morgantown (25,525), Weirton (24,005), Bluefield (21,506), Beckley (19,397), South Charleston (16,686), Martinsburg (15,621), and Moundsville (14,772). South Parkersburg (10,808) is the state's largest unincorporated place. (For populations of other places, see back of state map.)

Reversing a consistent trend from 1870 to 1930, the percentage of the state's urban population de-

clined from 28.4 in 1930 to 28.1 in 1940, owing largely to populational movements into suburban areas. However, the urbanization of population resumed in the 1940's, and in 1950 urban residents numbering 694,487 represented 34.6 per cent of the total population.

Counties.—The counties of the state, with their respective seats of government, are:

COUNTY	COUNTY SEAT	COUNTY	COUNTY SEAT
Barbour	Philippi	Mineral	Keyser
Berkeley	Martinsburg	Mingo	Williamson
Boone	Madison	Monongalia	Morgantown
Braxton	Sutton	Monroe	Union
Brooke	Wellsburg	Morgan	Berkeley Springs
Cabell	Huntington	Nicholas	Summersville
Calhoun	Grantsville	Ohio	Wheeling
Clay	Clay	Pendleton	Franklin
Doddridge	West Union	Pleasants	St. Mary's
Fayette	Fayetteville	Pocahontas	Marlinton
Gilmer	Glenville	Preston	Kingwood
Grant	Petersburg	Putnam	Winfield
Greenbrier	Lewisburg	Raleigh	Beckley
Hampshire	Romney	Randolph	Elkins
Hancock	New Cumberland	Ritchie	Harrisville
Hardy	Moorefield	Roane	Spencer
Harrison	Clarksburg	Summers	Hinton
Jackson	Ripley	Taylor	Grafton
Jefferson	Charles Town	Tucker	Parsons
Kanawha	Charleston	Tyler	Middlebourne
Lewis	Weston	Upshur	Buckhannon
Lincoln	Hamlin	Wayne	Wayne
Logan	Logan	Webster	Webster Springs
McDowell	Welch	Wetzel	New Martinsville
Marion	Fairmont	Wirt	Elizabeth
Marshall	Moundsville	Wood	Parkersburg
Mason	Point Pleasant	Wyoming	Pineville
Mercer	Princeton		

3. GOVERNMENT AND POLITICS

State Constitution.—The present constitution went into effect in 1872. Amendments must be passed by a two-thirds vote of the legislature and ratified by a majority of voters voting on an amendment at election.

Executive.—The executive branch of the government consists of a governor, secretary of state, superintendent of schools, treasurer, auditor, attorney general, and commissioner of agriculture, all of which positions are elective. The governor is elected for a term of four years and may not serve more than one consecutive term. He is invested with the power of the veto, may convene a special session of legislature, and make appointments with the approval of the Senate.

GOVERNORS

Arthur I. Boreman	Republican	1863–1869
Daniel D. T. Farnsworth[1]	"	1869
William E. Stevenson	"	1869–1871
John J. Jacob	Democrat	1871–1877
Henry M. Mathews	"	1877–1881
Jacob B. Jackson	"	1881–1885
E. Willis Wilson[2]	"	1885–1890
A. Brooks Fleming	"	1890–1893
William A. MacCorkle	"	1893–1897
George W. Atkinson	Republican	1897–1901
Albert B. White	"	1901–1905
William M. O. Dawson	"	1905–1909
William E. Glasscock	"	1909–1913
Henry D. Hatfield	"	1913–1917
John J. Cornwell	Democrat	1917–1921
Ephraim F. Morgan	Republican	1921–1925
Howard M. Gore	"	1925–1929
William G. Conley	"	1929–1933
H. Guy Kump	Democrat	1933–1937
Homer A. Holt	"	1937–1941
M. Mansfield Neely	"	1941–1945
Clarence W. Meadows	"	1945–1949
Okey L. Patteson	"	1949–1953
William C. Marland	"	1953–1957
Cecil H. Underwood	Republican	1957–

[1] As president of the Senate, Farnsworth became governor and filled the unexpired term of Boreman who resigned to become a United States senator.

[2] The election of Governor Fleming was contested, and Governor Wilson served until the contest was determined by the legislature.

In the event of a vacancy before the expiration of the first three years of the term, a new election is held; otherwise, the president of the Senate acts as governor in the event of death, disqualification, resignation, or removal from office.

Republicans administered the state from 1863 to 1871. Without interruption but sometimes by close contests, as in 1888, the Democrats administered it from 1871 to 1897. From 1897 to 1933, Republicans were in complete control, except during 1917–1921 when John J. Cornwell was governor. In 1911 the Republicans lost each of the United States senatorships. Since 1933 the Democrats have been in control, but they lost a United States senatorship to the Republicans in 1942. The Republicans elected the governor, state superintendent of free schools, and a United States senator in 1956.

Legislative.—There are six congressional districts. The state legislature, which convenes annually on the second Wednesday of January (for a possible 60-day session in the odd years and a possible 30-day session in the even years) is composed of 32 senators and 100 delegates. For the purpose of choosing senators the state is divided into 16 districts, each of which elects one senator every two years for a term of four years. Delegates, the number from each county determined by population, are elected by counties for two-year terms, each county having at least one delegate, and one county, Kanawha, having eleven.

Judicial.—West Virginia is a part of the fourth circuit of the United States Circuit Court of Appeals and is divided into two districts (northern and southern) which are served by three judges. The state is divided into 24 judicial circuits which are served by 25 judges, the first circuit composed of Ohio, Brooke, and Hancock counties, having two judges. Cabell, Harrison, Kanawha, Marion, Mercer, McDowell, Ohio, and Raleigh counties have intermediate or criminal courts, each served by one judge, and all of the important cities have police courts.

Local Government.—West Virginia towns and cities determine their own forms of government from a number of legislature-prescribed systems. A few of them are mayor-council governed but most of them function under city managers. Local government is of county-township form with increasing emphasis upon the county. This was notably true after 1933 with the adoption of the county unit for the administration of the public free schools.

Taxation.—Tax revenue of $145,364,245 in the 1955–1956 fiscal year included $75,811,775 from a general sales tax (1 per cent on purchases from 6 to 50 cents; 2 per cent on those from 51 cents to $1) and selective sales and gross receipts taxes, and $18,343,352 from licensing. The state does not impose individual or corporate income taxes but does levy a $2 poll tax per male person.

Suffrage and Elections.—The suffrage is extended in general to all citizens who have attained the age of 21 years. Special classes of persons barred from the exercise of voting rights include paupers, people of unsound mind, and those under conviction of treason, felony, or bribery in an election. Residence within the state for one year and within the county for 60 days next preceding the election is required. A permanent voter registration law is in operation, and voters must be properly registered in order to cast their ballots.

Under this law in 1956, 702,062 Democrats and 450,320 Republicans were registered. General elections are held on the Tuesday after the first Monday in November in every even-numbered year. Closed primary elections for the nomination of state and national candidates and the selection of delegates to the national party conventions are held in the month of May in presidential election years, and in August in the nonpresidential election years.

The Greenbrier

The Greenbrier, White Sulphur Springs. A plaque in the foreground is in memory of an older and equally famous hotel of the same name which stood on this spot from 1858 to 1921.

4. EDUCATION AND SOCIAL WELFARE

Elementary and Secondary Education.—Education is free to all persons between the ages of 6 and 20 and compulsory for all those between the ages of 7 and 16.

Largely as an emergency measure all the magisterial and independent districts were abolished in 1933 and merged into 55 county units for the administration of both the elementary and the secondary schools, but the new system worked so well that there is no present desire to change it. Each county is controlled by a single board which functions through a county superintendent and his assistants. There are no independent city systems. Outstanding among the secondary schools are Linsly Military Institute, Wheeling; DeSales Heights Visitation Academy, Parkersburg; and Mount De Chantal Academy, Wheeling. The state maintains schools of elementary and secondary grade at Romney for deaf and blind children.

Higher Education.—Primarily for the training of teachers, the state maintains seven colleges: Bluefield State; Concord, at Athens; Fairmont State; Glenville State; Marshall, at Huntington; Shepherd, at Shepherdstown; and West Liberty State. The state also maintains four other institutions: West Virginia University, Morgantown; West Virginia State Institute; Potomac State College of West Virginia University (a junior college at Keyser); and West Virginia Institute of Technology, Montgomery. There are eight private and denominational colleges, namely: Alderson-Broaddus, Philippi; Bethany, Bethany; Davis and Elkins, Elkins; Mason College of Music and Fine Arts, Charleston; Morris Harvey, Charleston; Salem, Salem; Wheeling, Wheeling; and West Virginia Wesleyan, Buckhannon. There are also three junior colleges: Beckley, Beckley; Greenbrier, Lewisburg; and Greenbrier Military, Lewisburg. There are 14 business colleges—3 of them in Huntington. In 1956 there were 18 accredited schools of nursing, most of them in hospitals.

Libraries.—Public libraries, in most cases tax-supported, operate in 44 of the state's 55 counties. These institutions possess collectively more than 762,000 bound volumes, and attain an annual circulation of more than 2 million volumes. In the state capitol at Charleston the Department of Archives and History maintains an extensive library collection which features files of public records, official reports of state departments and officials, newspapers, and other materials bearing upon the history and development of the state. There are also within the state 20 college libraries, headed by that of West Virginia University, which affords more than 300,000 volumes and possesses numerous valuable manuscript and archival collections. In some of the libraries, both public and college, small museums are maintained in conjunction with the library collection. The largest and most important of these is operated by the Department of Archives and History in the state capitol.

Public Welfare.—State charitable institutions include the Children's Home at Elkins for whites and the Industrial Home for Colored Girls at Huntington; hospitals for the mentally handicapped at Barboursville, Huntington, Lakin, Spencer, and Weston; and four state-maintained hospitals for tuberculars. There are also four industrial schools: two for whites and two for Negroes. Adult delinquents are housed in the State Penitentiary at Moundsville and in the Medium Security Prison at Huttonsville; there is also a State Prison for Women at Pence Springs. All executions under the capital punishment law take place in the state penitentiary. White Sulphur Springs was an army hospital during World War II, as was also Newton D. Baker Hospital in Martinsburg. Veterans Administration hospitals are located at Beckley, Clarksburg, Huntington, and Martinsburg. A United Mine Workers of America Memorial Hospital is located at Beckley.

Public Safety.—Since 1919 West Virginia has maintained a Department of Public Safety invested with statewide police powers of a general nature. Although it is concerned with general law enforcement and the identification and apprehension of criminals, the department assumes as its primary responsibility the patroling of the state highways and the enforcement of the traffic laws. Detachments are located in every county of the state, and officers of the department cooperate with local law enforcement agencies. In addition to its other duties the department operates a State Police Academy, a Bureau of Criminal Identification and a network of 14 radio stations. There is, in addition to the Department of Public Safety, a National Guard under command of the governor in time of peace, available for use in the event of a major disaster, serious rioting, or other disturbance too extensive to be handled by the ordinary police agencies.

Social Agencies.—State social agencies cooperating with the general program of the United States Department of Health, Education, and

Ewing Galloway

The Potomac and Shenandoah rivers meet at Harpers Ferry, scene of John Brown's famous raid. On the left is Maryland; Virginia is on the right.

Welfare include a Department of Public Assistance, a Department of Employment Security, and a Division of Vocational Rehabilitation. A Department of Labor is the enforcement agency for all labor legislation except that pertaining to mines and mining. The latter is the province of a separate Department of Mines, which also directs training in mine rescue work.

Matters pertaining to sanitation, immunization, sewage disposal, and water supply are controlled by a Department of Health, and in 1957 a new Department of Mental Health was provided to supervise the state's five mental hospitals and to implement a research and training program in the field of mental health.

A State Conservation Commission directs the maintenance and development of state forests, the protection of wild life, and the general beautification of the state. There is also a State Water Commission which concerns itself with the causes of stream pollution and their abatement.

Other social agencies are a Bureau of Negro Welfare which collects statistics on all matters pertaining to the Negro citizens of the state and endeavors to facilitate harmonious relations between the races, and a Department of Veterans Affairs whose primary purpose is to furnish aid and counsel to veterans and to the widows and orphans of deceased veterans.

5. ECONOMIC ACTIVITIES

The economic activities of the people of West Virginia are widely diversified, but manufacturing, commerce, and mining furnish the major portion of the state income. General manufacturing activities, with chemical production and the fabrication of metal products heading the list, supply approximately 22 per cent of the state's income. Trade, commerce, and service activities supply another 22 per cent of the total income, while mining, which in 1956 produced more than 137 million tons of bituminous coal, is productive of an additional 17 per cent.

Farming, although widely practiced, is no longer an important source of income, the net return from agricultural activities constituting in fact only 3 per cent of the state total. Forest industries are still important; nearly 10 million acres of commercial forest lands are located within the state.

Although in earlier times the economy of the state was based almost exclusively upon coal mining, forestry, and petroleum, the trend since 1940 has been toward economic diversification. In keeping with this trend some portions of the state, particularly the Ohio and Kanawha valleys, have experienced extensive industrial development and are today the seats of important chemical and metal industries.

The state possesses many advantages of natural resources, transportation, and location in proximity to large market areas which will undoubtedly result in a continuation of the process of industrialization. Despite these favorable fac-

tors and the progress already made, per capita income lags somewhat below the national figure, having been only $1,257 in 1952.

Manufacturing Industries.—The largest industrial groups are, by value of production: chemicals and allied products; iron and steel products; stone, clay, and glass products; food and kindred products; petroleum and coal products; fabricated metals; electrical machinery; lumber and timber products; and apparel. Many new plants were added during World War II making salt, chlorine, caustic soda, bromine, ammonia, and synthetic rubber.

MAJOR MANUFACTURES, 1955

	Persons engaged	Payroll and profit income (millions of dollars)	Value of output
Chemicals	25,000	$236	$ 665
Primary metals	27,000	250	585
Stone-clay-glass products	27,000	174	286
Food products	8,000	36	182
Petroleum and coal products	3,000	26	164
Fabricated metals	11,000	33	101
Electrical machinery	6,000	29	66
Lumber	10,000	20	64
Paper and pulp	2,000	10	48
Apparel	5,000	11	41
All manufactures	146,000	889	2,375

[1] Source: *Manufacturers' Record,* 1956 blue book directory edition.

Banking.—On June 30, 1956, there were 105 state banks with combined assets of $579,509,018.24, and deposits totaling $437,716,552.68. At this same date, there were 76 national banks with total assets of $659,491,000, and deposits totaling $601,868,000.

Finances.—Following is a statement of finances for the fiscal year 1955–1956:

Balance in treasury, beginning of fiscal year 1955–1956	$ 44,440,522.71
Receipts, all sources, 1955–1956	361,800,585.95
Total	$406,241,108.66
Disbursements, 1955–1956	356,833,759.24
Balance beginning of fiscal year 1956–1957	$ 49,407,349.42

The total state indebtedness on June 30, 1956, was $135,212,000.

Transportation.—West Virginia is traversed in general easterly and westerly directions by three trunk-line railroads: the Baltimore and Ohio, the Chesapeake and Ohio, and the Norfolk and Western. Among other important railroads having access to the state are the Western Maryland, the New York Central, and the Virginian. In 1955, there were 21 railroads with 3,713 track miles. Highways, state and federal, aggregated 36,053 miles, of which 11,720 miles were improved. Including state, municipal, commercial, private, auxiliary, and emergency, West Virginia contains 43 land airports and 6 seaplane bases. Since the completion in 1929 of the nine-foot stage in the Ohio, and the later completion of that in the Kanawha, these rivers have become increasingly important in the transportation of heavy freight, mainly coal and fabricated steel.

Communications.—Communications media included (1955) 43 AM and 11 FM radio stations; 7 television stations; (1956) 30 daily newspapers (circulation, 499,430); and (Jan. 1, 1956) 110,200 business and 323,000 residential telephones.

6. PLACES OF INTEREST

Forests and Parks.—In 1955 the forests, together with their respective locations and acreage, were Seneca, Pocahontas County, 11,049 acres; Cabwaylingo, Wayne County, 6,321 acres; Kumbrabow, Randolph County, 9,424 acres; Greenbrier, Greenbrier County, 5,004 acres; Cooper's Rock, Monongalia and Preston counties, 13,348 acres; Kanawha, Kanawha County, 6,705 acres; Calvin Price, Pocahontas County, 10,776 acres; Camp Creek, Mercer County, 5,580 acres; Sleepy Creek, Morgan and Berkeley counties, 21,114 acres; and Panther Creek, McDowell County, 7,724 acres. At the same time the state parks, together with their location and acreage, were Audra Tract, Barbour County, 316 acres; Babcock, Fayette County, 3,227 acres; Blackwater Falls, Tucker County, 911 acres; Bluestone, Summers County, 278 acres; Booker T. Washington, Kanawha County, 7 acres; Cacapon, Morgan County, 5,814 acres; Carnifex Ferry Battlefield, Nicholas County, 156 acres; Cathedral, Preston County, 126 acres; Cedar Creek, Gilmer County, 2,037 acres; Droop Mountain Battlefield, Pocahontas County, 269 acres; Grand View, Raleigh County, 878 acres; Hawks Nest, Fayette County, 94 acres; Holly River, Webster County, 7,592 acres; Lost River, Hardy County, 3,841 acres; Mont Chateau, Monongalia County, 42 acres; North Bend, Ritchie County, 1,369 acres; Pinnacle Rock, Mercer County, 33 acres; Tomlinson Run, Hancock County, 1,387 acres; Tygart River State Park, Taylor and Barbour counties, 1,803 acres; Watoga, Pocahontas County, 10,057 acres; Watters Smith Memorial, Harrison County, 270 acres.

Monongahela National Forest, comprising parts of nine counties (Grant, Greenbrier, Nicholas, Pendleton, Pocahontas, Preston, Randolph, Tucker, and Webster), lies almost entirely within West Virginia. In 1956 it contained 806,139 acres and 580,036 additional acres within the Monongahela purchase boundary area had been designated for possible inclusion. At the same time 97,419 acres of the George Washington (Shenandoah) National Forest were in West Virginia and about 63,817 additional acres had been designated for possible inclusion. It comprised parts of Hampshire, Hardy, and Pendleton counties.

Other Points of Interest.—Blennerhassett Island, in the Ohio River just south of Parkersburg, is interesting historically. Here was the home of Harman Blennerhassett (q.v.), a wealthy Englishman who had come to America to pursue his interests in the natural sciences without family interference. In 1805, Aaron Burr persuaded him to join in schemes, the nature of which he seems not to have understood. As a consequence, Blennerhassett lost his home and fortune.

Two towns of West Virginia became renowned through John Brown, the antislavery leader from Kansas. His raid upon Harpers Ferry in 1859 resulted in the death of several men, and his capture. He was tried, sentenced, and hanged in Charles Town (then Charlestown, Va.).

Moundsville, in Marshall County, contains Grave Creek Mound, the largest conical burying mound known to exist in this country. The excavated interior, thought to be 3,000 years old, is open to visitors.

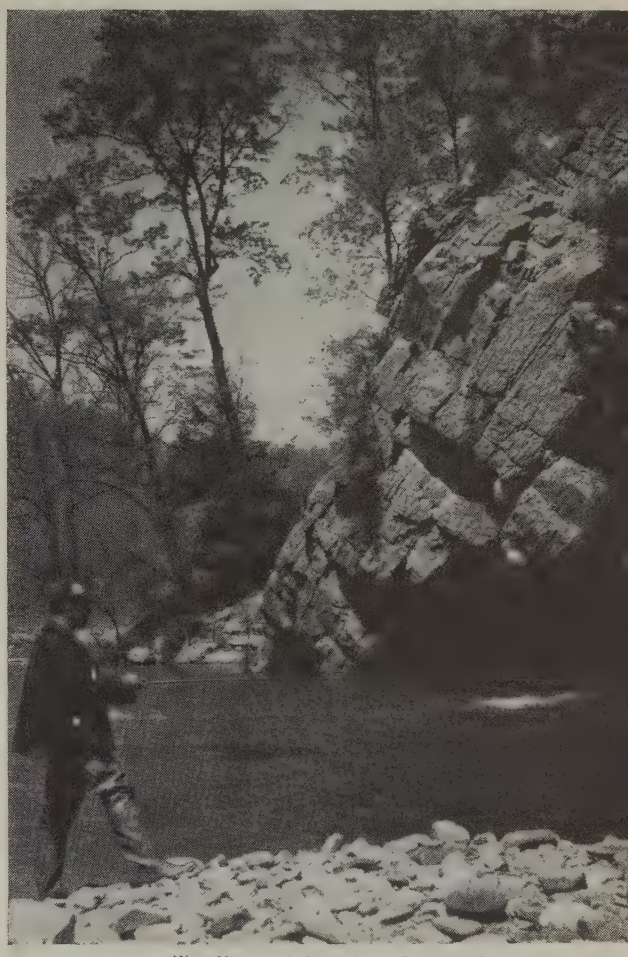
7. FAMOUS MEN AND WOMEN

Among those who have attained fame and were born in the state, or in sections of Virginia which are now a part of West Virginia, are: Ebenezer Zane (Hardy County, 1747–1812), pio-

neer; Thomas Worthington (Charles Town, 1773–1827), governor of Ohio; Robert Lucas (Shepherdstown, 1781–1853), territorial governor of Iowa; John Miller (Berkeley County, 1781–1846), congressman and governor of Missouri; Charles Bent (Charleston, 1799–1847), frontiersman; William Gregg (Monongalia County, now W. Va., 1800–1867), cotton manufacturer; David Waldo (Clarksburg, 1802–1878), physician and banker; Waitman Thomas Willey (Monongalia County, now W. Va., 1811–1900), United States senator; Martin Robinson Delany (Charles Town, 1812–1885), first Negro major in the United States Army; Philip Pendleton Cooke (Martinsburg, 1816–1850), poet and story-writer; David Hunter Strother (Martinsburg, 1816–1888), soldier, author, and illustrator; Edmund Burke Fairfield (Parkersburg, 1821–1904), educator; Jesse Lee Reno (Wheeling, 1823–1862), soldier; Thomas Jonathan Jackson (Clarksburg, 1824–1863), Confederate soldier, best remembered as "Stonewall" Jackson; John Caldwell Tidball (Ohio County, 1825–1906), soldier; William Lukens Elkins (near Wheeling, 1832–1903), capitalist; Daniel Bedinger Lucas (near Charles Town, 1836–1909), author, known as "poet of the Shenandoah Valley"; Henry Kyd Douglas (near Harpers Ferry, 1838–1903), lawyer and soldier; John Fletcher Lacey (near New Martinsville, 1841–1913), soldier and congressman; Charles Erastus Vawter (Monroe County, 1841–1905), educator; Ehrman Syme Nadal (Greenbrier County, 1843–1922), author; William Lyne Wilson (1843–1900), educator, cabinet member, congressional representative; French Ensor Chadwick (Morgantown, 1844–1919), naval officer; David Hummell Greer (Wheeling, 1844–1919), bishop; Franklin Reuben Carpenter (Parkersburg, 1848–1910), mining engineer; Lloyd Lowndes (Clarksburg, 1845–1905), governor of Maryland; Israel Charles White (Monongalia County, now W. Va., 1848–1927), geologist; Christopher Harrison Payne (near Red Sulphur Springs, 1848–1925), Negro clergyman, lawyer, federal official; William Dixon (Ohio County, 1850–1913), frontiersman, known as "Billy" Dixon; Charles Wells Russell (Wheeling, 1856–1927), lawyer, diplomat, and government official; Jonathan Prentiss Dolliver (near Kingwood, 1858–1910), statesman; George Burman Foster (Alderson, 1858–1918), clergyman; Michael Joseph Owens (Mason County, 1859–1923), inventor and glass manufacturer; Melville Davisson Post (near Clarksburg, 1871–1930), novelist and lawyer; Dwight Whitney Morrow (Huntington, 1873–1931), lawyer, banker, and diplomat; John Barton Payne (Taylor County, 1855–1935), lawyer, cabinet member, Red Cross official; Johnson N. Camden (Lewis County, 1828–1908), industrialist and United States senator; Hubert Skidmore (Webster County, 1909–1946), novelist; Harley M. Kilgore (Harrison County, 1893–1956), United States senator; Margaret Preston Montague (Greenbrier County, 1873–1955), novelist; Newton D. Baker (Berkeley County, 1871–1937), lawyer, mayor, cabinet member; and John W. Davis (Harrison County, 1873–1955), lawyer and diplomat.

8. HISTORY

The pioneer history of present West Virginia is replete with stories of personal adventure and daring. Outstanding among the participants was George Washington, who first crossed the Alleghenies in 1753. In the quest for lands and adventure which he and Christopher Gist initiated, countless thousands came and went. Among them were Daniel Boone, Lewis Wetzel, Jesse Hughes, Daniel and Levi Morgan, and the Poe brothers, Adam and Andrew. But more important than any of these were those who came to establish homes, to build churches and schools, and to record the history of the new society. One recalls Morgan



West Virginia Industrial and Publicity Commission

Trout fishing in the south branch of the Potomac River near Petersburg.

Morgan, the reputed first settler; Bishop Francis Asbury, the itinerant founder of the Methodists; and the Rev. Joseph Doddridge, author of *Notes on the Settlement and Indian Wars* (1824); and Alexander Scott Withers, author of *Chronicles of Border Warfare* (1831). For all such the Battle of Fallen Timbers (1794), the purchase of Louisiana (1803), and the coming of the steamboat (1811) were events of major importance.

During the evolution of the Jacksonian program of democracy and expansion, the interests of present West Virginia were largely political and economic. Located at the crossroads of the United States and favored by boundless resources, the area was chiefly concerned, after the War of 1812, with banks, internal improvements, and industry. When these, particularly the banks, and the internal improvements, were not provided by the federal government, the local inhabitants generally sought to increase their influence in the Virginia state government as a

means of providing them. To this end they demanded white manhood suffrage, equal representation in the General Assembly for equal numbers of white residents, and reforms in the local government. Finally, most of these demands were conceded in the reform convention of 1850.

Following 1851 the chief differences between eastern and western Virginia were economic. Although representation in the General Assembly was still arbitrarily apportioned, the question of reapportionment on the basis of white population was, under a constitutional requirement, to be submitted to the voters in 1865, and the westerners felt confident of its approval. But they had paid a high price for the concessions of the east, made in 1851. Among other things, that section demanded and secured a property classification under which Negro slaves under 12 years of age were exempt from taxation and those over that age, however valuable, could not be valued in excess of $300. Moreover, through their control of the General Assembly, the easterners had appropriated unto themselves all the state institutions and a fairly adequate system of railroads, financed in part by the state, whereas the westerners were given only macadam and dirt roads and two asylums for the insane. Worse still, the eastern-controlled assembly had refused the Baltimore and Ohio Company a franchise for a track to extend from Harpers Ferry to the Ohio River by way of the Shenandoah, New, and Kanawha valleys. The question of slavery was not, in itself, an issue between east and west. The middle class white residents of the west tended to abhor abolitionists and, without notable exception deplored John Brown's attempt to incite slaves to revolt against their masters.

Nevertheless, when the Virginia state convention voted (April 17, 1861) to secede from the Union, the westerners, in the First Wheeling Convention (May 13–15), repudiated the action, naming a central committee which proceeded at once to put the northwest in a state of defense. The state authorities in Richmond meanwhile proceeded to make a formal alliance with the Confederate States of America and to prepare for the removal of its capital from Montgomery, Ala., to Richmond, Va.

Under the circumstances, loyal leaders in the northwest abandoned their long-cherished desire for separate statehood and joined President Lincoln in his efforts to preserve the Union. To that end it was considered necessary to reorganize the government of Virginia on a loyal basis. The initial steps were taken in the first session of the Second Wheeling Convention (June 11–25). Acting as a constituent assembly, that body elected Francis H. Pierpont governor of the restored government of Virginia and authorized such changes in the wording of the existing constitution as were considered necessary to permit him and the other state agencies, particularly the General Assembly, to function. The work of reorganization was then completed by the General Assembly, which elected John S. Carlile and Waitman T. Willey to the United States Senate to fill vacancies caused by the withdrawals of R. M. T. Hunter and James M. Mason to cast their lots with the Confederacy. As expected, the new senators were seated, and the reorganized government was accepted as sufficient for any contingency, even the approval of the dismemberment of Virginia and the formation of a new state.

The Confederate defeat at Rich Mountain (July 11, 1861) and Gen. Henry A. Wise's retreat from the Kanawha Valley had meanwhile given impetus to a new state movement. Fortunately for those who wished it, the Second Wheeling Convention had only recessed. For the purpose of dealing with the altered situation it was reconvened on Aug. 6, 1861, and on August 20 it adopted a dismemberment ordinance which provided also for the formation of a new state to be called Kanawha. With only "Black Republicans" and abolitionists voting against the proposed new state, the ordinance authorizing it was approved by the participating voters on October 24. An attempt, directed by Gen. Robert E. Lee, to recover northwestern Virginia for the Confederates having failed meanwhile, the makers resolved to widen the bounds of the proposed new state. In fact, some of them wished to include all western Virginia. As a consequence, a constitutional convention, meeting Nov. 26, 1861, extended the boundary to the south so as to make a "well-rounded-out state" and to the east so as to include all of Virginia traversed by the Baltimore and Ohio Railroad. At the same time, the name was changed from Kanawha to West Virginia.

With the sole provision that the proposed state change its constitution so as to provide for the gradual abolition of Negro slavery, the constitution, ratified April 3, 1862, was accepted by the Congress as drafted. As this was a political matter wholly within the province of the Congress, its legality has never been questioned by the courts. Governor Pierpont having agreed to transfer the capital of the reorganized government from Wheeling to some available point in Virginia, Lincoln approved the separate statehood bill as a war measure and West Virginia was admitted as the 35th state on June 20, 1863.

Since Statehood.—Following the Civil War, West Virginia experienced a reconstruction not unlike that to which the former Confederate states were subjected. In 1872 this was ended in part through a new constitution (ratified August 22) drafted by ex-Confederates and liberal Democrats. Thereafter the best efforts of its leaders were directed largely to solving transportation problems and to developing the state's natural resources. For a time the new state led the entire country in developing a progressive free public school system. Later the leadership became preoccupied with material things, and the state fell behind in educational development on both the lower and the higher levels.

From 1871 to 1897 West Virginia was controlled by the Democratic Party. Of the six Democratic governors, E. Willis Wilson alone was a reform liberal. Throughout this period the state rarely exercised its regulatory powers, and reform was at a standstill. In 1882 certain exemptions from taxation accorded to the railroads and the farmers were nullified by court decision.

The Republicans controlled the state administration from 1897 to 1933, with the exception of the administration of Democrat John J. Cornwell (1917–1921). Like their predecessors, the Republicans were economy-minded, and eager to attract non-resident capital. They were more interested in business promotion than social reform. But the impact of the progressive movement with its demand for better schools, conservation of natural resources, improved highways, public health programs, and fair labor practices did not go

unnoticed. The chief problems of state and local governments were inadequate tax revenues, obsolescent administrative machinery, and strained relations between capital and labor.

From the great railway strike of 1877, which had its inception at Martinsburg, to the enactment of the National Labor Relations Act in 1935, West Virginia was the scene of industrial strife which on occasion erupted into open warfare. On the one hand there were the West Virginia coal operators resisting unionization of their mines; on the other, the United Mine Workers of America (aided and abetted by the operators of Pennsylvania, Ohio, Indiana, and Illinois), asserting their right to bargain collectively. The last citadel of resistance was the southern West Virginia "smokeless" field where the operators were a law unto themselves during the "Golden Twenties." But with the paralysis of the coal industry in the 1930's operators and miners alike welcomed the labor legislation of the New Deal, and unionization was effected by default.

Since statehood, West Virginia has had major disputes with neighboring states as follows: the suit brought by Virginia to recover Berkeley and Jefferson counties, settled in favor of West Virginia (1871); the action growing out of the abduction by Kentucky authorities of West Virginia citizens during the Hatfield-McCoy feud, resolved in favor of Kentucky (1888); the litigation initiated by Maryland for the adjustment of common boundaries, settled in 1910 in favor of West Virginia; the Virginia debt issue, finally settled in favor of Virginia (1911–1919); and the successful effort by Ohio and Pennsylvania in enjoining the state from restricting the exportation of natural gas (1923).

From 1933 to 1957 the political history of the state belonged to the Democrats, whose problems stemmed chiefly from depression, war, transition from war-time to peace-time economy, the coal depression, and the need of constitutional reform. As the Republicans assumed control of the executive branch of the government in 1957, they continued the state's effort to keep abreast of neighboring states in conservation, education, highway improvements, industrial expansion, and the promotion of the tourist trade.

Ewing Galloway

Miners emerging from a bituminous coal mine at Maidsville.

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WEST VIRGINIA UNIVERSITY, a coeducational state institution located at Morgantown, 100 miles south of Pittsburgh. The university grounds, with an outlook upon the Monongahela River, have an attractive natural site.

The university originated from the national land grant act of June 2, 1862, and from the subsequent action of the state legislature in accepting and carrying out the provisions of the act. Its location at Morgantown was largely determined by the foundation of an educational institution which had already been laid at Morgantown through an academy first established in 1814 and re-established in 1832. On Jan. 30, 1867, the legislature accepted the property of the old Monogalia Academy and on February 7 passed an act permanently establishing the Agricultural College of West Virginia and authorizing the governor to appoint a board of visitors. A department of military science was organized soon thereafter. By an act of Dec. 4, 1868, the name of the college was changed to West Virginia University.

In addition to the original college (arts and sciences) the university maintains colleges of agriculture, commerce, education, engineering, law, and pharmacy; schools of dentistry, journalism, medicine, mines, music and physical education; divisions of military and air science, and agricultural extension; and agricultural and engineering experiment stations. There is also a graduate school. In 1951 the two-year school of medicine was expanded into a four-year school.

The first notable increase in attendance occurred between 1889 and 1897 when women were admitted as students, after a long struggle against conservative opposition.

In 1909 the financial and business affairs of the university were placed under direction of a state board of control appointed by the governor. In 1919, academic control, hitherto exercised by a bipartisan board of regents, was vested in the state board of education. In 1927 the financial and business affairs of the university were vested in a seven-member board of governors (increased to nine members in 1947).

WEST WARWICK, town, Rhode Island, in Kent County, 11 miles south-southwest of Providence at an altitude of 135 feet, on the Pawtuxet River, two state highways, and the New York, New Haven, and Hartford Railroad. The town is noted for its textile manufactures which include woolen, cotton, rayon, and silk goods, and lace, yarn, and braid. It also manufactures metal products and its agricultural industries include poultry, dairy, and truck farming.

West Warwick was separated from Warwick and incorporated in 1913. It comprises the villages of River Point, its administrative center, Arctic, its railroad station, Crompton, Centreville, Natick, and Phenix. Pop. (1950) 19,096.

WEST YORK, borough, Pennsylvania, just west of the city of York in York County, at an altitude of 370 feet, served by the Pennsylvania and the Western Maryland railroads and state and federal highways. Chiefly an industrial community, West York manufactures machinery, pottery, hosiery, and furniture. The borough was incorporated in 1905 and the government is administered by mayor and council. Pop. (1950) 5,756.

WESTBOROUGH or **WESTBORO,** wĕst'bûr-ô, town, Massachusetts, in Worcester County, nine miles east of Worcester at an altitude of 298 feet, served by the Boston and Albany Railroad. Surrounded by a farming region, yielding apples, peaches, and poultry products, Westborough is chiefly an industrial community. Among its manufactures are abrasives, cotton and woolen articles of clothing, and narrow fabrics. The town also has tanneries and machine shops. Located here are a high school, the Lyman School, which is a state correctional school for boys, and a public library.

Westborough was settled around 1675, and received its first charter in 1717. Its government is administered by a board of selectmen and New England town meeting. Pop. (1950) 7,378.

WESTBROOK, city, Maine, in Cumberland County, six miles east of Portland on the Presumpscot River at an altitude of 85 feet, served by branches of the Boston and Maine Railroad and bus lines connecting it with Portland. The river furnishes considerable water power which is used by the leading industries, the manufacture of textiles and paper. Cotton goods were first manufactured here about 1830 and in 1874 the manufacture of silk was begun. In 1854 Samuel D. Warren purchased a paper factory here and the same concern had a daily output of over 400 tons in 1951. The city also has flour mills and machine shops, and its chief cotton and silk products are dress goods, cotton warp, and seamless bags. The Walker Memorial Library was erected here in 1894.

In 1814 sections of this region called Ammoncongin and Saccarappa were incorporated into the town of Westbrook, in honor of Col. Thomas Westbrook. It was chartered as a city in 1891. The principal sections of the city are West End, East End or Cumberland Mills, Pride's Corner, and Highland Lake. The government is administered by mayor and council. Pop. (1950 12,284.

WESTCHESTER, village, Illinois, in Cook County, 14 miles west of Chicago, of which it is a suburb. It is served by the Illinois Central and the Indiana Harbor Belt railroads and two federal highways. Westchester was incorporated in 1925 and is chiefly a residential community. Pop. (1950) 4,308.

WESTCOTT, wĕs(t)'kŭt, **Brooke Foss,** English bishop and theologian. b. Birmingham, Jan. 12, 1825; d. Bishop Auckland, Durham, July 27, 1901. He was graduated from Trinity College, Cambridge, in 1848, was elected a Fellow of his college in 1849 and in 1851 was ordained in the English Church. He was assistant master at Harrow 1852–1869, and here he remained till 1869, when he became a residentiary canon of Peterborough. He became canon of Westminster in 1883 and on the death of his friend, Lightfoot, bishop of Durham, was appointed his successor in 1890, and in this see he remained until his death.

Westcott showed a deep interest in the lot of the miners in his diocese, which won him their genuine esteem, and he was very successful in preventing and settling industrial disputes. From 1870 to 1890 he was regius professor of divinity at Cambridge and during his tenure of the office exercised a powerful and abiding influence on undergraduates and scholars.

As a scholar and theologian Westcott's position was a very high one. As a textual critic he is best known for his share in the revision of the Greek text of the New Testament, which occupied him and J. F. A. Hort for 28 years, and resulted in the publication of their important work, *The New Testament in the Original Greek,* in 1881. The text formed the basis of the Revised Version of the New Testament. His other published works include *General Survey of the History of the Canon of the New Testament During the First Four Centuries* (1855), which has gone through many editions; *Introduction to the Study of the Gospels* (1860); *A General View of the History of the English Bible* (1868); *The Paragraph Psalter* (1879); *The Revelation of the Risen Lord* (1882); *Social Aspects of Christianity* (1887); *Essays in the History of Religious Thought in the West* (1891); *The Gospel of Life* (1892); *The Incarnation and Common Life* (1893); *Lessons of the Revised Version of the New Testament* (1894); *Christian Aspects of Life* (1895); *Lessons from Work* (1901), and *Words of Faith and Hope* (1902).

WESTCOTT, Edward Noyes, American writer and banker: b. Syracuse, N. Y., Sept. 26, 1846; d. there, March 31, 1898. He was educated in the schools of Syracuse and at 16 became a bank clerk. From 1866 to 1868 he lived in New York City but returned to his native place where he worked for various banks.

In June 1895 tuberculosis forced his retirement, and during the summer at Lake Meacham in the Adirondacks and the following winter in Italy, he wrote his well-known novel, *David Harum* (q.v.). His manuscript was refused by several publishers. It was only accepted in January 1898, two months before his death, and Wescott did not live to see his book printed in September of that year. Its subsequent success was manifested in the sale of over a million copies.

WESTERLY, town, Rhode Island, in Washington County, 69 miles east of New Haven on the Pawcatuck River and the Connecticut boundary, and served by the New York, New Haven, and Hartford Railroad. It is at an altitude of 15

feet and comprises several villages. In environment and character it combines rural, seaside, and industrial elements. Summer resorts and Long Island Sound beaches are nearby. Granite is quarried in the county and the town manufactures textiles and metal products and has a food canning industry.

In the late 17th and the 18th centuries, shipbuilding was an important industry. The first permanent settlers in the area were John and Mary Babcock, in 1648. Westerly's charter dates from 1669. Pop. (1950) 12,380.

WESTERMANN, wĕs'tĕr-măn, **William Linn,** American historian: b. Belleville, Ill., Sept. 15, 1873. With degrees from the University of Nebraska and the University of Berlin, he taught Latin, Greek and history in several American schools and universities and was professor of history at Columbia University from 1923 to 1948. He was the author of *Story of the Ancient Nations* (1912), the editor of *Westermann's Classical and Historical Map Series* (1918), and a collaborator in the publishing of three series of *Greek Papyri* (1926, 1931, 1933).

WESTERMARCK, Edward Alexander, Finnish philosopher and anthropologist: b. Helsingfors, Nov. 20, 1862; d. Lapinlahti, Finland, Sept. 3, 1939. He was educated at the University of Finland, and he became professor of moral philosophy there in 1894. From 1907 to 1930 he occupied the Martin White professorship of sociology at the University of London; and thereafter he was professor of philosophy at Turku University until his retirement in 1935. He was an authority on the history of marriage, morals, and the social customs of mankind. His works included: *The History of Human Marriage* (1891; 5th ed. 3 vols. 1921); *The Origin and Development of the Moral Ideas* 2 vols. (1906–08); *Marriage Ceremonies in Morocco* (1914); *A Short History of Marriage* (1926); *Ritual and Belief in Morocco* (1926); *Wit and Wisdom in Morocco* (1930); *Ethical Relativity* (1932); *Early Beliefs and Their Social Influence* (1933); *The Future of Marriage in Western Civilization* (1936); *Christianity and Morals* (1939).

WESTERN AUSTRALIA, largest of the states of the Commonwealth of Australia. On the north, west, and south it is bounded by the Indian Ocean, and on the east by the Northern Territory and South Australia. The greatest length is 1,480 miles, north to south; and the greatest breadth is almost 1,000 miles. The area is 975,920 square miles, and the population in June 1944 numbered 485,407 (252,508 males and 232,899 females). The capital is Perth (pop. 1941, 230,000), and Fremantle (28,169) is the principal port; other cities are Kalgoorlie (10,500) and Bunbury (5,700).

The coastline measures about 3,000 miles, and except on the south is indented by numerous bays, creeks, and estuaries. The chief rivers are the Ord and Fitzroy, on the north; and De Grey, Fortescue, Ashburton, Gascoyne, Murchison and Swan, on the west. Perth is situated on the banks of the Swan River. Few of the rivers are large and navigable. The greater part of the seaboard is separated from the interior by a low range of hills running parallel to it, and covered with forests. To a large extent, the country is an alternation of ridges and hollows, sandy, without grass, and clothed with bushes and scrubby timber. The fertile land exists in patches, and some of it is of a very rich character. Large forest areas are covered with jarrah, a species of eucalyptus in great request for building purposes. Another eucalyptus is the karri, found principally in the southwest, where, also, are numerous forests of sandalwood trees. Pearl oysters, bêche-de-mer, and tortoise shell are obtained off the northwest coast. Western Australia is the principal gold-producing state in the Commonwealth; 45,588,000 fine ounces of gold were mined there down to 1939. Coal is also produced in considerable quantity, and other minerals of commercial importance comprise silver, lead, copper, tin, iron, zinc, and wolfram.

The pastoral and agricultural industries are of great importance. Sheep are raised in considerable numbers in the southeast and center of the state, and cattle in the north, where the rainfall is heavier. Horses and hogs are relatively fewer than in other parts of the Commonwealth. Wheat is by far the largest cereal crop, and oats rank second in importance. Other crops include barley, hay and green forage; vines and orchard fruits do well.

Although the first settlement was made in 1826, Western Australia was not constituted a colony until June 1829. From 1850 to 1868 it was a place for the transportation of convicts. The colony obtained responsible government in 1890; and on Jan 1, 1901, it became an origin-constituent state of the Commonwealth of Australia (q.v.)

WESTERN EMPIRE, The, the western portion of the Roman empire, consisting of Italy, Illylricum, Spain, Gaul, Britain and Africa, as distinguished from the Eastern or Byzantine empire, comprising the eastern half of the Balkan Peninsula, Greece, Egypt, Syria and Asia Minor, so far as Persia. This partition of the Roman empire occurred in 364 when Valentinian I shared the imperial authority with his brother Valens, who ruled in Constantinople as emperor of the East, while Valentinian ruled in Rome as emperor of the West. The partition became final in 395 when Theodosius the Great divided the Roman world between his two sons Honorius, who became emperor of Rome and the West, and Arcadius, who became emperor of Constantinople and the East. The Western empire terminated in 476. See Byzantine Empire; Rome.

WESTERN INDIA STATES AGENCY, a grouping of 16 Indian States, west of Bombay Province, in direct political relations with a British Resident whose headquarters are at Rajkot. The States, which have internal autonomy, comprise Bhavnagar, Cutch, Dhrangadhra, Dhrol, Gondal, Jafrabad, Junagadh, Limbdi, Morvi, Nawanagar, Palitana, Porbandar, Radhanpur, Rajkot, Wadhwan, and Wankaner. The area of the Agency is 37,894 square miles; at the census of 1941 the population totaled 4,904,156.

WESTERN ISLANDS. See Azores; Hebrides.

WESTERN MARYLAND COLLEGE, located at Westminster, Md. It was founded under the auspices of the Methodist Protestant Church, and was first opened to students in 1867.

It was the first college in the South to offer equal educational privileges to both sexes. The preparatory school, established in 1899, has been discontinued, and its quarters, Levine Hall, converted into a men's dormitory. The campus is situated on elevated ground in the western part of the city. The degree of A.B. is conferred for the completion of a four years' course in the classical, scientific or historical field. Courses are also given in music, art and elocution. The enrollment for the year 1949–1950 was 825 and the faculty numbered 55.

WESTERN ONTARIO, University of, Canadian university, situated at London, Ontario. It was founded in 1878 as a college in connection with the Church of England. In 1949–1950 there were 3,323 students and 230 teachers. In the same year the library had 187,000 volumes. Degrees and diplomas up to, and including, Ph.D. are given.

WESTERN RESERVE, or CONNECTICUT RESERVE, that portion of the Northwest Territory (q.v.) reserved by Connecticut when, in 1786, that state ceded to the United States other parts of the territory claimed under the charter of 1662, which granted to Connecticut lands limited east and west by the sea. This section of land is what is now included in the northeastern part of Ohio; it was all the territory between lat. 41° and 42° 2′ N., and extending 120 miles from the western boundary of Pennsylvania. In 1795–1796 Connecticut sold this land, except 500,000 acres, to a number of men who established what was known as the Connecticut Land Company. At first settlers hesitated about purchasing any of the land on the "Reserve," fearing the validity of the title, but when the State of Connecticut yielded all claim to the government, there was no longer any doubt about the titles. There were a large number of colonists from Connecticut who settled on this "Reserve"; counties were organized, 13 in all, which were in whole or in part from lands of the "Reserve." (See NORWALK, OHIO.) The people were characterized by their thrift, industry and the manner in which they established schools. A large part of the money received by Connecticut for the sale of the lands was set aside "as a perpetual fund, the interest of which should be appropriated to the support of schools." This school fund was the means of influencing in Ohio a unique system of education, in some respects different from that of any other state.

WESTERN RESERVE UNIVERSITY, an endowed, independently controlled university, located in Cleveland, Ohio, was the first institution offering higher education in Connecticut's Western Reserve, having been chartered in 1826 as Western Reserve College, and located at Hudson, Ohio, twenty miles southeast of Cleveland. The Cleveland Medical College was organized in 1843 and became the medical department of Western Reserve College in 1844.

The institution was moved to Cleveland in 1882, and the name was changed to Western Reserve University. The undergraduate college for men took the name of Adelbert in recognition of a substantial gift from Amasa Stone whose son, Adelbert, died while a student at Yale University.

In 1888 undergraduate instruction in arts and sciences was made available to young women by the organization of a coordinate college for women which is now known as Flora Stone Mather College.

The university now consists of eleven schools and colleges, three offering degrees in arts and sciences and business, and eight offering graduate or professional degrees as follows: Adelbert College and Flora Stone Mather College, for men and women, respectively; Cleveland College, located on the Public Square, and enrolling both full-time and part-time students, the majority of whom are adults; Graduate School; the School of Medicine; the School of Dentistry; the School of Library Science; the School of Applied Social Sciences; the Frances Payne Bolton School of Nursing; the School of Architecture; and the Franklin Thomas Backus School of Law.

From its founding in 1826, the college, and then the university, adopted and maintained high standards of scholarship with the result that by 1840 its faculty was recognized as being superior to any in the Middle West, and equal to that of many of the older institutions in the East. Western Reserve College was the pattern to be followed in the founding of many other colleges in Ohio and in other parts of the Middle West. Frequently it was referred to as the "New England college of the West" and also as the "Yale of the West." In its early days the institution played a leading part in the cultural, educational, and religious development of Connecticut's Western Reserve. In later years, its graduates occupied positions of great influence and leadership in the industrial development of northeastern Ohio.

During the 20th century Western Reserve University has developed as an urban university, placing more and more emphasis on serving the educational and cultural needs of an urban community based on an industrial economy. The development of Cleveland College, located in the heart of the city, has made available a great variety of educational opportunities to citizens of all ages. At the same time the university has continued its tradition of small undergraduate colleges, thus making available to its students the opportunities both of the small college and of the large university.

The university has grown more rapidly than the community which it serves and by which it has been supported. The population of Cleveland has increased from 381,768 in 1900 to 914,808 in 1950, an increase of 139 per cent. In the same period the number of students has grown from 717 to 17,980, an increase of 240.7 per cent. The university's assets have increased from $2,634,427 in 1902 to a total of $35,175,174.94 in 1950.

The university works in close cooperation with the other educational institutions of the community. The Cleveland Museum of Art, the Cleveland Symphony Orchestra, the Cleveland Institute of Art, Case Institute of Technology, the University Hospitals are all located in the University Circle area and have arrangements for the interchange of personnel and facilities with the university.

JOHN SCHOFF MILLIS,
President, Western Reserve University.

WESTERN SPRINGS, village, Illinois, in Lyons Township, Cook County, is a residential community (altitude, 670 feet), situated 17 miles southwest of Chicago on the Chicago, Burlington & Quincy Railroad, and on federal and state highways. Its name derives from mineral springs which once abounded in the vicinity and were

notable in that, during dry weather, they raised mounds of earth from which the water jetted forth. On the grounds of the Western Springs Country Club there was located in 1843 one of the stations of the Underground Railroad where slaves were sheltered on their flight to Canada.

The village was settled by Quakers (about 60 families), and was incorporated in 1886. It is governed by an elected president and six trustees. It has a public library; private, parochial (Lutheran), and public schools; five Protestant churches, a newspaper, a Little Theater group, symphony orchestra, and a number of clubs including branches of the American Association of University Women and the League of Women Voters. Pop. (1950) 6,120.

WESTERNPORT, town, Maryland, in Allegany County; altitude 922 feet; on the north branch of the Potomac River; at the head of navigation; 27 miles southwest of Cumberland; on the Western Maryland Railroad. It was once a prosperous coal-mining town. Pop. (1950) 5,439.

WESTFIELD, city, Massachusetts, in Hampden County, altitude 154 feet, on the Westfield River, the Boston and Albany, and New York, New Haven and Hartford railroads; and one state and two federal highways, 9 miles west of Springfield. There is a city airport. Westfield was famous for its whips in the 19th century; at one time 40 establishments here made whips. Finally this became a premium and carnival trade only. Now the main manufactures are bicycles, boilers and radiators, textile machinery, envelopes and other paper products, brushes and mops, thread, bricks, wood and paper boxes. Here are Massachusetts State Normal School (1844); a state sanatorium for tuberculosis and cancer; the Atheneum (1864) which houses a good library; the Edwin Smith Historical Museum; and the Jasper Rand Art Museum. Fowler Tavern was frequented by George Washington; its front door is now in the American Wing of The Metropolitan Museum in New York. An Indian trading post here in 1640 was called Woronoco (now the name of the city park). In 1669 Westfield separated from Springfield, and remained a town till 1921, when it was chartered as a city. It has a mayor and council. Pop. (1940) 18,793; (1950) 20,961.

WESTFIELD, residential town, New Jersey, in Union County; altitude 130 feet; 18 miles southwest of Jersey City; on the Central of New Jersey Railroad; skirted by State Highway 29. Many residents commute to business in New York and other nearby cities. Places of interest include Mindowaskin Park, and Scudder House, headquarters of Gen. William Alexander during the Revolutionary War. It has excellent public and parochial schools; mayor and council government. Pop. (1940) 18,458; (1950) 21,335.

WESTFIELD, village, New York, in Chautauqua County; altitude 748 feet; two miles from Lake Erie, and six miles from Lake Chautauqua; on the New York Central, and New York, Chicago and St. Louis railroads. It is in the Chautauqua grape belt, and the manufacture of unfermented grape juice is the leading industry. It is known as the grape juice capital of the world. Other products include tomato juice and canned fruits. Fisheries are important. Pop. (1940) 3,434; (1950) 3,649.

WESTFORD, town, Massachusetts, in Middlesex County; altitude 160 feet; 25 miles northwest of Boston; on the Boston and Maine Railroad. First settled in 1653, it was incorporated as a town in 1729. It is in an agricultural and fruit-growing section. Industries include the manufacture of worsteds, machinery, and foundry products. Old Fletcher Tavern, dating from 1713, is interesting. Pop. (1940) 3,830; (1950) 4,240.

WESTINGHOUSE, George, American inventor: b. Central Bridge, N. Y., Oct. 6, 1846; d. New York, March 12, 1914. He entered the machine shop of his father, a manufacturer of agricultural implements, when very young and early evinced an inventive genius, designing at 15 a rotary engine. He served in the Union Army in 1863–1864, and in 1864–1865 was assistant engineer in the United States Navy, after which he studied at Union College for two years. He continued his interest in mechanics, his first invention of importance being a railway frog. In 1868 he introduced the famous Westinghouse brake (see AIR-BRAKE), which has since been developed to a remarkable degree of efficiency, and has come into international use. At first his invention was scouted as impracticable. The story is told that he interviewed Commodore Vanderbilt, and explained his designs. The Commodore is said to have replied, "If I understand you, young man, you propose to stop a railroad train with wind; I have no time to listen to such nonsense." A few years later the "impossible" device was operating on all the Commodore's lines. Mr. Westinghouse was one of the pioneers in introducing alternating-current machinery, and he succeeded in securing the use of this method at the Chicago Exposition in 1893. He had also made numerous improvements in railroad signaling, and through his devices the safety of high-speed railway traveling has been greatly increased. He erected extensive works in this country and abroad for the manufacture of his various inventions, was president of over 30 corporations, and proved to be as good a businessman as he was a skilled mechanician. He received the Order of Leopold from the Belgian king in 1884, and in 1889 the Royal Order of the Crown from the king of Italy. He was also decorated with the French Legion of Honor.

Consult Leupp, F. E., *George Westinghouse: His Life and Achievements* (Boston 1918); Prout, H. G., *A Life of George Westinghouse* (1921); Faris, J. T., *Men Who Conquered* (New York 1922); Harper, F. C., *Pittsburgh of Today* (1931).

WESTLAKE, Nathaniel Hubert John, British painter, designer and writer in art: b. Romsey, 1833; d. London, May 9, 1921. He studied painting and design under the British artists, William Dyce and J. R. Herbert, also at Antwerp and Paris. At a friend's suggestion he became associated with a firm of glass painters as designer, and about 1880 became art manager and partner of the firm. He was a frequent exhibitor at the Royal Academy, Arts and Crafts, and other art centers. Examples of his paintings are in St. John's Church, Richmond; Portsmouth Cathedral; St. Augustine's Church, Tunbridge Wells; Bute Memorial Chapel, Cardiff Castle, Wales; and the chapel of Maynooth College, Ireland. Notable examples of his glass work in England and the United States are in St. Paul's Cathedral, London, the cathedrals of Peterborough and Wor-

cester, the Gate of Heaven Church, South Boston, Mass., the Via Crucis of Saint Francis's, Notting Hill, London. He designed Salviati's mosaic of Blessed James of Ulm at the South Kensington Museum, London, the apse mosaic in the Newman Memorial Church, Birmingham, and collaborated with many famous architects. His publications include 'Outlines of the History of Design in Mural Painting' (3 vols.); 'History of Painted Glass' (4 vols); 'True Portraiture of St. Francis'; 'Sketches at Malines Exhibition.' He edited 'Reproduction of Royal Manuscripts, 2 B VII, British Museum'; 'Queen Mary's Psalter,' etc.

WESTLAKE, William, American inventor: b. Cornwall, England, 23 July 1831; d. Brooklyn, N. Y., 28 Dec. 1900. He came to the United States in 1847, settled in Milwaukee, Wis., and there was employed in a printing office. He was subsequently an apprentice to a tinsmith, and in 1853 made for Captain John Ericsson the models for his first hot-air engine. He entered the employ of the La Crosse and Milwaukee Railroad Company in 1857, and soon after began the series of inventions which made him famous. Among them are the Westlake car heater, the globe lantern, the first practical car lamp, the oil cook stove, the stoveboard, etc.

WESTLAND, New Zealand, a provincial district in South Island, bounded north by Nelson district, south by Otago, west by the ocean and east by Canterbury, from which it is separated by the chain of the Southern Alps. It is about 200 miles long and about 25 miles in average breadth, its area being about 4,881 square miles. It consists principally of hills branching off from the great alpine system, intersected by narrow bush-clad valleys, and merging coastward into undulating plateaus, river valleys and shelving coasts. The streams are numerous but short. Practically the whole of the district is covered with forest. Large tracts can be prepared easily for pastoral purposes, but there is little ground suitable for agriculture. Gold is found in the valleys of the rivers, especially in those of the Arahura and Waiho, and gold-bearing quartz is also worked in some places. Silver, copper, iron and tin are among the other metallic treasures of the district, which has also yielded much coal, especially from the valley of the Grey. The climate is equable and temperate. The rainfall is heavy, and snow lies on the high mountains during much of the year. The capital is Hokitika, the other chief towns being Greymouth, Brunnerton, Kumara and Ross. Railways connect Greymouth with Hokitika, Jackson and Reefton (in Nelson district). Westland was formerly part of Canterbury district. Pop. about 15,025.

WESTMACOTT, wĕst'mą-kŏt, **Richard,** English sculptor, son of Sir Richard Westmacott (q.v.): b. London, 1799; d. there, 19 April 1872. He studied under his father and also in Italy 1820–26, and after returning to England rose to prominence in his art. In 1857 he succeeded his father as professor of sculpture at the Royal Academy, having become associate member of the academy in 1838 and a full member in 1849. His style resembled that of his father in many respects He published a 'Handbook of Sculpture' (1864) and a pamphlet 'On Coloring Statues.'

WESTMACOTT, Sir **Richard,** English sculptor: b. London, 1775; d. there, 1 Sept. 1856. He was the son of Richard Westmacott, also a sculptor, and was early trained to a knowledge of art by his father. In 1793 he was sent to Rome to study his profession under Canova, and there gained the annual gold medal for sculpture given by the Pope at the Academy Saint Luke. He also obtained a first prize for sculpture at Florence, and was elected a member of the Academy there. In 1798 he returned to England and rose rapidly in estimation as an artist. Many of the monuments in Saint Paul's Cathedral are by him, and that building forms, in some respects, a gallery of his works. The figure of a Welsh girl in a monument to the memory of Lord Penrhyn, at Penrhyn, in North Wales, is considered by many as his best creation. He designed also the statue of Nelson in Birmingham, besides figures of Addison, Pitt and many others. He became an associate of the Royal Academy in 1805, a full member in 1811 and in 1827 succeeded Flaxman as lecturer to the academy on sculpture. He was knighted in 1837.

WESTMEATH, Irish Free State, county of the province of Leinster, having Meath on the east, Roscommon on the west, Cavan on the north and King's County on the south; greatest length, east to west, about 40 miles; greatest breadth, north to south, about 35 miles; its area is 708 square miles, or 453,468 acres, of which 111,752 are under tillage. The surface is generally level, the land is chiefly in pasture. Mullingar is the chief town, but Athlone is the great manufacturing centre. Pop. 56,796.

WESTMINSTER, London, England, a metropolitan and Parliamentary borough, formerly the ancient city and Liberty of Westminster, which still retains its civic title and certain privileges. Area, 2,502 acres. It is bounded on the south and east by the river Thames; east by the city of London, from which it was separated by the former Temple Bar; north by Holborn, Marylebone and Paddington, and west by Kensington and Chelsea. It is connected with Lambeth by Vauxhall, Lambeth, Westminster and Waterloo bridges. It has the highest valuation of any of the London boroughs (£10,728,957 in 1936) not excepting the City of London. The city contains some of the finest and most imposing buildings in London and teems with historical and literary associations. All the metropolitan royal palaces are within its limits and also Westminster Abbey, the Houses of Parliament, a fine modern Roman Catholic cathedral, the principal government buildings, the headquarters of the metropolitan police force, the National Gallery and the Tate Gallery, Burlington House, Somerset House and the principal theatres and opera-houses. It is divided into three Parliamentary constituencies, each returning one member, Saint George's, Hanover Square, the Abbey and Strand.

The History of Westminster goes back to a very early period. It became a city when, in 1540, Henry VIII made it the see of a bishop, and even though the see was suppressed 10 years later it retained the right to the style of city. The only (Anglican) bishop of Westmin-

ster was Thomas Thirlby. Since 1831 a branch of the Grosvenor family has borne the title of marquis, and since 1874 of duke of Wesminster. Pop. (1951) 98,895. See also LONDON.

WESTMINSTER, city, Maryland, Carroll County seat, altitude 744 feet, on the Western Maryland Railway and a federal highway, 28 miles northwest of Baltimore, on Parr's Ridge. The city is in an agricultural section and holds weekly auction markets of livestock, eggs, and poultry. Vegetables and fruits from the surrounding country are canned here, and canning and poultry equipment are manufactured. Clothing, shoes, flour, fertilizer, upholstery, meat packing, floor covering are other factory products. The county courthouse and County Historical Society are housed in colonial buildings.

In the western part of the city, on College Hill, are the Western Maryland College (Methodist Protestant, coeducational, 1866) and the Westminster Theological Seminary, of the same denomination, which also has a home for the aged here. The government is vested in a mayor and five councilmen, elected annually on a nonpartisan basis. Westminster was settled in 1764 and became a center for the nonepiscopalian Methodist organization that grew up in Maryland about 1830. Pop. (1940) 4,692; (1950) 6,140.

WESTMINSTER ABBEY. See LONDON —*Ecclesiastical London.*

WESTMINSTER ASSEMBLY OF DIVINES, a celebrated assembly held in the middle of the 17th century for the settlement of a general creed and form of worship throughout Great Britain, at a time when Presbyterianism had gained a strong position in England as well as in Scotland. On the 23d of Nov. 1641 the House of Commons (Long Parliament) addressed to the king a remonstrance desiring a synod of the most learned and pious men throughout the island for the settling of the government of the church; but it was not until 1643, after the civil war had begun, that an ordinance was passed (on June 12) convoking the long-proposed assembly of divines. By this act 121 clergymen, with 10 lords and 20 commoners as lay assessors, were nominated as constituents of the assembly. The assembly began its sittings on July 1, 1643 in Henry VII's Chapel, at Westminster Abbey, but in the meantime a proclamation forbidding the assembly to meet had been issued by the king on June 2, which had the effect of inducing the greater part of the Episcopal members to absent themselves, and Episcopacy was thus almost entirely unrepresented. The majority of those who remained were Presbyterians, but there was a powerful and energetic minority of Independents. A deputation was now sent along with commissioners from the English Parliament to the general assembly of the Scottish Church and the Scottish Convention of Estates, soliciting their cooperation in the proceedings of the Westminster Assembly, and accordingly on September 15, four Scottish clergymen, Alexander Henderson, George Gillespie, Samuel Rutherford and Robert Baillie, with two laymen, Lord Maitland and Sir Archibald Johnston of Warriston, were admitted to seats and votes by an act of the English legislature. The assembly continued to hold its sittings until Feb. 22, 1649. Among the results of its deliberations were the *Directory of Public Worship,* which was presented to Parliament on April 20 and ratified on Oct. 2, 1644; the *Confession of Faith* presented to Parliament in October and November 1646 and ratified with a few verbal alterations in March 1648; the *Shorter Catechism,* presented to the House of Commons on Nov. 5, 1647 and the *Longer Catechism* on Sept. 15, 1648. In the latter period of the sittings of the assembly the growing power of the Independent party in Parliament presented a serious obstacle to the carrying into effect of its recommendations, though in 1648 an order of Parliament was pronounced declaring "all parishes and places whatsoever," with the exception of chapels for the king and peers, to be under the Presbyterian form of church government. The accession of Cromwell to power destroyed the hopes of the Presbyterians, and on the Restoration the whole proceedings of the Westminster Assembly, with the ratification of Parliament, were annulled as invalid.

While this celebrated convocation was thus allowed, as regards England, to remain almost inoperative, its deliberations have left on Scotland and on Presbyterianism, as established in the United States, an impress which will never be effaced. The present standards of the Presbyterian churches are made up of the various formularies above enumerated. They were ratified by the Scottish General Assembly as follows: The *Directory of Public Worship* in February 1645; the *Confession of Faith* in August 1647, and the *Longer and Shorter Catechism* in July 1648. See also PRESBYTERIANISM.

WESTMINSTER COLLEGE, located at Fulton, Missouri. It was founded in 1853 by the Missouri Synod of the Presbyterian Church. Though badly crippled during the Civil War by reduction in numbers and loss of endowment, the college continued its work throughout the war. In 1901 an amendment of the charter placed the college under the joint control of the southern and the northern synods of Missouri. The college formerly conferred the three degrees of A.B., B.L. and B.S. for the completion of the classical, literary and scientific courses respectively; but recently arranged its course in three groups corresponding to the former three courses, and confers the single degree of A.B. Each group includes required and elective studies. Bible study is required and Hebrew is among the electives. There is also an academy offering a classical and a literary and scientific course and commercial courses. The campus comprises over 40 acres of ground on a wooded slope bordering on Stinson Creek. More than one-third of the students regularly work all or part of their way through college. Enrollment annually is about 400 men.

WESTMINSTER COLLEGE, located at New Wilmington, Pennsylvania. It was chartered in 1852, as Westminster Collegiate Institute under the auspices of the United Presbyterian Church. The board of trustees now consists of 40 members, the majority of whom are elected by two synods of that church. The name was changed to Westminster College in 1892. The college offers two four-year courses, leading to degrees, the classical and the scientific, and confers the degrees of A.B. and B.S. The work of the scientific course is mostly required; that of the classical course largely elective in the junior and senior years. Greek is required for

the A.B. degree. There are also a three years' preparatory course, a department of music and an art department. The college has a pleasant situation on elevated ground, some parts of the campus commanding a fine view. The buildings are the main building, scientific hall, the ladies' hall and the gymnasium. The average annual enrollment is about 900.

WESTMINSTER CONFESSION OF FAITH. See CONFESSION OF FAITH, WESTMINSTER.

WESTMINSTER PALACE, London, England, an alternative name for the Houses of Parliament, perpetuated from the ancient palace built by Edward the Confessor as a royal residence and which contained the various national administrative and judicial offices. With the exception of the great hall, the building was destroyed by fire in 1834. The site is occupied by the new palace of Westminster or Houses of Parliament. See LONDON—*Historic Buildings and Other Points of Interest.*

WESTMINSTER SCHOOL, an ancient English public school established in Westminster Abbey by Henry VIII, and refounded in 1560 as St. Peter's College by Queen Elizabeth. The school buildings closely adjoin the abbey, several of them having once been a part of the domestic buildings of the abbey, the great schoolroom being originally the monks' dormitory; others, such as Ashburnham House, belonging to the Post Reformation period. The institution was reorganized in 1868 as one of the seven principal public schools of England. The Westminster play, for which this school is noted, is a yearly performance by the pupils of some Latin comedy. Many eminent Englishmen have been educated at this school.

WESTMINSTER STANDARDS. See PRESBYTERIANISM.

WESTMOUNT, wĕst'mount, Quebec, Canada, on Montreal Island, a residential section of Greater Montreal. It is situated immediately to the west of the city proper on the southwestern slope of Mount Royal commanding extensive views. Incorporated as a town in 1873 and as a city in 1908, it has a public library, the Herbert Reddy Memorial Hospital, seven banks, a weekly newspaper, and a "business association." The lower level of the city is traversed by the Canadian Pacific and Canadian National railways, and there are 15 industries the largest of which is a manufactory of medical and pharmaceutical preparations. The city is administered by a mayor and five aldermen elected for a two-year term. Pop. (1941) 26,047; (1951) 24,388, about 74 per cent of English-speaking origin.

WESTON, Edward, American electrician: b. London, England, May 9, 1850; d. Montclair, N. J., Aug. 20, 1936. He came to the United States in 1870 and engaged as chemist to a nickel-plating company. He devised various improvements in the process of nickel-plating and invented several dynamo-electric machines, establishing at Newark, N. J., in 1875, the first factory in America devoted exclusively to the manufacture of the latter class of machines. After the consolidation of his plant with another company in 1881 he continued as its electrician until 1888 when he formed the Weston Electric Instrument Co., Waverly, N. J., becoming president. He improved appliances for lighting by electricity. He was one of the founders of the American Institute of Electrical Engineers and president in 1888.

WESTON, Edward Payson, American pedestrian: b. Providence, R. I., March 15, 1839; d. Brooklyn, N. Y., May 13, 1929. In his youth he was a reporter on the New York *Herald* and was valued because of his ability to bring his night copy back to the office on foot quicker than could others traveling on the horse-cars of the period. He attracted attention in 1861 by walking 443 miles in 208 hours to attend the inauguration of Abraham Lincoln. His professional career began in 1867, when he walked 1,326 miles from Portland, Me., to Chicago, in 26 days. Later he engaged in six-day races, first in the effort to make 500 miles in a week, and when that record was passed he learned to run and created higher records. Some years later he again took to long walks on the highway, and in 1907 repeated his trip from Portland, Me., to Chicago, bettering the time 29 hours. Next he walked from New York to San Francisco, 3,895 miles (1909), in 104 days, 7 hours. The following year he walked back to New York, 3,500 miles, in less than 77 days. He lectured on pedestrianism and temperance in cities of the United States and England.

WESTON, wĕs'tŭn, town, Ontario, in York County, immediately northwest of Toronto on the Canadian National and Canadian Pacific railways. Electric railway communication with Toronto is supplied by the Toronto Transportation Commission. Though largely a residential suburb of Toronto, amid pleasant surrounding country, it has 45 industrial establishments of a diversified character which employ 2,438 persons and produce to the value of $20,012,274 (1949). Heating and cooking apparatus, bicycles, automobile supplies and stone products are the principal manufactures. There are seven churches, six primary schools, high and vocational schools, a public library of 10,937 volumes, a weekly newspaper and a board of trade. The immediate neighborhood was settled early, but the municipality was not incorporated until 1881. Pop. (1941) 5,740; (1951) 8,646.

WESTON, town, West Virginia, and Lewis County seat; altitude 1,100 feet; on the Monongahela River, here not navigable; 25 miles southwest of Clarksburg; on the Baltimore and Ohio Railroad. It is in a hilly region, where sheep and cattle are raised. The county has coal, oil, and gas; great quantities of the gas are piped to large cities. The manufacture of glass tableware is the principal industry. There is a public library and the high school library is also well equipped. The city is governed by a council, composed of a mayor and four councilmen elected by the people. Weston was incorporated in 1818 and received its charter in 1847. Pop. (1950) 8,945.

WESTPHALIA, wĕst-fāl'yà; -fā'lĭ-à, Germany, a name originally given (1) to a large region of Germany; (2) to a duchy; (3) to an ancient imperial circle; (4) to a kingdom; (5) to a province of Prussia. These various divisions will be described in the above order.

1. The name of Westphalia was given from the second half of the 8th century to the west-

ern part of the ancient Duchy of Saxony incorporated by Charlemagne in the kingdom of the Franks, that is, to all the country between the Weser and Rhine while the territory between the Elbe and Weser was called Eastphalia (Ostfalen). The latter name was lost after the dissolution of the Duchy of Saxony in 1180; the former was retained and was applied in the first place to a newly-erected duchy.

2. **Duchy of Westphalia.**—This was formed out of the part of the old Duchy of Saxony, then called Süderland or Sauerland, on the Upper Ruhr and Lenne. When Henry the Lion, the last of the old dukes of Saxony, was put under the ban of the empire, this territory was taken possession of by Philip of Heinsberg, archbishop of Cologne, who obtained the title of duke from Frederick Barbarossa. Cologne remained in possession of it until the dissolution of the archbishopric in 1801, upon which it was given, by way of indemnity, to Hesse-Darmstadt. In 1815 it was ceded by this power to Prussia and was united with the Prussian province of Westphalia.

3. **Circle of Westphalia,** one of the 10 circles into which the empire of Germany was divided by Maximilian I in 1512. It comprised the region between Lower Saxony, the Netherlands, Thuringia and Hesse, as well as considerable tracts on the left bank of the Rhine; but the proper Duchy of Westphalia, as an appendage of Cologne, was considered as belonging to the electoral circle of the Rhine. Its total area was 22,175 square miles.

4. **Kingdom of Westphalia.**—The Peace of Tilsit, now Sovetsk (July 1807), had made Napoleon master of all the Prussian territory west of the Elbe and he also kept possession of the territories of the electors of Hesse and Hanover and the Duke of Brunswick. Out of the countries just mentioned he created by decree of Aug. 18, 1807 a kingdom of Westphalia, with an area of 14,712 square miles and a population of nearly 2,000,000. Napoleon gave the kingdom to his youngest brother, Jerome, and on Nov. 15, 1807 a constitution similar to the French was granted to it. The insurrections that broke out in several parts in 1809 occasioned the adoption of various severe measures, and the introduction of an oppressive system of police. At the same time the king was required to bring his army up to a strength of 30,000 men, which produced great disorder in the finances. In 1810 a part of Hanover was added to the kingdom, the whole area of which was now 17,540 square miles. After the Battle of Leipzig (1813) the kingdom was dissolved. On October 26, Jerome was obliged to quit his capital (Cassel) and make his escape from the kingdom, whereupon the territories of which it was composed returned to their former possessors.

5. **The Prussian Province of Westphalia** was formed in 1815 out of some of the provinces which Prussia formerly possessed in the circle of Westphalia. It is bounded on the north by the province of Hanover; on the east by Hanover, Schaumburg-Lippe, Lippe-Detmold, Brunswick, Hesse-Nassau and the principality of Waldeck, south by the province of Hesse-Nassau, and west by the province of the Rhine and the Netherlands. Its area is 7,805 square miles. The chief cities are Münster, Bielefeld, Hamm, and Paderborn. The province in the south and northeast is generally mountainous. The northwest spreads out into extensive plains and belongs to the basin of the Ems; the northeast and a small part of the east to the basin of the Weser; the remainder, constituting the far larger portion of the whole, belongs to the basin of the Rhine. Livestock are numerous, particularly horned cattle, sheep and swine; the hams made from the latter have long been famous. The staple manufacture is linen, but that of iron is also very extensive. Mineral wealth is very great, especially coal and iron, mainly in the Ruhrgebiet. Other minerals mined include copper, lead, zinc and salt.

WESTPHALIA, Peace of, the treaty concluded in 1648 at Münster and Osnabrück, Westphalia, which ended the Thirty Years' War and established a new political system in Europe. After preliminaries had been settled at Hamburg toward the end of 1641 the actual negotiations were begun in 1644, at Osnabrück, between the empire, Sweden and the Protestant states, at Münster between the empire, France and other foreign powers. Two treaties were drawn up, one at Osnabrück, signed Aug. 6, 1648, and one at Münster, signed Oct. 24, 1648. Peace was restored with the signing of the latter. By this peace the religious and political state of Germany was settled. The sovereignty of the members of the empire was acknowledged. They received the right of concluding treaties among themselves and with foreign powers, only not against the emperor and empire. Their consent was made necessary to enable the emperor to put any of the members under the ban. The concessions that had been made to the Protestants since the religious peace in 1555 were confirmed. The form of public worship and the right to secularize ecclesiastical benefices were to return to what they were at the beginning of the so-called normal year 1624. The Calvinists (Reformirten) received equal rights with the adherents of the Augsburg Confession or the Lutherans. The elector-palatine had the palatinate of the Rhine and the electorate restored to him; Alsace was ceded to France; Sweden received western Pomerania, Bremen, Verden, Wismar and a sum equal to $3,750,000; Brandenburg, Mecklenburg, Hanover and Brunswick were compensated by the secularization of numerous ecclesiastical foundations. Germany lost altogether more than 40,000 square miles of territory and about 4,500,000 inhabitants. The independence of the United Provinces was recognized by Spain, and that of Switzerland by the empire. The solemn protest of Pope Innocent X against these terms, particularly in respect of the secularization of bishoprics and abbeys, etc., was not regarded; but the complete execution of the treaty was obstructed by many difficulties.

WESTPORT, town, Connecticut, in Fairfield County, on Long Island Sound at the mouth of the Saugatuck River and on the New York, New Haven and Hartford Railroad, and a federal highway, 4 miles east of Norwalk. The town has a total area of 22 square miles and contains three villages. Many artists and authors live here. Bedford High School has murals by John Steuart Curry. Four miles to the east, in the Great Swamp Fight of July 1637, the Pequot Indian War was ended. Westport's factory products are soap, disinfectants, embalming fluid, twine and cordage, woolen goods, and boats. It is governed by representative town meeting and three selectmen. Pop. (1940) 8,258.

WESTPORT, town, Massachusetts, in Bristol County; altitude 60 feet; on the Atlantic Ocean; 7 miles southeast of Fall River. Its Horseneck Beach is one of the finest beaches on the coast. There are manufactures of textiles, the first mill having been built in 1812. Pop. (1940) 4,134; (1950) 4,989.

WESTVIEW, town, British Columbia, Canada, about 100 miles north of Vancouver, incorporated 1942. It is the largest of three municipalities that are mainly residential and business adjuncts to Powell River the company town of the Powell River Paper Company whose local plant has a capacity of 1,000 tons of newsprint and 300 tons of pulp daily—the largest of its kind in Canada. There is a Dominion Government dock and airport. Pop. (1951) 3,507.

WESTVILLE, village, Illinois, in Vermilion County; altitude 671 feet; 132 miles south of Chicago; on Chicago and Eastern Illinois and the Big Four railroads. Industries include coal mining, an overalls factory and chick hatchery. Pop. (1940) 3,446; (1950) 3,196.

WESTVILLE, wĕst'vĭl, mining town, Nova Scotia, Canada, on the Middle River in Pictou County, 11 miles south of the town of Pictou and 130 miles northeast of Halifax via the Canadian National Railway. There are bus services to the neighboring towns of New Glasgow, Trenton and Stellarton. The town has four churches, three schools and two banks. Pop. (1941) 4,115; (1951) 4,261.

WESTWARD HO, one of the best known historical novels of Charles Kingsley, was begun in the spring of 1854 while Kingsley was living at Bideford and appeared the following year. The scene, laid chiefly in Bideford and at Plymouth and neighboring parts in the west of England, deals with the sea-faring English about the time of the Spanish Armada. The attempt is to picture the spirit of the English in their warfare against Spain. Historical characters, as Drake and Raleigh, are introduced, but the particular story is that of Amyas Leigh, his brother Frank and other members of the League of the "Rose of Torridge," so called from the beautiful heroine for whose hand these chivalrous and high-minded youths were rivals. Their individual rivalry was merged in the common cause against Spain, in which several, including Frank Leigh and the Rose, met their deaths. Finally Amyas, a stout-hearted young giant who had been particularly successful in vanquishing Spaniards, losing his eyesight, was obliged to pass the long remainder of his life in helplessness. The picture is a spirited one, though by no means in all respects historically accurate. The character and achievements of the English and the wiles and wickedness of the Spanish are painted with unstinting hands. As is usual in Kingsley's best-known works, like *Alton Locke* and *Hypatia,* even such chivalrous achievements do not constitute the best end of life. Only when Amyas Leigh, blind and helpless, can turn from an active to a spiritual life, is his highest happiness won.

WILLIAM T. BREWSTER.

WETASKIWIN, wĕ-tăs'kĭ-wĭn, city, Alberta, Canada, 42 miles south of Edmonton on the Canadian Pacific Calgary-Edmonton line at its junction with the line from Saskatoon. It is in an excellent mixed farming district which also yields timber, coal, natural gas and oil. A creamery, a flour mill, and a stock and poultry feed establishment are the principal local industries. There are five local grain elevators of a total capacity of 273,000 bushels. The town has churches, public and high schools, two weekly newspapers, the Wetaskiwin Community Hospital, a public library, a park and banks. The name is derived from a Cree word meaning "Hill of Peace" from a treaty which was concluded here between the Crees and Blackfeet. Pop. (1941) 2,318; (1951) 3,813.

WETHERALD, Agnes Ethelwyn (BEL THISTLEWAITE), Canadian poet: b. Rockwood, Ontario, April 26, 1857; d. Fenwick, Ontario, Canada, March 9, 1940. She was educated at Pickering College, Ontario. For some time she edited the women's department of the Toronto *Daily Globe,* and she was subsequently connected with the staff of the *Ladies' Home Journal.* Author *The House of Trees* (1896); *Tangled in Stars* (1902); *The Radiant Road* (1904); *The Last Robin* (1907); *Tree Top Morning* (1921); *Lyrics and Sonnets* (1931).

WETHERELL, wĕth'ĕr-ĕl, **Elizabeth.** See WARNER, SUSAN.

WETHERELL, Emma (Abbott), American soprano opera singer: b. Chicago, Ill., Dec. 9, 1849; d. Jan. 5, 1891. She first sang in public at the age of nine. Through the patronage and friendship of Clara Louise Kellogg she was enabled to go to New York in 1870, where she was engaged in the choir of the Church of the Divine Paternity, a number of whose members in 1872 contributed to send her abroad, and she studied for four years in Paris. She made her début in London in 1876 as Marguerite. For refusing to take the part of Violetta, in *La Traviata,* on moral grounds, her engagement was cancelled. In 1874 she was married to Eugene Wetherell. She made her first appearance in New York in 1877.

WETHERSFIELD, wĕth'ĕrz-fēld, town, Connecticut, in Hartford County; altitude 40 feet; 4 miles south of Hartford; on the New York, New Haven and Hartford Railroad. Once it had regular steamer connections with New York and intermediate ports but now is connected with Hartford and other nearby places by passenger and freight bus lines. It has manufactures of agricultural implements. Important industries of the town are the cultivation of seeds and packing and shipping of them. John Oldham, from Watertown, Mass., settled here with 10 men in 1634; the town was thus one of the first places in the state to be colonized. It has a famous elm tree 40 feet in circumference. The first church (Congregational) dates from 1761. A historic building is the Webb house where, in 1781, Washington and Rochambeau met. A state prison is located here. The educational institutions include public and private schools and a public library. Pop. (1950) 12,533.

WETMORE, Alexander, American biologist: b. North Freedom, Wisconsin, June 18, 1886. He was graduated from the University of Kansas in 1912, and later attended George Washington University and the University of Wisconsin. His

early positions were with the University of Kansas Museum, the Colorado Museum of Natural History, and with the Biological Survey of the United States Department of Agriculture. In 1924 he was superintendent of the National Zoological Park, Washington, D.C., and from 1925 to 1944 he served as assistant secretary, Smithsonian Institution, in charge of the United States National Museum. He has been secretary of the Smithsonian Institution since 1945.

His writings include *Observations on Birds of Argentina* (1926); *Fossil Birds of North America* (1931); *Systematic Classification for Birds of the World* (1940). He has also contributed numerous papers on ornithology and avian paleontology.

WETMORE, Edmund, American lawyer: b. Utica, New York, 1838; d. July 11, 1918. He was graduated at Harvard University in 1860, and at the Columbia University Law School in 1863. He was thereafter engaged in law practice in New York and became one of the most prominent lawyers in the city. He was senior member of the firm of Wetmore and Jenner. In 1900–1901 he was president of the American Bar Association. The degree LL.D. was conferred upon him by Yale University in 1906.

WETMORE, Elizabeth Bisland, American author: b. Fairfax Plantation, Louisiana, Feb. 11, 1861; d. near Charlottesville, Virginia, Jan. 6, 1929. She was privately educated, and was for a time on the staff of the New Orleans *Times-Democrat.* She later established herself in New York, became one of the editors of the *Cosmopolitan Magazine,* and was known as a magazine writer. She was married to C. W. Wetmore in 1891, and lived much in England.

Her work, published under her maiden name, includes *A Flying Trip Around the World* (1892); *A Candle of Understanding* (1902); *At the Sign of the Hobby Horse* (1908); *The Case of John Smith* (1916). She edited *Life and Letters of Lafcadio Hearn,* 2 vols. (1907); and *Japanese Letters of Lafcadio Hearn* (1910).

WETTERHORN, vĕt'ĕr-hôrn (peak of tempests), peak, Switzerland, one of the most striking of the Bernese Alps; has three summits —the west, called Jungfrau, 13,653 feet high; the middle, known as the Mittelhorn, 12,163 feet; and the east, the Rosenhorn, 12,114 feet. These were ascended first in 1844 and frequently since, the ascent being made from Grindelwald. The contrast between the bright fresh pastures and the black precipices and dazzling snow ridges of the Wetterhorn is particularly striking, making the valley of the Reichenbach a favorite resort of artists.

WEWOKA, wē-wō'kȧ, city, Oklahoma, Seminole County seat, 60 miles east-southeast of Oklahoma City. Agricultural products include corn, wheat, and cotton. Manufactures are gasoline, carbon black, petroleum products, brick, tile, oil well supplies, chemicals, and mattresses. Lake Wewoka, about 3 miles long, is nearby. It is popular as a recreation spot.

Wewoka was settled in 1902, incorporated as a town in 1907, and as a city in 1925. Pop. (1950) 6,747.

WEXFORD, wĕks'fĕrd, county, Ireland, in the province of Leinster, bounded north by the county of Wicklow, east by St. George's Channel, south by the Atlantic, west by the counties of Waterford, Kilkenny, and Carlow. Its greatest length, north and south, is about 60 miles; greatest breadth, east and west, 34 miles; area about 907 square miles. Its capital is the borough of the same name. Occupations of the inhabitants include livestock raising, agriculture, fishing, and dairy farming. Industries are also tanning, woolen milling, brewing, bacon and ham curing, and iron founding. Mt. Leinster, the highest point in the county, rises to 2,610 feet. Pop. (1946) 91,855.

WEXFORD, seaport and municipal borough, Ireland, capital of the county of Wexford, situated on the west shore, and in the upper part of Wexford Harbour. It is 93 miles due south of Dublin. The town, which is on the river Slaney, is irregularly built and the streets are narrow. Its chief manufactures are agricultural machinery and implements. The fisheries also employ many persons. It is a market town and exports grain, cattle, poultry, and butter. There are two newspapers in the town, the *Wexford Free Press,* and the *Wexford People.*

The name, Wexford, is a corruption of the Danish *Weis-Fiord,* meaning West Haven. Wexford was one of the main harbors used by the Norsemen in the 10th century. It was here also that the Anglo-Norman chiefs made their first invasion of Ireland in the 12th century. Wexford has always been a rebellious town; it not only fiercely resisted Cromwell in the 17th century, but in the 18th century it staged a revolution so successful that it is remembered in popular ballads. Pop. (1946) 12,296.

WEYBURN, wā'bĕrn, city, Province of Saskatchewan, Canada, 65 miles southeast of Regina, on the Canadian Pacific and Canadian National railways. It is a distributing point for a fertile mixed farming area. A flour mill and a creamery are the chief local industries. The Saskatchewan provincial mental hospital is located there. The town, which was incorporated in 1913, has five churches, three public schools, a collegiate institute, a public library, a municipal general hospital, a weekly newspaper, three banks, and an airport. Pop. (1951) 7,148.

WEYDEN, vī'dĕn, **Rogier van der** (French Roger de La Pasture), Flemish painter: b. Tournay, 1399?; d. Brussels, June 16, 1464. In 1426 he was apprenticed to learn painting, in 1432 became master in the painters' guild of Tournay, and in 1436 was chosen town artist of Brussels. His four works illustrating justice, executed for the golden chamber of the Hotel de Ville, were destroyed by fire in 1695. In 1499 he journeyed to Italy where he worked at Ferrara for Leonella d'Este, and painted also for the Medici and the Sforzas. He was the founder of the Brabant school. Among his principal extant works are a triptych in the Belvidere of Vienna; a triptych, *The Last Judgment;* and *The Descent from the Cross.*

WEYGAND, vā-gäN', **Maxime,** French army officer: b. Brussels, 1867. He trained at St. Cyr in 1888. He was chief of Foch's general staff, 1914–1923, and reorganized the Polish Army to resist the Bolshevik attack in 1920. In

1923 he was French high commissioner in Syria; chief of the army general staff in 1930, and vice president of the Higher Council of War in 1931. He was general inspector of the French Army from 1931 to 1935. General Weygand was commander in chief of all Allied forces, succeeding General Gamelin, at the time of the French collapse in the summer of 1940. He remained in France with the Vichy government until early September when he was dispatched to Africa to deal with the colonial situation. In November 1942, he was arrested by the Germans and held as hostage for Gen. Henri Giraud who had escaped from a German prison and joined the Allies. On May 5, 1945, with several other prominent Frenchmen, he was liberated from his Itter Castle prison in Austria by American troops. The investigating committee of the French High Court of Justice acquitted him of the charge of collaboration with the Nazis on May 6, 1948. Two days before the official announcement the committee's Communist members resigned in a body, enraged at the forthcoming exoneration of a general whose brilliant strategy in the Russo-Polish War of 1920 stalled the Soviet plan for Poland's conquest for 20 years.

WEYLER Y NICOLAU, wĕ'ĕ-lĕr ē nē-kô-lä'ŏŏ, **Valeriano,** MARQUIS OF TENERIFE, Spanish general: b. Palma, Island of Majorca, Dec. 17, 1838; d. Oct. 20, 1930. He was governor of the Philippines, 1888, and corps commander at Barcelona, 1892. He succeeded Martinez Campos as captain general of Cuba 1896 where his severe measures caused much adverse comment. Recalled in 1897, he was several times minister of war in Spanish Cabinets, and was president of the supreme war council in 1910. As captain general of Catalonia he suppressed the riots following the execution of Francisco Ferrer (q.v.) in 1909.

WEYMAN, wā'măn, **Stanley John,** English novelist: b. Ludlow, Shropshire, Aug. 7, 1855; d. Wales, April 10, 1928. He was educated at Shrewsbury School and Christ Church, Oxford, studied law, and was called to the bar in 1881. For nine years he practiced on the Oxford circuit and then began a literary career in 1890 by publishing a romance entitled *The House of the Wolf.* It was succeeded by *The New Rector* (1891) and *The Story of Francis Cludde* (1891), but it was his brilliant story, *A Gentleman of France* (1893), that first brought him into prominence and on his historical novels his reputation rests. His later works include *My Lady Rotha* (1894); *The Red Cockade* (1895); *The Man in Black* (1896); *Shrewsbury* (1897); *Under the Red Robe* (1899); *The Castle Inn* (1899); *Sophia* (1900); *Count Hannibal* (1901); *In Kings' Byways* (1905); *Wild Geese* (1908); *The Great House* (1919); *Ovington's Bank* (1922); *Traveller in the Fur Cloak* (1925); *Queen's Folly* (1925); and *The Lively Peggy* (1928). His tales are well constructed, with plenty of incident and adventure.

WEYMOUTH, town, Massachusetts, in Norfolk County; altitude 42 feet; on Boston Harbor; 12 miles southeast of Boston; on the New York, New Haven and Hartford Railroad. Weymouth contains a half dozen villages, each one a compact industrial center with its own residential section and post office. It has factories for boots and shoes, shoe counters, paper boxes and paper tubes. The educational institutions are grammar and primary schools; private schools; Tufts Library, which contains about 47,000 volumes; the Fogg Library; and a high school at Weymouth Center. The first permanent settlement was made in 1623 by Capt. Robert Gorges, but the place had been visited often before this time, notably in 1622 by Thomas Weston. The place was first called by the Indian name Wessagusset, until it was incorporated Sept. 2, 1635, when the present name was adopted. It is the second oldest settlement in the state. Abigail Adams, wife of President John Adams, was born here. Pop. (1950) 32,690.

WEYMOUTH AND MELCOMBE-REGIS, contiguous towns which form the municipal borough, England, in Dorsetshire, on a beautiful semicircular bay, seven miles south-southwest of Dorchester. Melcombe-Regis is separated from Weymouth by the small river Wey. It is well built; has two parish churches; several other places of worship, a general and an eye infirmary, townhall, reading room, Victoria jubilee hall, and libraries. There is a considerable coasting trade and an active traffic, passenger and other, with the Channel Islands and France. There are shipbuilding, sail-making and rope-making establishments. Portland stone is exported from the neighboring isle of Portland (q.v.). Both Weymouth and Melcombe-Regis, particularly the latter, from the beauty of the bay and its smooth, firm sands, attract numerous visitors. There is a fine esplanade about one mile in length. Pop. (1951) 37,097.

WEYPRECHT, vī'prĕĸt, **Karl,** German polar explorer: b. König, Odenwald, Germany, Sept. 8, 1838; d. Michelstadt, Hesse, March 29, 1881. He joined the Austrian Navy as a cadet in 1856, received his commission as an officer in 1861, and was promoted in 1866 for distinguished conduct in naval action off the island of Lissa in the Adriatic. He voyaged to the Orient, to America, and surveyed the coast of Dalmatia for two years. He explored the Barents Sea with Julius von Payer, Austrian polar explorer and painter, on an expedition which reached the high latitude of 78° 48′ N., 41° E. In 1873, again accompanied by von Payer, he commanded the expedition which discovered Franz Josef Land, the archipelago east of Spitsbergen and north of Novaya Zemlya. The expedition spent the winter and part of the summer of 1874 exploring the islands, and returned in the fall to Novaya Zemlya. At a meeting of German naturalists held at Graz in 1875, Weyprecht suggested that concerted scientific work at selected stations, undertaken by all interested nations, replace isolated excursions. His proposal, after being debated at the International Meteorological Congress and at two international polar conferences held at Hamburg and Berne, was accepted, and ten nations agreed to cooperate. Eventually all countries participated, and 15 expeditions were sent out.

Weyprecht's published works included *Die Metamorphosen des Polareises, Astronomische und geodätische Bestimmungen der österreichisch-ungarischen arktischen Expedition, Praktische Anleitung zur Beobachtung der Polarlichter und der magnetischen Erscheinungen im hohen Breiten.* Von Paver's account of the

Franz Josef Land expedition, *New Lands within the Arctic Circle,* has been translated. Consult A. W. Greeley, *Three Years of Arctic Service* (New York 1886).

WEYR, vīr, **Rudolf,** Austrian sculptor: b. Vienna, 22 March 1847. A pupil of Bauer and Cesar at the Vienna Academy, he won the Reichel prize with his *Samson and Delilah* (1870) and in 1878 was commissioned to execute the decorations of the Grillparzer monument. His reliefs and experiments in polychrome sculpture won for him a considerable reputation. Besides numerous decorations for the university and museum buildings at Vienna, his works include the *Triumphal Procession of Bacchus and Ariadne* for the pediment of the Burgtheatre, and the great fountain before the imperial palace. D. 1914.

WHALE. Dolphins, porpoises, and whales all belong to the order Cetacea. The classification is as follows:

Order *Cetacea.* Cetaceans.
  Suborder *Mystacoceti.* All cetaceans with whalebone.
    Family *Balaenidae.* Right whales.
    Family *Neobalaenidae.* Pygmy whales.
    Family *Rachianectidae.* Gray whales.
  Suborder *Odontoceti.* All cetaceans with teeth.
    Family *Physeteridae.* Sperm whales.
    Family *Ziphiidae.* Bottlenose whales.
    Family *Delphinidae.* Porpoises or dolphins.
    Family *Phatanistidae.* River porpoises.

The Cetacea are not fish but true mammals. They give birth to their young, nourish them with milk, and have warm blood. There are many indisputable evidences to show that whales once lived upon the land and walked on four legs like ordinary quadrupeds, but now they have assumed a completely aquatic life. In consequence, their body structure has been radically changed. Some of these modifications are listed below.

Externally the body has become long and streamlined. The fore limbs have been overlaid with tissue and blubber to form a paddle and have no articulations except at the shoulder; all other joints of the fore limb are stiffened. These «flippers» are used only in turning and ascending to the surface; not in forward movement. The hind limbs have completely disappeared, externally, and exist only as rudimentary bones buried deep within the body, some specimens showing vestiges of the pelvis, femur, and tibia. (Andrews records a «sport» humpback whale in which one of the hind limbs projected like a club for nearly two feet.) The flat propeller-like tail is horizontal and thus all Cetacea may be readily distinguished from fish in which the tail is verticle. The tail, called the «flukes,» is the sole means of propulsion. In some species there is a special erect longitudinal fold of skin, the dorsal «fin.» The skin of the Cetacea is comparatively thick and, except in the porpoises, very soft. It has lost the temperature-regulating sweat glands but there is a thick layer of fat or blubber directly beneath the skin which acts as an insulating blanket to prevent the animal's bodily heat from being absorbed by the water. The body temperature of a whale has been given as 31.1°, 36.6°, and 36.9° C. which is a little lower than that of a horse (38.2° C.) and a sheep (40.2° C.). Hair has entirely disappeared except for a few scattered bristles on the top of the head and chin. In all Cetacea the neck is short and immovable. The water pressure has not only greatly flattened the skull but also modified the soft parts of the face. Most important, is the migration of the nasal opening to the top of the head. In the baleen whales this is double; in toothed whales, single. The reason for this shifting of position is to allow the nostrils to be first exposed when the animal rises to the surface. The instant the whale's head appears, a blast of air is exhaled through the nostrils. This has been under pressure in the lungs, is highly heated and saturated with water vapor. It condenses upon striking the colder outer air forming a column of spray called the «spout.» This has given rise to the still widespread belief that a whale spouts out water through its nostrils. Since a whale is merely a land mammal that has become adapted for an aquatic existence, if water were taken into its lungs it would die as would a horse or cow. When the whale is beneath the surface, the nostrils are tightly closed, and the animal «holds its breath.» The length of time whales can remain submerged varies with the species. Andrews records 20 minutes for humpbacks; 50 minutes for blue whale; finback 23 minutes. All these species can doubtless remain under much longer if necessary. A bottlenose is reported to have stayed below for over an hour. The toothed whales descend to greater depths for their food and can remain submerged longer than baleen whales. The olfactory organs are so reduced that the whale has no sense of smell. The external ears have disappeared, and the auditory openings situated a few feet behind the eyes are very minute; about the size of knitting needles. The eyes are comparatively small with no nictitating membranes or lachrymal apparatus. Thus a whale cannot shed tears. The lungs are very large, and the diaphragm in Cetacea extends farther forward ventrially and farther backward dorsally than in land mammals. Thus the buoyant air is not confined to the forward part of the animal but much of it is disposed more caudally. This contributes to the balancing effect. Whales are subjected to great pressure when they make deep dives, and the sperm whale is known to go deeper than any other species except the bottlenose. Kellog (1940) records that in April 1932, the cable repair ship *All America* hoisted to the surface a dead sperm whale, 45 feet long, from a depth of 3,240 feet off the coast of Colombia. The cable was twisted about the lower jaw of the animal and an additional 180 feet was wrapped around the body. At such a depth the whale was subjected to a pressure of approximately 1,400 pounds per square inch.

Since none of the toothed whales chew their food, the dentition has degenerated. There is no differentiation into incisors, canines, premolars, and molars as in land mammals. The dentition consists of simple peglike teeth ideally suited for grasping slippery fish which form the greater part of the diet of most odontocetes. In the large killer whale the teeth are of the same type but much more powerful and are not only used for grasping fish but in tearing the flesh of seals and other whales. In the white porpoise (*Delphinapterus*) the teeth are few and weak and all in the front part of the jaws. The narwhal of the Arctic has no teeth in the lower jaw, but, in the upper, two maxillary teeth have developed as tusks. In the female these usually

grow to a length of 8 or 10 inches but remain unerupted. The male, however, has a straight, spirally-twisted tusk, 7 or 8 feet in length. In the ziphioid whales the teeth usually are reduced to two and are of no use in feeding. In one group of whales (Mystacoceti) the teeth are replaced with the so-called «whalebone.» This is not bone, but a series of horny plates or laminae, an epidermal growth which in reality is merely an exaggeration of the transverse ridges present in the mouths of land mammals. They hang in two parallel rows from the upper jaw. The inner edges are frayed out into hair-like bristles which are useful in straining out the minute crustaceans upon which these whales live. The animal feeds by swimming with open mouth into large shoals of crustacea. The water passes into the front of the mouth and out at the sides between the baleen plates. The food is left on the whalebone bristles. The tongue, which is a great fibrous mass weighing a ton, squeezes out the water when the mouth is closed. In order that a whale may feed beneath the surface without getting water into the breathing passages, an elongation of the arytenoid cartilages and the epiglottis fits into the soft passage between the nostrils and the trachea, entirely shutting off the nasal passages from the mouth. In the baleen whales the throat is small; in the toothed whales, large. The sperm is the only species with a throat large enough to swallow a human being. No man, however, could possibly live in a whale's stomach as he would be immediately smothered. A whale's stomach is complex and unlike that of any other mammal. The first, and largest, compartment, appears to be a dilatation of the oesophagus. The second is the true digestive part which contains the gastric glands. Then follow from one to five more compartments corresponding to the pyloric portion of the ordinary mammalian stomach. The intestinal canal is extremely long and narrow. In the odontocetes there is no caecum; the mystacotes have a caecum. The liver is small, not much divided, and has no gall bladder. In the reproductive system there are many adaptations to life in the water. Chief among these is the incomplete descent of the testes. They descend to the body wall in some cases but never appear externally. The penis is conical and pointed and normally is entirely retracted within a preputial sheath. In a large blue whale the penis was 9 feet 6 inches in length. In the female the mammary gland teats are only three or four inches in length. They are concealed in slits on either side of the vulva but are protruded during nursing. By means of a special compressor muscle the milk is injected into the calf's mouth. The milk itself looks exactly like cow's milk.

The blue whale, or sulphurbottom, is not only the biggest animal existing today on the earth or in its waters, but so far as is known is the largest animal that has ever existed. It exceeds in size and weight even the greatest dinosaurs. The three largest blue whales recorded from South Georgia Island in the South Atlantic, according to C. A. Larson, were 103 feet, 108 feet, and 111 feet in length measured on a straight line. Undoubtedly the principal reason why whales grow to such enormous size is because their bodies are supported by the water in which they live. A bird is limited to the weight its wings can bear up in the air; a land mammal to what its legs can hold off the ground. The 111 foot blue whale must have weighed about 90 tons. In 1903 Dr. Frederic A. Lucas weighed in sections a blue whale taken at Newfoundland. The animal was 78 feet long and 35 feet around the shoulders. The total weight was 63 tons; flesh 40 tons; blubber 8 tons; blood, viscera and baleen 7 tons; bones 8 tons.

The size of the young at birth varies with the species and size of the mother. Andrews records a 25-foot foetus from an 80 foot blue whale. The baby weighed about 8 tons. Off the Japan coast a 32-foot sperm whale contained a foetus 14 feet 8 inches long. In Alaska a 65-foot finback gave birth to a 22 foot baby as she was being hauled out of the water. The great size of the calves is due, of course, to the fact that whales live in a supporting medium. It is impossible to determine how long whales live. By examining the ovaries and counting the scars on the outer surface, or more precisely the number of *corpora lutea,* an idea of the age of the females can be obtained. A. H. Laurie, of the *Discovery* expeditions to the South Atlantic, concludes that the blue whales there breed at the rate of once every two years at best; the oldest females were 30 years of age; the young nurse for 6 to 7 months. The blue whales were physically mature at from 10 to 11 years; fin whales, at 6 to 8 years.

A short diagnosis of the principal species of whales follows.

Humpbacks (*Megaptera nodosa*).—The humpback is in many respects the most remarkable of all whales. It reaches a length of about 55 feet. The anterior part of the body is very massive, but the posterior quite slender and at the same time so irregularly shaped and so awkwardly joined to the thorax that the animal appears misshapen. This effect is heightened by the dorsal fin, which is low and thick. Not less striking are the immense crenate-margined pectoral fins, like the wings of a bird, and about one third as long as the body. The broad abdominal ridges nearest the median line join below the throat, forming a chinlike protuberance. Humpbacks are infested by large barnacles of the genus *Coronula,* which fasten on the head, fins, flukes, and abdominal ridges. Where they settle on the black skin but are afterward rubbed off, or otherwise got rid of, they leave behind distinct white marks, in the form of disks, circles, crescents, etc., which add to the singular appearance of these whales. Fastened to the large barnacles, are often bunches of stalked barnacles, genus *Otion,* which hang down like fringes on the fins. Humpbacks occur in all seas, from the Arctic to the Antarctic. They are very irregular in their movements and indulge in all manner of uncouth actions. When they dive or sound they throw the flukes out of the water. Like other cetaceans they engage in seasonal migrations northward and southward. They feed chiefly on a small shrimp.

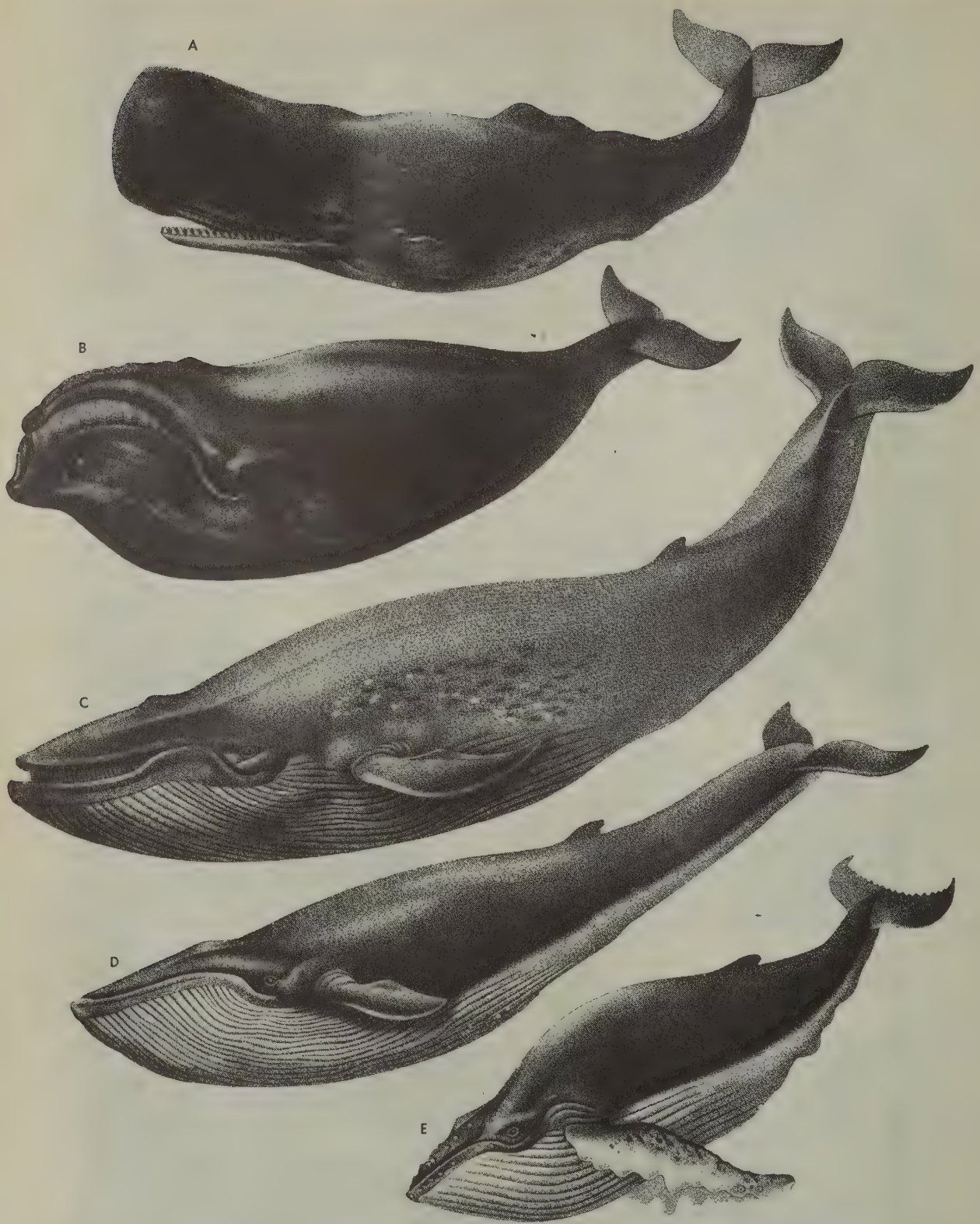
Blue Whale, or Sulphurbottom (*Balaenoptera musculus*).—The blue whale has a massive head and broad snout, and the body tapers gradually to the flukes. The dorsal fin is falcate and less than a foot long, and is situated at a point a little more than three-fourths the distance from the top of the snout to the notch of the flukes. The pectoral fins are falcate and about seven and one-half feet long, from the axilla. In color the blue whale is gray, nearly

WHALE

D. Richard Statile

Top: Tons of whale are on the other end of this towline from the "killer" boat. *Center left:* Helicopters are being used to spot whales. *Center right:* This whale carcass is being hauled up the ramp on the "factory" ship to be dismembered. Inside the open mouth, a curious interior structure is visible. The hair-like bristles, or baleen, serve to "strain" the crustacean food the whale obtains by swimming with its mouth open. *Bottom:* A blue whale is cut up; about an hour after it comes aboard, the whole animal has gone down, piecemeal, to the boilers where the oil is taken out of the blubber.

WHALE



Important oil whales: A, the sperm whale yields an average of 90 barrels of oil for industrial uses. Males grow up to 70 feet in length. B, the right whale is now protected by restrictions on whaling. The whale got its peculiar name because it was just "right" for the whalers, easy to kill and full of oil. C, the blue whale is one of the largest living creatures. Some reach 100 feet in length, and yield as much as 150 barrels of oil. D, finback whales grow to an average length of 65 feet, and yield something like 70 barrels. It's the most plentiful remaining species. E, the humpback whale, is the most playful of all. It may run to 55 feet and yield up to 60 barrels of oil. Only 1,250 may be killed each year.

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uniform on the head, but mottled on the back and sides. On the belly are numerous white spots. The pectoral fins are gray above and white below, the flukes gray on both sides and the dorsal fin also gray, sometimes with a whitish center. The abdominal ridges number 62 to 88. The whalebone is about three feet long, broad at the base and black in color, both plates and bristles. These huge whales feed exclusively on small crustaceans, the species in the North Atlantic being the thysanopod *Euphausia inermis*.

Common Finback (*Balaenoptera physalus*).—This is the most commonly observed and best known of the finbacks. In size it ranks next to the blue whale. The form is exceedingly attenuated. Adult individuals reach an average length of 65 feet. The head is narrow anteriorly. The dorsal fin exceeds a foot in height. The pectoral fins are small, somewhat triangular, and about five feet long, from the axilla. This whale is gray on the back and upper surfaces of the pectoral fins and flukes and white on the belly and the under surfaces of the pectoral fins and flukes. The whalebone as a whole is gray, striped longitudinally with white, but at the anterior end of the jaw on the right side the whalebone is all white. The outside of the right lower jaw is also white. These parts are dark on the left side. This singular asymmetry of coloration is peculiar to, and characteristic of, the species. The common finback feeds on various kinds of small fish and *Euphausia*.

The large whales which strand on the east coast of the United States are almost invariably of this species. When swimming or rising to spout, this whale, like the blue whale, shows the top of the head and back and the dorsal fin, but nothing beyond. The flukes are not thrown out of the water when it dives or sounds.

Little Piked Whale, or Lesser Finner (*Balaenoptera acuto-rostrata*).—This is the smallest of the finbacks and is not sought for by whalers. The form is thickset like that of a porpoise and the head pointed. When adult, it is about 25 feet long, and the maximum length is about 28 feet. The dorsal fin is larger than in any of the other finbacks and is situated farther forward, or at a point only about two-thirds the distance from the tip of the snout to the notch of the flukes. It is very dark gray or blackish on the back and sides and white on the belly, a little clouded with gray. The pectoral fins are blackish above, with a broad crossband of white near the middle; below they are white. The flukes are blackish above and whitish below. In this species the abdominal ridges are very numerous and narrow. The whalebone is very short and entirely white. The little piked whale feeds upon fish.

California Gray Whale, Grayback or Devilfish (*Rhachianectes glaucus*).—This remarkable whale is found only in the North Pacific. When full grown it has a length of about 50 feet. It is a restless and sagacious animal, and when wounded frequently attacks the boats sent out for its capture. In earlier days it was found abundantly in the winter months in the lagoons and bays of Lower California whither it repaired to breed. It is fond of playing in the surf and approaches close inshore to indulge in this recreation without fear of stranding. The gray whale is found as far northward as Bering Sea and occurs also on the coast of Korea, but has no counterpart in other seas.

Greenland Right Whale, Arctic Right Whale, or Bowhead (*Balaena mysticetus*).—This Arctic right whale, or bowhead, as it is called by American whalers, is most remarkable in appearance. The snout is narrow and arched like a bow. From the roof of the mouth depends the extraordinary, narrow black whalebone, which may be 12 feet long or even longer. This whalebone is enclosed and protected by the immense oblong lower lip, the curved upper edges of which fit against the side of the upper jaw when the mouth is shut. The back is without a fin, while the pectorals are short and broad. There are no ridges or furrows on the belly. Adults reach a length of about 60 feet. The bowhead rarely or never leaves the Arctic ice, but like other whales it migrates northward and southward with the changes of the seasons. On the east coast of America it is never seen as far south as the southern extremity of Greenland, though there is a tradition that at the time of the discovery of the country it ranged as far south as the Strait of Belle Isle in winter. It occurs in the Arctic Ocean north of Alaska and ranges southward into Bering Sea. Individuals are believed to pass back and forth through the channels between the islands north of the continent from the eastern to western side. The bowhead feeds chiefly on small pteropod mollusks and crustaceans which occur in vast multitudes in the Arctic Ocean.

Atlantic Right Whale (*Balaena glacialis*).—This whale resembles the bowhead in general appearance, but the head is smaller and less arched, and the whalebone shorter, or only about seven feet long. Near the end of the snout is a low rounded protuberance, called the «bonnet» by whalers. This bonnet is covered with barnacles, which are not found adhering to the bowhead. It is usually entirely black, but some individuals have been reported as whitish or grayish on the throat and breast. When full-grown it reaches a length of about 55 feet. Like the bowhead it feeds upon crustaceans and pteropod mollusks. There is every reason to believe that this whale was the object of pursuit of the earliest whale fishers among the Basques in the Bay of Biscay in the Middle Ages. It was the species on which the American colonial shore whale-fishery was based. The Atlantic right whale, like the bowhead, feeds upon pteropod mollusks and crustaceans.

Pygmy Right Whale of New Zealand (*Neobalaena marginata*).—This is a remarkable little whale, resembling the large right whales, but reaching a length of only about 20 feet. It has a small dorsal fin, but no abdominal ridges or furrows. The whalebone is long and white. In color the whale is black, with a line of white along the belly. It has many osteological peculiarities, among which one of the most striking is the flatness and breadth of the ribs, of which there are 17 pairs. The lumbar vertebrae are only two in number. Little is known of the habits of this whale.

Sperm Whale (*Physeter macrocephalus*).—This whale belongs to the Odontoceti, or toothed whales. But one species of sperm whale is known. When full-grown the male reaches a length of 60 to 70 feet, but the female is much smaller. The head is of immense size, and is shaped like an elongated wedge with the base uppermost, and the edges and free end rounded. The blowhole is single and situated at the end

of the snout on the left side. The lower jaw is very narrow and much shorter than the upper, and the two sides are joined together anteriorly for about one-half the length. In it are implanted about 44 large conical teeth which fit into pits in the upper jaw when the mouth is closed. There are no teeth in the upper jaw. The back is without a fin, but is raised into a number of low irregular humps posteriorly. The pectoral fins are broad and about six feet long. In color the sperm whale is blackish above and somewhat mottled with gray below. It occurs in all seas except the Arctic and Antarctic, but is essentially an animal of the tropics. The herds or schools are diversified in character, some comprising only young bulls; others, females and young led by an old bull. At times old bulls are encountered wandering singly or in small groups. These old males are ill-tempered and pugnacious, and do not hesitate to attack the boats of the whalers. The sperm whale feeds upon large cuttlefish, which its great strength and powerful under-teeth are supposed to enable it to dislodge from their rocky retreats at the bottom of the sea.

Bottlenosed Whales, or Beaked Whales (family *Ziphiidae*).—This family comprises four or five genera of small whales, none of them exceeding about 30 feet in length. Several species of each genus have been described. Like the sperm whale, they belong to the suborder Odontoceti, or the toothed whales. They never have, however, more than four teeth regularly implanted in the jaws, but some species have numerous minute, rudimentary teeth imbedded in the lips. The head of all the forms, at least in the young, is pointed, the dorsal fin low and placed far back toward the flukes, the pectoral fins narrow and of moderate length. In the bottlenose whale of the North Atlantic (*Hyperoödon rostratum*) the forehead gradually increases in size with age, until it is sharply marked off from the narrow beak, like the shoulder of a bottle. The species congregates in large herds and is eagerly sought by whalers for its oil. The beaked whales of the remaining genera *Mesoplodon, Berardius,* and *Ziphius,* are far less abundant. They travel in pairs. *Hyperoödon* is peculiar to the North Atlantic; *Berardius* occurs only in Bering Sea and about New Zealand and Japan, while *Mesoplodon* and *Ziphius* appear to be cosmopolitan genera. The beaked whales subsist upon cuttlefish.

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WHALE-BIRD. See FULMAR.

WHALE-HEAD, a stork. See BALAENICEPS.

WHALE-LOUSE, any of various small crustaceans parasitic on whales. (See FISH-LICE). These crustaceans have a rudimentary abdomen, and have the limbs of the first joint of the thorax or chest inserted beneath the throat. The body is flattened and of oval shape and the legs are all prehensile. They burrow deeply into the skin of their hosts.

WHALE OIL. Oil obtained from a whale's blubber by trying out. (See WHALE). It is light yellow to dark brown. The variety known as sperm oil comes from the head of the sperm whale. The use of whale oil appears to be of ancient origin. It was doubtless first obtained from whales accidentally stranded on the shores, a more frequent occurrence during the early abundance of the cetaceans than at present, when their numbers have been so greatly reduced by excessive fisheries. As the demand for the oil increased beyond the supply available from stranded whales, individuals sighted from the shore were attacked and beached. Owing to the frailty of the boats and equipment, this was a more daring attempt than might be supposed. Just prior to the Revolutionary War there were 183 American vessels in the right whale fishery of the North Atlantic waters and 125 were engaged in cruising for sperm whales from Newfoundland to the coast of Brazil. The Revolutionary War and the War of 1812 interfered with the fisheries; but during the period of peace following 1815 they increased greatly in extent until 1846, when the fleet numbered 678 ships and barks, 35 brigs and 22 schooners, a total of 735 vessels, with an aggregate tonnage of 233,189 tons and a value of $21,075,000, exclusive of outfits and supplies. The entire capital invested in the fishery and its associated industries at that time approximated $40,000,000 and 40,000 persons derived from it their chief support. During the same year the whaling fleet of all Europe numbered but 230 vessels. Large whales have been known to yield 250 barrels of 32 gallons, but probably an average for a large whale was 75 barrels and down to 12 barrels for a small bottlenose whale. The crude value of the American catch from 1840 to 1860 averaged about $8,000,000 annually. The greatest value was in 1854, when 2,315,924 gallons of sperm oil worth $1.48¾ per gallon, 10,074,866 gallons of whale oil worth 59⅝ cents per gallon and 3,445,200 pounds of whalebone worth 39⅕ cents per pound were secured, the total value being $10,802,594. In the preceding year, 1853, the total product was 3,246,925 gallons of sperm oil, 8,193,591 gallons of whale oil and 5,652,300 pounds of whalebone, the whole valued at $10,766,521. Sperm oil and whale oil then served nearly all the diversified uses for which oil was required, the chief exception being leather-dressing, for which neatsfoot and cod oils were largely employed. The principal uses were as illuminant, lubricator, in cordage manufacture, screw-cutting and steel-tempering. The streets of the principal cities were lighted with the oil and theaters and public buildings were lighted with gas made from the oil settlings.

In 1902 the whaling fleet of the United States consisted of eight steamers, 18 barques and brigs and 12 schooners, aggregating 8,366 tons. Of these, 11 barques and 10 schooners were sperm whale fishing in the Atlantic Ocean, eight steamers in the Arctic, six barques in Okhotsk Sea and off the coast of Japan, two schooners in Hudson Bay and one brig at Desolation Island. The total whale oil product of the world in 1902 approximated 3,000,000 gallons, of which 750,000 gallons were produced by the United States fisheries, 900,000 by those of Norway and the remainder by Scotland, Russia, Japan, Newfoundland, etc. Since that date the product has steadily reduced.

WHALEBACK STEAMSHIP. See STEAM VESSELS.

WHALEBONE. See WHALING.

WHALING, or the pursuit of whales as an industry, existed in the North Atlantic Ocean at

a remote period. There are obscure references to it in Norwegian and English history as early as the beginning of the 10th century. In the 11th century the Basques pursued the North Atlantic right whale, or black whale (*Balaena glacialis*), with harpoons, in open boats. It is even asserted that they crossed the Atlantic in pursuit of their quarry before the time of Columbus, but this has not been substantiated. Certain it is that they visited Newfoundland immediately after the discovery of America and captured the same species of right whale in those waters. They are supposed also to have first seen the Arctic right whale, or bowhead (*Balaena mysticetus*), in the Strait of Belle Isle. In 1607 Henry Hudson encountered the bowhead in the vicinity of Spitzbergen. The Spitzbergen fishery developed rapidly on account of the large amount of oil yielded by this species and was extensively engaged in by various European nations, especially the Dutch, who in 1680 employed 260 vessels and about 14,000 men in the industry. During the decade beginning 1679, the Dutch took an average of about 1,000 whales annually. As the bowheads decreased about Spitzbergen, they were sought for to the westward, and in 1719 a Dutch vessel first entered Davis Strait. This fishery was developed chiefly by the British, Danes and Americans; in 1789 there were 255 British vessels engaged in it. The first American vessel visited Davis Strait in 1732. The number increased rapidly, and at the height of the fishery, just before the Revolutionary War, Massachusetts alone sent 183 vessels to the strait.

About 1670, the American colonists succeeded in establishing a boat shore-fishery for the Atlantic right whale, which in those days was abundant on the coast, especially off Long Island and in Delaware Bay, and was well known from a much earlier date through stranded individuals. Later the colonists pursued the whales in sailing vessels farther from shore and in the Gulf of Saint Lawrence, but finally turned their attention to the Arctic right whale, or bowhead, in Davis Strait, as already mentioned.

About 1712 the first sperm whale was captured at sea by a Nantucket whaler. This fishery rapidly rose in importance and was pursued in all the oceans of the globe, especially by the Americans. The British did not apply themselves to it until 1775, but in 1790 a British whaling vessel rounded Cape Horn and opened up the Pacific fishery, which immediately grew to enormous proportions, and was at its height in 1837. The American whaling fleet in 1839 comprised 555 vessels, of which the majority were engaged in the Pacific sperm whale fishery. In 1847 the number rose to 594, while the foreign whaling fleet numbered 230 vessels. The size of the American fleet reached its maximum in 1846, when 729 vessels were employed.

While a large part of the American fleet was engaged in the pursuit of the sperm whale, the remaining vessels were chiefly employed in hunting right whales, especially in the North Pacific. As the sperm whale fishery declined, this branch increased in importance. In 1835 the famous Kadiak ground was discovered. A new epoch opened in 1843 when bowhead whales were first taken off the Kamchatka Coast. In 1848 the first vessel passed through Bering Strait to pursue these large whales in the Arctic Ocean. The fishery in the North Pacific and adjoining Arctic was at its height in 1852, when 278 vessels were employed. In 1866 the first American steam whaling vessel was brought into use, and in 1880 two steamers were added to the Pacific-Arctic fleet.

The introduction of mineral oils for illuminating and other purposes and the decrease in the abundance of whales gradually broke down the fishery for right and sperm whales and at the present time the number of vessels engaged in the industry is negligible. A few sailing vessels still pursue the sperm whale, but in 1902 only five British vessels (steamers from Dundee, Scotland) entered Davis Strait in pursuit of the bowhead. The American whaling fleet in 1902 comprised 38 vessels, including eight steamers engaged in the Pacific-Arctic bowhead fishery. Of the remaining 30 sailing vessels, 21 engaged in sperm whaling in the Atlantic; six visited Okhotsk Sea and the coast of Japan, two entered Hudson Bay and one remained about Desolation Island. In recent years about 250 whalers operate in Antarctic waters. The annual catch is about 30,000 whales.

The humpback whale was always pursued to some extent by right whale whalers, but the finbacks and sulphurbottoms, besides furnishing a relatively small amount of oil, were too swift to be attacked successfully with hand harpoons. About 1865, Svend Foyn, a Norwegian fisherman, invented a method of shooting them with a combined harpoon and bomb fired from a swivel gun mounted at the bow of a small steamer and for 30 years large numbers of sulphurbottoms, finbacks, and humpbacks were killed annually at stations established on the coast of Finmark. Later the same method was employed at Iceland, the Faröe and Shetland Islands and also about Japan. In 1898 this mode of whaling was introduced into Newfoundland, where a number of sulphurbottoms, common finbacks and humpbacks are still killed annually.

A considerable number of common finbacks and humpbacks have been killed in Massachusetts Bay and the Gulf of Maine by means of explosive bombs attached to a special form of hand harpoon, called a «darting gun.» A boat-fishery of limited extent has been in existence for many years on the coast of California. It has for its object the capture of the California gray whale, and the humpback, which are killed by harpoons fired from a swivel gun mounted at the bow of a whale boat. Similar boat fisheries exist on the coast of New Zealand, in the West Indies and in other parts of the world.

Pelagic whalers capable of processing animals at sea have become extremely efficient, not only in treating the whales taken, but also in capturing them. The catch of the large blue whale (*Balaenoptera musculus*) has been estimated to reach 12,000 a year. Fear has consequently been expressed that many species face extermination, especially as the great mammals are not prolific. The females give birth usually to only one offspring once every two years or so. The government of the Falkland Islands has accordingly for some time prohibited the capture of right whales, restricted the taking of humpback whales to owners of permits, and has prohibited the killing of cow whales and of calves altogether.

WHALLEY, hwŏl'ĭ, **Edward,** English regicide: b. England, about 1616; d. Hadley, Mass., about 1675. He was in trade, probably that of woolen-draper, at the outbreak of the

Civil War, when he enlisted for Parliament. In 1643 he became a major in Cromwell's regiment. After Charles I was seized, Whalley was ordered to take charge of the king and in that post displayed much tact. On the Restoration he did not obey the summons of surrender of the king's judges and was therefore excluded from the indemnity. He sailed with William Goffe (q.v.) for New England, and resided for a time in Cambridge. When the act of indemnity reached Boston in November and the town council met (February 1661) to consult regarding the refugees, he went with Goffe to New Haven. He was associated with Goffe in the subsequent wanderings and concealments which have lent such interest to their history.

WHARTON, Anne Hollingsworth, American author: b. Southampton Furnace, Pa., Dec. 15, 1845; d. Philadelphia, Pa., July 29, 1928. She wrote mainly upon colonial themes and among her books are: *The Wharton Family* (1880); *Through Colonial Doorways* (1893); *Colonial Days and Dames* (1894); *A Last Century Maid* (1895); *Martha Washington: A Biography* (1897); *Heirlooms in Miniature* (1897); *Salons Colonial and Republican* (1900); *Social Life in the Early Republic* (1902); *An English Honeymoon* (1908); *In Chateau Land* (1911); *English Ancestral Homes of Noted Americans* (1915); *In Old Pennsylvania Towns* (1920).

WHARTON, Edith Newbold (nee **Jones),** American novelist: b. New York City, Jan. 24, 1862; d. Saint-Brice-sous-Forêt, France, Aug. 11, 1937. She was a descendant of wealthy, socially prominent New York families and was privately educated. After making a formal debut, in 1885 she married Edward Wharton of Boston. During the remainder of her life she lived in the United States and France, maintaining residences in both countries.

Mrs. Wharton began writing as a therapeutic measure and as a means of occupying her free time, when her husband was suffering from a mental illness. In the 1890's she published her first short stories in *Scribner's* magazine and for over 30 years was classed among the better popular American writers. In 1924, she was the first woman ever to receive an honorary degree from Yale University. Many details of her career can be found in her autobiography, *A Backward Glance* (1934). She continued writing until her death, and an unfinished novel, *The Buccaneers,* was published posthumously in 1938.

Much of her writing was concerned with the closed, wealthy New York society which she had known as a child. Her first very successful novel, *The House of Mirth* (1905), was the story of a young woman without money who tried to maintain her status in the high social group to which she was born. The setting of her most famous story, *Ethan Frome* (1911), was the region around Lenox, Mass., where Mrs. Wharton often spent her summers. The unhappy love affair of Mattie Silver and Ethan Frome was soon recognized as an American classic. Her most successful use of the New York scene was in *The Age of Innocence* (1920) which was given the Pulitzer Prize in 1921. The characters of Newland Archer and Ellen Olenska expressed the unbreakable moral code which ruled Victorian society

The drama in the narratives, especially in the endings, is evidenced by the fact that three of the novels have been adapted for the stage with great success: *The Age of Innocence, Ethan Frome,* and *The Old Maid* (winner of the Pulitzer Prize for drama in 1935). Mrs. Wharton had a rich, colorful style, frequently satiric, and full of humor. Her friendships with the American author, Henry James, and Paul Bourget, the French novelist, had a great effect upon her work, as she frequently discussed it and read parts aloud to these friends before publication. With more than 35 volumes of work to her credit, some of the best remembered are: *The Valley of Decision* (1902); *The Reef* (1912); *Summer* (1917); *The Marne* (1918); *A Son at the Front* (1923); *The Children* (1928); *Hudson River Bracketed* (1929); and *Ghosts* (short stories, 1937). See also Age of Innocence; American Literature; Novel—*Modern* (American).

WHARTON, Francis, American jurist: b. Philadelphia, Pa., March 7, 1820; d. Washington, D.C., Feb. 21, 1889. He was graduated at Yale in 1839, studied law, and was admitted to the bar in 1843. He was professor of logic and rhetoric in Kenyon College, Ohio, 1856–1863; in 1863 took orders in the Episcopal Church and became rector of Saint Paul's, Brookline, Mass. In 1866 he became a professor in the Episcopal Divinity School at Cambridge, Mass., and also held the chair of international law in the Boston Law School. In 1885 he was appointed counsel for the State Department at Washington and under a resolution of Congress (1888). His best known work is a *Treatise on the Criminal Law of the United States* (1846), which is accepted as a standard and has passed through many editions. He edited *A Digest of the International Law of the United States,* 3 vols., in 1886.

WHARTON, Philip, Duke of, English politician: b. December 1698; d. Tarragona, Spain, May 31, 1731. At 16 he married clandestinely and in 1716 traveled on the Continent and visited the Pretender at Avignon. That prince, gratified by his attentions, gave him the title of Duke of Northumberland. About the end of 1716 he returned to England and thence to Ireland, where he possessed a peerage, and was allowed, although not yet 19, to take his seat in the Irish House of Peers. He obtained a British dukedom in 1718 and on attaining his majority made his appearance in the English Parliament, where he distinguished himself as the defender of Bishop Atterbury.

WHARTON, Thomas, American journalist: b. Philadelphia, Pa., Aug. 1, 1859; d. there, April 6, 1896. He was graduated from the University of Pennsylvania in 1879 and joined the editorial staff of the Philadelphia *Times* in 1888. His short story *Bobbo* enjoyed wide popularity and was dramatized and successfully played in England.

WHARTON, N.J. (formerly Port Oram), borough in Morris County; on the Rockaway River; 23m. W. of Paterson; on the Delaware, Lackawanna and Western, and Central of New Jersey (the Wharton and Northern) railroads. The borough is located in an old iron-mining

region. Manufactures include silks, paper and gunpowder. Near by is Lake Hopatcong, a popular summer resort. Pop. (1940) 3,854; (1950) 3,862.

WHARVES AND WHARF CONSTRUCTION. Definitions.—The words wharf, pier, quay, jetty, and dock frequently are used indiscriminately. Authorities generally agree that wharf is a general term for a structure at the water's edge in a port or harbor, which serves to secure a ship, vessel, or boat in place while it is receiving or discharging passengers, cargo, or both. A pier is a wharf which projects more or less perpendicularly from the shore line permitting vessels to be berthed or secured on either side; while a quay is a wharf constructed along the shore line offering only one side for the berthing of vessels. Jetty is an alternate word for pier which is used in England, but in the United States the word jetty is applied to a structure which may have the same form as a pier, but serves the purpose of protecting a harbor entrance or other shore line feature from erosion, deposition, or storm waves rather than providing a landing space for vessels. Dock properly connotes an enclosed body of water. A wet dock usually is equipped with gates or locks through which vessels may enter or leave and while within are protected from tidal fluctuations. A dry dock is also equipped with gates and may be pumped dry for the purpose of accomplishing repairs to vessels therein.

Historical.—There is evidence of harbors having been constructed in the Mediterranean Sea as early as 3500 B.C. Among the earliest navigators were the Cretans and the island of Crete contained a harbor at Mesara prior to 3000 B.C. The large port of Pharos was built by the Cretans shortly after 2000 B.C. The remains of a great breakwater can be traced at the latter port and there are rough stone blocks which appear to have formed a quay nearly 50 feet wide. The Phoenicians were engaged in sea trade prior to 1250 B.C. and their earliest harbor was at Saida, although no physical traces remain. At Tyre, however, there are remains of breakwaters and quays constructed of hewn stone joined together with iron dowels. Remains of a similar nature have been found at Carthage. Alexander the Great founded the port of Alexandria and a part of it consisted of Pharos, originally an island, which was joined to the mainland by a causeway. The ancient Greeks built a number of harbors. The structures involved were generally of stone masonry joined together with iron rods and clamps which in turn were secured with melted lead. Foundations below water were built by dumping broken stone into the water forming mounds upon which the structures projecting above water were built. The Romans were the first to unwater a site on an extensive scale for the construction of harbor works. They also employed driven piles to support masonry walls. Unwatering was accomplished by use of piles, planks, and timbers chained together in the form of double walls, between which a filling of clay and weeds was rammed to form a temporary watertight structure surrounding the area which was to contain the permanent work. The water from the area was pumped out by the means then available, such as water wheels. The foundations for the permanent work were then leveled or excavated to firm foundations, or piles were driven. The whole procedure was like modern cofferdam construction methods and differences were mainly in materials and equipment then available. The Romans also used a hydraulic cement which possessed strength and durability comparable to modern portland cement. A common form of Roman construction employed for piers and quays was of masonry with about one half the length of the structure carried to foundation levels at sea bottom with circular arch spans between the foundation sections, much like a stone arch bridge of short multiple spans. In some cases, a pier would consist of two such structures built parallel joined by an arch deck in the transverse direction, and with spans staggered to reduce wave action. Many of these ancient structures were monumental in character beyond anything which has been built since. After the Romans, practically no harbor construction was done until the 18th century. Among the early works of this latter period, which started the modern era, were docks near Dunkerque, the then most important port in France. Walls for the locks forming the entrance to the docks and quay walls were founded on timber piles driven into the natural sand. Timber beams were fastened to the pile heads and floored over with wooden planks. Walls were built on these floors with stone and mortar and iron dowels.

Basic Requirements and General Forms of Construction.—A wharf must provide a place in a harbor or port to which a vessel may be brought and secured in ample depths of water and safe against breaking adrift due to storms and waves; and at which place passengers and cargo may be received or discharged from or to a firm floor contiguous to and at a height convenient to the decks or openings to the hold of the vessel. The floor must permit the handling and temporary storage of cargo and the transfer of passengers and cargo from and to any one of the several forms of land transportation. For modern vessels, the edge of the wharf floor or deck must be vertically above or slightly overhang the full depth of water required by the vessels and the length of the wharf must be approximately equal to the length of the vessel, to provide safe mooring facilities. The width of the wharf will be governed by the handling and storage requirements of the cargo, the character and number of land transportation means provided, and the space available at the site. Water depths will vary from about 10 feet for inland waterway vessels to 45 feet for ocean-going types. Wharf lengths may exceed 1,500 feet and provide space for several vessels. Widths of piers generally must increase with length and a width of 150 feet for a pier 1,000 feet long is nearly a practical minimum. The width of quays, since they abut the shore along their long side, is usually less critical.

Wharves, in common with most modern engineering structures, vary widely in design in order to best fit natural and other conditions prevailing at the site, to best utilize the materials available for construction, and to accomplish these things at somewhere near the minimum cost. Quays, which are less common than piers, are chosen where there is ample shore line space, an unusual condition in most modern ports. Piers, on the other hand, require ample width of waterway to permit maneuvering of vessels into berths. Seaports near the mouths of rivers are sometimes limited in the use of piers by lack of width in the rivers. In a few places in the world having rock

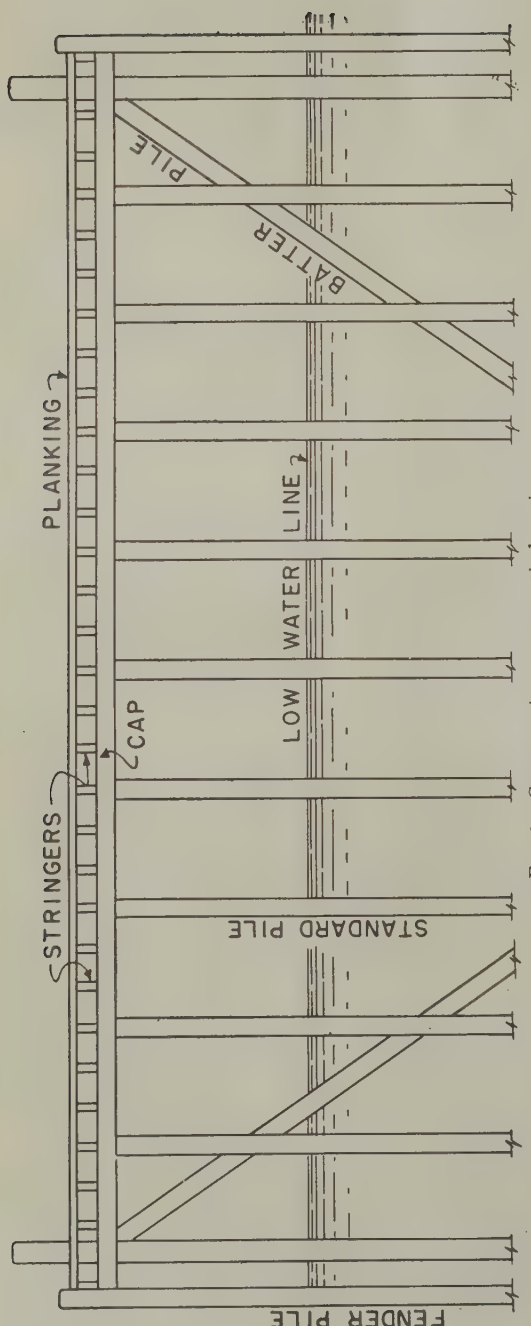


FIG. 1. Cross section, common timber pier.

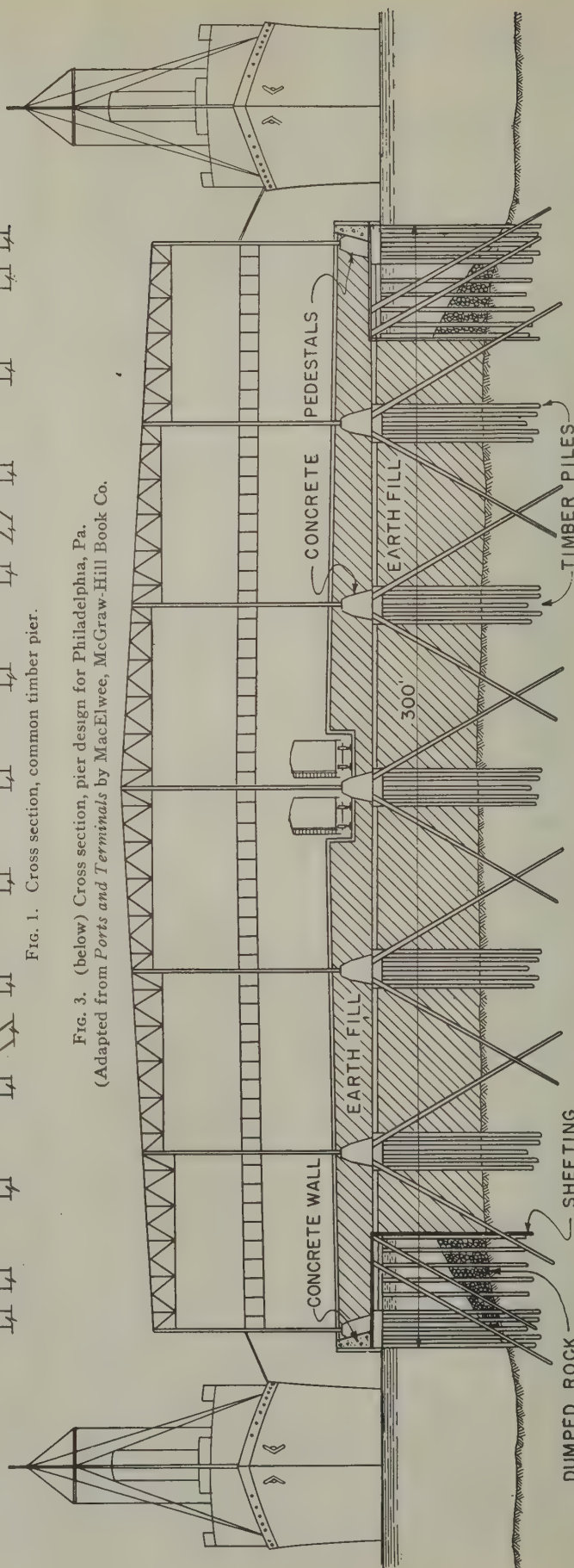


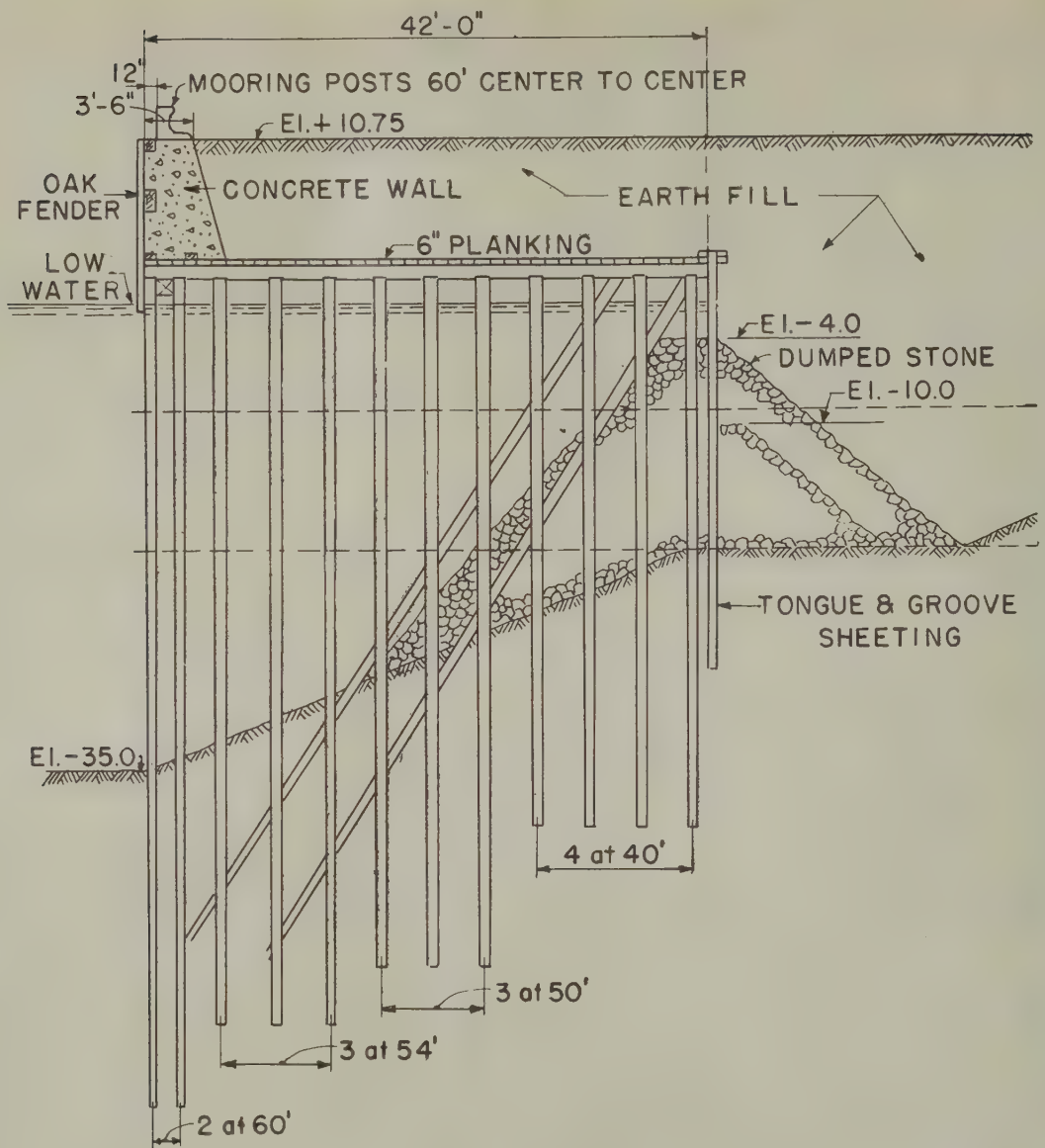
FIG. 3. (below) Cross section, pier design for Philadelphia, Pa.
(Adapted from *Ports and Terminals* by MacElwee, McGraw-Hill Book Co.

shore lines, wharves have been created by excavating the rock to form vertical rock faces and horizontal rock floors. A much more common practice is to excavate the required depths in earth shore lines, and to form the vertical faces by means of walls of stone masonry, mass concrete, reinforced concrete, or pile bulkheads of wood or steel; and to form the horizontal surfaces by earth filling behind the walls topped by pavements of various materials. (Fig. 4.) Possibly the most common type of construction is a variation of this wherein, for reasons of economy, the vertical walls are dispensed with in whole or in part and mounds of stone or other available natural granular material are substituted therefor. The stone assumes a natural angle of repose of something less than 45° from the horizontal and, in order to provide the vertical aspect between the edge of the wharf deck and the full depth of the water, a pile structure is built over the rock slope which provides a floor or deck at the required height, and which adjoins the leveled earth back of the rock mounds. (Figs. 2 and 3.) These general descriptions apply to either quays or piers, the only difference being that a quay is a one-sided structure whereas a pier has two similar sides. In addition, many piers have been built taking little advantage of the natural site except the depth of water which is often augmented by dredging. (Fig. 1.) The entire structure is built up from the bottom usually on piles of timber, concrete, or steel, and sometimes on massive concrete structures carried down to firm foundation materials by any one of several subaqueous construction methods.

Design.—The design of wharves involves methods which are common to many civil engineering structures. Where walls are used, they are designed basically as ordinary retaining walls and, in the case of mass concrete walls, will often have base widths somewhere near one half the heights of the walls. Reinforced concrete walls of cellular or inverted T shape are likely to have bases somewhat wider than the above stated proportion. The exact proportions are, of course, dependent upon the nature of the foundation and backfill materials and upon the water levels both in front of the walls and within the backfill behind the walls. The latter material often is drained either by use of granular self-draining material, like sand and gravel, placed adjacent to the wall, or by the use of perforated drain pipes. One feature of many wharf wall designs which deserves especial attention is the tendency for the wall to slide on its base. This is important, due to the weak unconsolidated soil materials which form the foundation materials at many wharf sites. Soil mechanics offers a fairly precise solution to this design problem through the use of the so-called Swedish circle method of analysis. This analysis involves the selection of a critical circle of failure within the soil mass adjacent to the wall and passing close under the base of the wall or near the tips of the piles if they are used. By comparing the forces tending to produce rotation along the circular path by reason of the heavier soil weights and other loads on the landward side of the center of the circle with the restraining forces due to the sheer resistance of the soil along the periphery of the circle, a fair idea of the margin of safety of the wall against sliding may be obtained. A form of wall frequently used in wharf construction is known as the relieving type, a sketch of which is shown in Fig. 2. This type utilizes the natural stable slope of the backfill material to remove load from the back of the wall by the use of relieving platforms founded on piles, and is used for reasons of economy.

Piles are used in the foundations of the majority of wharf structures. Here again, the design of pile foundations is much the same as in other structures, except that at many wharf sites the foundation soils are deep and weak, thereby requiring very long piles. Timber piles were used almost universally in times past and are still commonly used. Douglas fir piles 120 feet long are obtainable on the west coast of the United States, but east coast species such as oak or pine are scarce in lengths over 60 feet. Steel and reinforced concrete piles, which are coming into increased use, can be used in lengths limited only by the practically available driving rigging. Steel piles up to 200 feet long have been used successfully. In computing design loads for piles, there are several pile-driving formulae available, such as the *Engineering News* formula, but experience has proved that full size pile-loading tests on the site of the work are worth their cost for a structure of any substantial size. In such tests, the piles are driven and loaded with steel rails, beams, earth filled boxes, or by jacks, and settlements are noted for various loads and driven lengths of pile. If the settlements are small, such as one quarter of an inch, under the load which the completed structure will place on the pile, the tested pile may be considered to indicate a length which will be satisfactory. The exact criteria, of course, depend upon the nature of the structure and its susceptibility to damage by foundation settlement. Loads commonly used for timber piles depending on soil friction to resist settlement are in the neighborhood of 15 tons per pile. If there is a firm stratum of soil such as dense sand or rock which can be reached by the piles, the loads per pile may be increased well above this figure because the piles will then have so-called end bearing which is more reliable than soil friction for support. This fact often justifies the use of very long piles, which in turn often dictates the use of steel or reinforced concrete piles rather than timber. It should be stated that many ship owners favor timber construction because of the resiliency obtained which produces less damage to vessels berthed alongside.

The layout or general arrangement, the overall dimensions and load carrying capacity of wharves are so dependent on site conditions, the size of vessels, and the nature of cargoes that it is difficult to state any general rules. There are several vessels in the North Atlantic trade in the neighborhood of 1,000 feet long and New York harbor has several piers 1,100 feet long to accommodate them. Since the pierhead line in New York and other United States harbors is established by the Corps of Engineers, Department of the Army, and since no pier can project beyond these lines, which allow 2,800 feet of unobstructed river at New York, those 1,100-foot long piers had to be excavated partly out of the rock of the shore. They therefore have concrete retaining walls founded upon rock for their shoreward portion and the more typical New York construction of a reinforced concrete deck on timber piles for their riverward ends. There are piers longer than this where ample space is available, but these are intended for berthing several vessels of the more usual length of 500 to 600 feet end to end along their sides. Furthermore,



(Courtesy of *Civil Engineering*)

FIG. 2. Cross section, quay at Bayonne, N. J.

in localities where adequate depths of water are far off shore, piers well over a mile in length have been built which provide for berthing vessels only at their extreme ends.

The New York piers mentioned above are 125 feet wide and this is quite a narrow width compared to other harbors such as Philadelphia and Baltimore where 300 feet of width is more common. One reason for the many narrow piers at New York is, of course, the value of the water frontage, although this is also high at other ports. A second reason at New York is the practice of railroad car lighterage service whereby railvessel transfers are made by ferrying railroad cars to the ship's side. Thus, there are no railroad tracks on many New York piers and less width is necessary. Slip space, that is the width of water between adjacent piers, is 400 feet at New York to provide room for lighters. Depth of water at the New York piers under discussion is 45 feet below low water. Depths at most ports for ocean-going ships are in the neighborhood of 30 to 35 feet.

Most wharves have sheds from 1 to 3 stories high. (Fig. 3.) These are necessary for temporary storage of cargoes while transferring from ship to truck or railroad, or vice versa. In some cases, inbound cargoes occupy one floor and outbound another. Frequently, passengers occupy a separate floor. In many instances, railroad tracks are provided along the edge of the pier for occasional loading of very heavy pieces of cargo and also at center lines of piers or landward edges of quays for the more usual shipments. Design floor loads occasionally are 1,000 pounds per square foot but more usually 500 to 600. Some wharves depend upon ships' tackle to move cargo between vessel and wharf, but many have cranes of a few tons' capacity to augment or assist the vessels' equipment. Unusually heavy loads frequently are moved by floating cranes which move from wharf to wharf. There are many wharves designed for highly specialized purposes with equipment capable of moving only one kind of cargo. Loaded railroad cars are transferred at some. Coal wharves accept loaded cars, turn them over, and chute the coal directly to the vessels. Wharves for iron ore loading and unloading are common on the Great Lakes and turnaround time of vessels is a matter of a few hours. Ce-

ment is loaded by blowing it through pipes and, of course, petroleum and other liquid products are piped. Belt conveyors are used for other products.

A design feature of many wharves is some sort of shock-absorbing mechanism along the wharf edge to minimize damage to the vessel and the wharf as the vessel is being brought to berth. The weight of vessels is so large that a very large amount of energy must be absorbed by the wharf or the vessel's plating, even if the vessel is brought to rest from an approach velocity of only one or two miles per hour. Timber wharves serve this purpose by their natural resiliency and a horizontal pier movement of nearly one foot is not uncommon nor too destructive. A reinforced concrete pier on the other hand could not accept such movements and buffers of one type or another are essential. In some instances, timber piles have been driven around the edge of concrete wharves for this purpose. In others, vertical timbers hinged at their lower ends and held out from the wharf by horizontal helical steel springs at their upper ends have been used. Hydraulic buffers have been used. Several types using heavy weights, usually of concrete, suspended in such a way that the horizontal thrust of the vessel will cause the weight to rise against gravity, have been successful. In most all cases, the striking surfaces are sheathed with timbers to minimize damage to the vessel's plating.

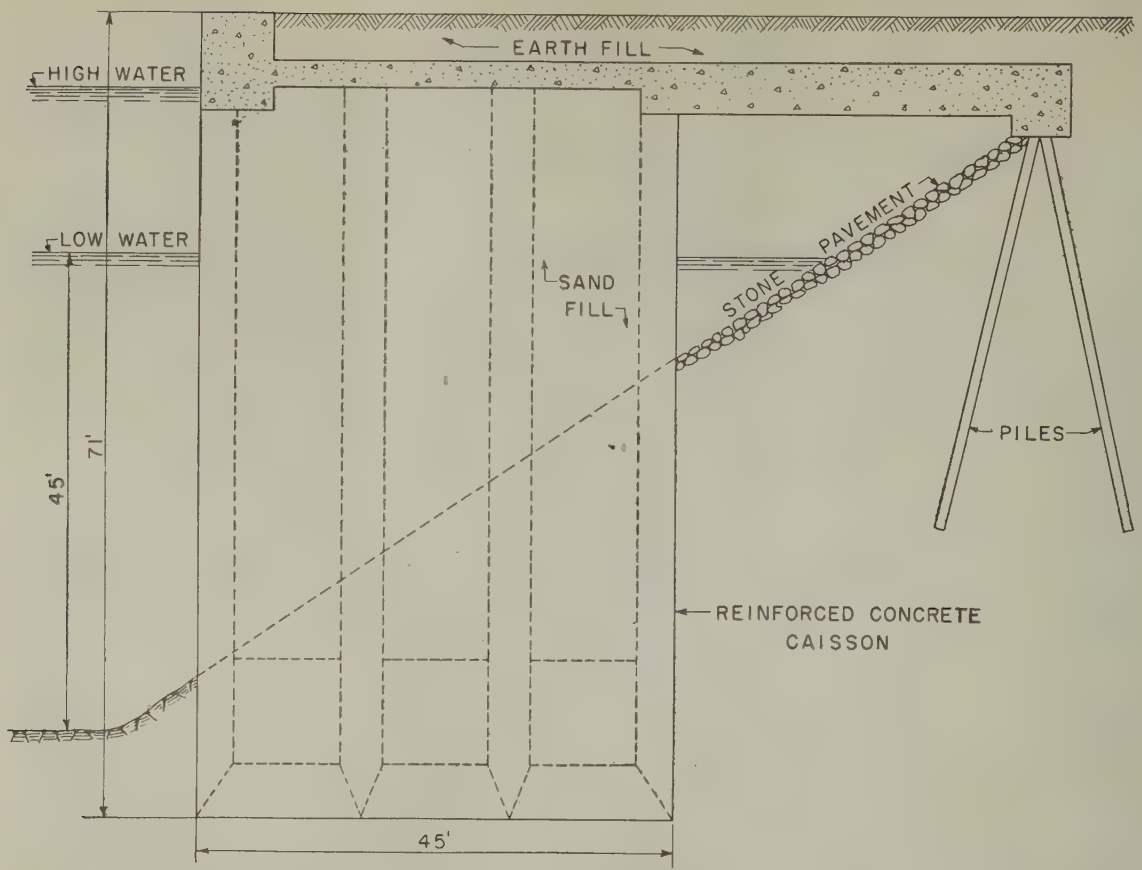
Waterfront structures, especially those on salt water, are subjected to some severely destructive influences. Marine borers attack timber structures in many parts of the world. In general, such destruction is most severe in the tropics, but certain of the pests have reached as far north as Halifax. *Teredo navalis* and *Limnoria terebrans* are the most widely distributed and the most destructive. The teredo, or ship worm, is worm-shaped up to 36 inches long and ¼ inch in diameter. Its head has a two-part calcareous shell for boring. It will bore into timber up to several feet above low water and hollow it out with non-connecting tunnels. Limnoria is a small crustacean about the size of a grain of wheat. It works within the timber between high and low water levels, and its borings are so close together that the timber is almost completely disintegrated. Creosote seems to be the best preservative against these pests. The timbers may be painted with creosote, or better still they may be impregnated with the material under pressure. Species of timber vary in their adaptability to the latter process and, of course, its use adds considerably to the cost. Nonetheless, little timber is used in wharf construction that has not been creosoted to some degree. It is important in handling creosoted timber that hooks or other tools, which gouge the surface, be not used, because such ruptures are apt to form entrance for marine borers.

Destruction by fire is a serious hazard for wharf structures. Creosoted timber burns readily, of course, and at waterfront locations, where oil spillage is common and high winds are frequent, the danger is increased. Many designs avoid the use of timber for this and other reasons, but some safeguards are effective. Some wharves have been sheathed around their perimeters to below low water, in order to prevent oil and other inflammable material from floating beneath the structure. Such sheathing must not be allowed to cut off the circulation of air, lest dry rot attack the enclosed timber. Fire walls of timber, metal, or masonry are usually installed in important structures to prevent the spread of fire, and sprinkler systems in the wharf sheds are a common feature. Decks of earth fill or concrete, or both, are often used on timber substructures to minimize the fire hazard.

The disintegration of concrete is accelerated by alternate wetting and drying, alternate freezing and thawing, the leaching action of salt water, and the erosive action of waves. All of these elements may exist at one wharf location and one or more is always present. The best defense against such disintegration is the use of well-designed, dense, and carefully placed concrete. In general, it may be said that if the water can be prevented from penetrating the concrete, the disintegration will be very slow. The concrete aggregate material should be durable in itself, with few soft particles and as little of it as possible subject to swelling when wet. The aggregate should have a particle shape as near cubical or spherical as possible, and should be well graded from the coarsest size (the largest possible which will fit easily between reinforcing rods or other elements of the structure), down to that portion of the material which will pass a number 100 sieve. The cement content should be higher for waterfront structures than for the average land structure, in order to better resist the aggressive action of the water. Air entraining cement appears to increase materially the impenetrability of the concrete. The water should be held to the minimum amount which will assure correct placement of the concrete with the aid of vibrators. Sufficient water to permit the concrete to flow should never be used. Correct amounts vary considerably, but there is seldom justification for more than seven sacks (7 cubic feet) of cement per cubic yard of concrete or more than six gallons of water per sack of cement. The precasting of concrete elements for wharves is often desirable because it is much easier to control concrete manufacture and placement conditions on land, and, furthermore, it minimizes expensive over-water work. The curing of concrete by keeping it constantly wet for seven days after placement is worthwhile from the point of view of durability.

Features of Recently Built Wharves.—The following brief descriptions cover wharves built since about 1935. Further details of these and others may be found by consulting the indexes of the magazine *Civil Engineering,* the magazine *Engineering News-Record,* or the *Transactions of the American Society of Civil Engineers* which are available in most public libraries.

Standard New York Pier Construction.—Most New York piers are founded on timber piles driven to 15 tons' bearing capacity. Such foundations are expected to last for 20 to 30 years and be good for another 20-year period by cutting off and replacing the piles above low water without disturbing the deck or superstructure. More durable construction has been considered wasteful due to the changing needs of shipping. The piles are driven on 10-foot centers each way and timber pile caps form bents transverse to the pier centerline. Decks are of reinforced concrete 10 inches thick and designed for loads of 500 pounds per square foot. Below deck, the pier is divided into 120- to 140-foot sections by transverse fire walls of concrete. Footings for the superstructure are carried to low water by means of concrete



(Courtesy of *Civil Engineering*)

FIG. 4. Deep-water quay well at Southampton, England.

pedestals on pile clusters. The superstructure is usually a 2-story building of four-column steel bents placed 20 feet apart. The second floor is designed for 300 to 400 pounds per square foot. The shed sides are turn-over doors along the pier length and the front shed (transverse at shore end) contains waiting rooms, offices, and boiler rooms. As stated heretofore, New York piers are relatively narrow at 125 feet wide and up to 1,100 feet long.

Quay at Bayonne, N. J.—At the site, the pierhead line is two miles from shore with only fringes of land above water. The project therefore required dredging to secure the desired 35 feet below low water and filling with dredge spoil to create land for the terminal and factory sites at an elevation 11 to 13 feet above mean low water. A wharf was constructed around the margin of the fill 9,300 feet long and 42 feet wide, as shown in Fig. 2. The wharf is of the relieving platform type designed for a dead load of fill of 750 pounds per square foot and a live load of the same amount, or 1,500 pounds total. The piles were driven to support 15 tons each and pile bents were spaced 5 feet on centers with 12 piles per bent most of which were 4 feet apart. Tongue and groove sheet piling was driven at the rear edge of the platform and a bank of riprap stone was placed on either side thereof. The dredged material was sand, gravel and silt and efforts were made to eliminate as much of the silt as possible near the quay. Wash borings indicated fine sand at elevation —20 and —30, with sand becoming coarser with depth, and test piles indicated adequate bearing power if driven to —50, that is, feet below mean low water. At one location, softer materials apparently existed to greater depths and two test piles 75 feet long were driven and test loaded. They penetrated 30 feet to elevation —60. One settled 0.74 inch and the other 1.14 inches under 30 tons, or twice the design load each. Upon load removal, the net settlement was 0.25 and 0.36 inch which was considered satisfactory. Based on these tests and pile driving experience on the job, a satisfactory pile resistance was established as follows: For penetration less than 30 feet, use the *Engineering News* formula. For 30 to 35 feet of penetration, require not less than 6 blows for the last foot driven. For 35 to 39 feet of penetration, not less than 4 blows for the last foot. For more than 39 feet, at least 3 blows. The hammer used was McKiernan-Terry 11-B-3.

Pier at Davenport, Calif.—A welded steel pier has been built which carries a railroad track, walkway, and two 12-inch pipelines for loading cement. The support is steel H beams driven to point bearing on shale. These steel piles are standard 8- to 10-inch rolled sections of 33 to 49 pounds per foot. The outside piles are driven through steel cylinders which are filled with concrete. The pierhead, at which the ships are berthed, is supported on four steel cylinders seven feet in diameter anchored by six H beams driven within each cylinder and concrete filled. All bracing is welded steel.

Pier at Halifax, Nova Scotia, Canada.—A pier of precast concrete cribs and fill 1,250 feet long and 300 feet wide has been built at Halifax. The cribs are reinforced concrete 42 feet by 52 feet, floated to the site, sunk by filling with siphons, and then filled with sand. The cribs

form the perimeter of the pier and the central portion is sand and rock fill.

Wharf at New Orleans, La.—The port of New Orleans, near the mouth of the Mississippi River, has the problem of unstable banks to contend with in the construction of its wharves, usually quays. The stream brings down heavy loads of silt when in flood and the banks are composed of this material which also extends to great depths below the river bed. Minor shifting of the river bed often starts the banks moving toward the river and sloughing to lower elevations, as deep-seated silt movements occur. Ordinary pile foundations have moved with these soil movements. In an effort to combat this condition, a quay 1,000 feet long by 75 feet wide has been built on large diameter steel caissons driven 90 feet through the silt and 10 feet into a stable sand horizon. The caissons, with a maximum design load of 320 tons, are from 33 to 54 inches in diameter and were driven with a 10,000-pound steam hammer with a 2,000-pound cast steel driving hood fitted to the top of the caisson. The caissons were built ashore and bulkheaded and floated to the site. Soil was removed from the caissons after driving, by use of water jets and compressed air, and concrete was placed within the water-filled caissons by tremies. Caissons were spaced 20 and 30 feet apart and were connected by welded steel rigid frames. Reinforced concrete was used for an 8-inch thick deck and the superstructure building.

Pier in New York Harbor.—A pier on the New Jersey side of New York harbor has a steel pile foundation of 14-inch standard rolled H sections 200 feet long. The pier is 600 feet long by 90 feet wide. Rows of 13 steel piles each are formed into bents with reinforced concrete pile caps 3 feet by 3 feet. A 10-inch thick reinforced concrete deck slab on reinforced concrete girders 3 feet 3 inches deep span 21 feet between pile caps. Crane supports are separated 9 inches from the deck slab all around to avoid whipping of the revolving cranes when ships strike the wharf. The outer half of the piles are jacketed with concrete 28 inches in diameter.

Wharf at Long Beach, Calif.—A wharf 32 feet wide by 2,500 feet long is supported on 1,000 concrete filled steel tubes 75 to 80 feet long. A steel sheet pile bulkhead is used on the filled side of the structure and is anchored into the fill with tie rods. Pile bents are 10 feet apart and piles in the bent 8 feet apart. This close spacing permitted reinforced concrete flat slab construction for the deck, which supports 2 to 4 feet of earth fill and 750 pounds per square foot live load. Design loading is as high as 58 tons per pile and a 140-ton test load caused settlements of 1.75 inches which reduced to one inch upon unloading. Heavy rubber tubing 14 inches long and 7 inches in diameter between the wharf edge and a continuous heavy timber forms a bumper for ships striking the wharf. Sheds are 200 feet wide of clear spans.

Quay Wall at Southampton Eng.—Fig. 4 is a cross section of a quay wall at Southampton, England. The wall is formed of concrete caissons 45 feet by 45 feet, sunk by dredging sand from the interior cells. The landward cells subsequently are filled with sand. To reduce pressures on the rear of the wall, a rock paved slope is used as well as a concrete relieving platform. While types of structures vary in Europe, as they do in America, it may be said that more massive construction generally is used in Europe, as is typified by this quay wall.

Ralph L. Bloor,
Office of the Chief of Engineers, Department of the Army.

WHAT EVERY WOMAN KNOWS, play by James M. Barrie, Scottish novelist and dramatist, produced in 1908, published in 1918. Maggie Wylie is a plain, small, modest but resolute spinster of 26, with no prospects of marriage, when John Shand, an ambitious, impecunious student five years younger, breaks into the Wylie library in a bizarre effort to advance his learning. Maggie's father and two brothers at once seize this as a heaven-sent opportunity to provide a husband for her in exchange for financing John's education. All are portrayed as Scottish to the marrow.

John, though lacking in a sense of humor, does amazingly well; in six years he is elected to Parliament. He goes through with the agreed marriage, though frankly admitting he does not love Maggie. On her part her one desire, carried out with passionate devotion and self-effacement, is to help him realize his political ambitions; she types his speeches for him.

At this point enters Lady Sybil Tenterden, worldly, charming, beautiful—all that Maggie is not; John quickly loses his head over her. Maggie, facing her problem with determination, is ready to give John up if he should find greater help and inspiration in her rival. After a brief period in the company of Sybil it becomes apparent that the novel ideas and shafts of wit that had propelled John to the top were missing from his new speeches. It is hard for him to understand why; for, as is the way with men, he has believed in his strength and gloried in the conviction that he has risen all by himself. But, says Maggie, the wife of every successful man knows better, and only smiles.

WHAT PRICE GLORY?, a war comedy by Maxwell Anderson and Laurence Stallings, was produced in New York in 1924 under the direction of Arthur Hopkins. It is usually ranked with R. C. Sheriff's *Journey's End* as the best dramatization of the ordeal of trench fighting in World War I.

The play owed its success to vivid creation of character and atmosphere rather than to plot. The characters are United States Marines—old-time professional soldiers mingled with green recruits. The thread of formal plot is the long-standing rivalry between two of the old-timers, Captain Flagg and Sergeant Quirt, who have come up together in the service. As the play opens, Quirt has just been reassigned to Flagg's company as top sergeant; the company is in rest camp in a French village, and Flagg is going off on leave. In his absence, Quirt supplants him as lover of Charmaine, the daughter of the local innkeeper. On Flagg's return, the girl's father complains that she has been seduced. Flagg orders Quirt to marry her, but before the ceremony can be performed the company is ordered to the front.

Act II is staged in a frontline dugout. On accomplishing its mission, the remnant of the company is relieved, but in Act III, before the weary men have had a chance to rest, all leaves are cancelled and the company is ordered back to the trenches. The curtain falls as the wounded

Quirt hobbles after the others, calling, "What a lot of . . . fools it takes to make a war!"

When originally produced, the play created a sensation because of the relatively uncensored profanity put in the mouths of the soldiers. Flagg and Quirt are tough, hard-drinking, unromantic, but they know how to take care of their men, and to lead them. For such professionals, war is neither a noble crusade for an ideal nor a dashing quest of glory. It is a messy job which they are paid and trained to carry through as best they can.

WHATCOM, Washington, former county seat of Whatcom County. See BELLINGHAM.

WHATELY, hwāt'lĭ, **Richard,** English prelate, archbishop of Dublin: b. London, England, Feb. 1, 1787; d. Dublin, Ireland, Oct. 8, 1863. He was educated at Oriel College, Oxford, and in 1819 made his first appearance as an author by publishing his since famous *Historic Doubts Relative to Napoleon Bonaparte.* This pamphlet was among the most popular of the author's writings, more than 12 editions of it having been published. Its purpose was to show that objections of the same kind as those brought forward by skeptical writers of the truth of the Gospel narratives, founded on what seem to be certain inconsistencies in these narratives, may be brought against any well-known and incontrovertible piece of history, such as that of Napoleon Bonaparte. In 1822 he delivered a series of lectures on party feeling in matters of religion. In the same year he received the living of Halesworth in Suffolk, and was appointed principal of St. Alban's Hall, Oxford, in 1825. In 1826 was published perhaps the most widely known of his works, *The Elements of Logic,* and the scarcely less popular *Elements of Rhetoric* in 1828. Whately was appointed professor of political economy in 1830. The lectures he then delivered were afterward published under the title of *Introductory Lectures on Political Economy.* In Oxford, Whately stood in the front rank of those who held liberal views in ecclesiastical and social matters and among these his earnest love of truth, his contempt for arguments resting solely on tradition and the keenness of his logic gave him great influence. In 1831 he was appointed archbishop of Dublin and bishop of Glendalough. He warmly embraced the cause of common unsectarian religious education for Protestant and Roman Catholic schools and wrote manuals suited to this purpose.

WHEAT, hwēt, a grass of the Gramineae family, of the tribe Hordeae, and of the genus *Triticum,* is the most widely grown of all the cereal grains. Except in the rice-eating regions of Asia, wheat products are the principal cereal foods of an overwhelming majority of the world's inhabitants. In the United States, food products from wheat contribute about one fourth of the total food energy requirements of man; and in European countries, particularly France and Italy, they make up a considerably greater proportion of the diet.

The pre-eminence of wheat as a food is due to several factors. It is adapted to a wide variety of soil and climatic conditions and can be grown extensively throughout the world. It is economical to produce and gives good yields of grain with excellent storage properties. Its great popularity as a human food is due to its mild, acceptable flavor, and the unique ability of its principal proteins to form gluten when mixed with water to make a dough. The gluten gives a soft springy quality to bread doughs and enables them to retain the carbon dioxide which is produced by yeast fermentation; this permits the production of light, finely textured loaves of bread. Flours from other cereals such as barley, corn, rice, and rye, which do not have gluten-forming properties, yield rather heavy loaves.

History.—Wheat played an important part in the development of civilization and was grown before the dawn of recorded history, so that its origin is obscure. The most ancient languages mention wheat, or corn, and archaeologists have found carbonized grains of wheat in the prehistoric lake dwellings in Switzerland, in remains from the Stone Age in England, in the tombs of the pharaohs in Egypt, and in the excavations of ruins in Turkey, some of which date back to 4000 B.C. There is evidence that wheat was cultivated in China in 3000 B.C. Some scientists believe that wheat originated in Mesopotamia (Iraq) although many others hold the view that the plant once grew wild in the valleys of the Euphrates and Tigris rivers and spread from these regions to the rest of the world.

Wheat is not believed to have been cultivated in America prior to its discovery by Christopher Columbus, who brought it to the West Indies in 1493. It was taken to Mexico by Hernándo Cortés in 1519, and Jesuit and Franciscan missionaries carried it into what is now Arizona and California. Production was started in Massachusetts and Virginia by the colonists early in the 17th century. It was not as well adapted to the coastal area as corn; but as settlers moved into the Ohio Valley and the West, wheat became one of their main crops.

World Production.—Wheat has a range of cultivation which is probably greater than that of any other crop, and is being seeded and harvested somewhere in the world each month of the year.

The following table gives world production and acreage figures for a period of 20 years.

WHEAT: ACREAGE, AND PRODUCTION IN SPECIFIED COUNTRIES, YEAR OF HARVEST, AVERAGES 1935–1939 AND 1945–1949, ANNUAL 1954–1955 [1]

Continent and country	Acreage [2]				Production			
	Average				Average			
	1935–39	1945–49	1954	1955 [3]	1935–39	1945–49	1954	1955 [3]
	1,000 *acres*	1,000 *acres*	1,000 *acres*	1,000 *acres*	1,000 *bushels*	1,000 *bushels*	1,000 *bushels*	1,000 *bushels*
NORTH AMERICA								
Canada	25,595	24,717	24,267	21,504	312,399	362,774	308,909	494,090
Mexico	1,244	1,244	1,804	1,804	14,284	15,522	30,300	30,310
United States	57,293	71,024	53,712	47,376	758,629	1,202,396	969,781	915,528
Estimated total [4]	84,170	97,040	79,850	70,750	1,086,000	1,581,000	1,310,000	1,441,000

WHEAT: ACREAGE, AND PRODUCTION IN SPECIFIED COUNTRIES, YEAR OF HARVEST, AVERAGES 1935–1939 AND 1945–1949, ANNUAL 1954–1955 [1]

Continent and country	Acreage [2]				Production			
	Average				Average			
	1935–39	1945–49	1954	1955 [3]	1935–39	1945–49	1954	1955 [3]
	1,000 *acres*	1,000 *acres*	1,000 *acres*	1,000 *acres*	1,000 *bushels*	1,000 *bushels*	1,000 *bushels*	1,000 *bushels*
EUROPE								
Austria	630	528	588	603	15,942	10,800	16,600	19,440
Belgium	394	371	455	473	15,887	14,733	21,140	25,910
Denmark	319	175	211	164	14,470	8,704	10,730	9,740
Finland	230	420	400	370	6,100	8,966	10,000	8,000
France	12,560	10,354	11,100	11,300	286,505	238,200	388,220	385,000
German Republic	2,785	2,283	2,735	3,200	92,400	67,420	106,260	124,120
Greece	2,172	1,917	2,540	2,564	30,425	24,750	44,800	48,870
Ireland	225	561	486	360	7,689	17,746	18,250	13,810
Italy	12,577	11,742	12,100	12,300	278,366	227,200	266,400	338,000
Luxembourg	47	32	48	40	1,215	800	1,500	1,300
Netherlands	333	262	272	235	15,217	11,109	14,590	12,856
Norway	80	91	50	...	2,391	2,670	1,510	...
Portugal	1,720	1,665	1,907	1,918	18,400	14,190	27,470	14,500
Spain	[5] 11,253	9,640	10,670	10,536	[5] 157,986	116,700	180,000	150,000
Sweden	740	749	1,068	875	26,351	23,222	37,490	27,460
Switzerland	183	223	223	236	6,050	7,800	11,030	10,070
United Kingdom	1,843	2,148	2,457	1,966	62,361	77,505	103,890	92,360
Yugoslavia	5,400	...	...	...	97,700	...	...	...
Estimated total [4]	53,500	47,590	52,120	52,120	1,136,000	947,000	1,328,000	1,565,000
Other Europe, estimated total [6]	21,350	18,530	20,770	20,530	464,000	318,000	392,000	405,000
Estimated total, all Europe [4]	74,850	66,120	72,890	72,650	1,600,000	1,265,000	1,720,000	1,770,000
USSR (Europe and Asia)	104,000	82,200	...	...	1,240,000	885,000	...	...
ASIA								
Iran	[8] 4,191	...	...	...	[8] 72,128	70,791	78,000	91,500
Iraq	[8] 1,724	1,593	...	...	18,114	14,424	27,000	17,000
Lebanon	[9]	166	165	165	[9]	2,133	1,910	1,850
Syria	[9] 1,363	1,998	2,720	..	[9] 19,485	19,091	31,200	18,000
Turkey	8,973	9,436	15,830	17,790	135,690	125,089	180,040	260,000
China	[8] 49,000	54,447	...	...	[8] 750,000	864,280	...	...
Manchuria	2,896	...	...	...	36,035	...	...	...
India [10]	[8] 25,460	23,312	26,310	26,842	[8] 262,100	212,336	293,920	317,330
Pakistan [10]	[8] 9,305	10,337	10,650	10,700	[8] 117,000	129,017	137,500	118,000
Japan	1,735	1,655	1,660	1,639	49,954	34,325	55,700	54,890
Korea	832	...	...	...	10,240	...	...	..
Estimated total [4]	114,190	117,860	140,750	142,410	1,558,000	1,585,000	1,790,000	1,815,000
AFRICA								
Algeria	4,185	3,566	4,849	4,690	35,201	29,900	51,140	47,400
Egypt	1,464	1,618	1,864	1,581	45,849	42,633	63,500	53,310
French Morocco	3,254	2,621	3,999	3,786	23,128	21,792	46,410	35,070
Tunisia	1,950	1,907	3,356	1,955	14,962	12,320	22,940	15,100
Union of South Africa [10]	1,926	2,416	2,857	2,963	16,025	15,067	22,050	24,300
Estimated total [4]	13,850	13,740	18,610	16,650	143,000	134,000	220,000	190,000
SOUTH AMERICA								
Argentina	15,834	11,432	13,500	...	221,769	193,740	282,560	240,000
Brazil	414	876	...	...	4,978	11,283	28,000	...
Chile	1,963	1,980	1,980	1,925	31,562	35,628	38,270	34,350
Peru	285	280	420	...	3,274	3,798	6,100	...
Uruguay	1,210	1,060	1,840	..	13,256	13,124	30,580	...
Estimated total [4]	20,490	16,260	20,200	19,430	281,000	263,000	393,000	345,000
OCEANIA								
Australia	13,128	12,662	10,499	10,500	169,744	177,742	166,610	210,000
New Zealand	221	140	110	...	7,129	5,241	4,600	..
Total	13,349	12,802	10,609	10,590	176,873	182,983	171,210	214,000
Estimated world total [4]	424,900	406,020	464,910	483,480	6,085,000	5,895,000	6,945,000	7,300,000

[1] Years shown refer to years of harvest in the Northern Hemisphere. Harvests of Northern Hemisphere countries are combined with those of the Southern Hemisphere which immediately follow; thus, the crop harvested in the Northern Hemisphere in 1955 is combined with preliminary forecasts for the Southern Hemisphere harvests which begin late in 1955 and end early in 1956. [2] Figures refer to harvested areas as far as possible. [3] Revised estimates for Northern Hemisphere countries, for Southern Hemisphere, preliminary forecasts based largely on acreage and weather conditions to date. [4] Estimated totals which in the case of production are rounded to millions, include allowances for any missing data for countries shown and for other producing countries not shown. [5] Figure for 1935 only. [6] Comprises Albania, Bulgaria, Czechoslovakia, Eastern Germany, Hungary, Poland and Rumania. [7] Average of less than 5 years. [8] Estimates for Syria and Lebanon not shown separately during this period. [9] Figures for the period shown are not strictly comparable since figures for 1953–1955 include allowances for non-reporting areas, which were not included in earlier figures shown, but were included in estimated total for Asia. [10] Production on European holdings only.

Foreign Agricultural Service. Prepared or estimatedon the basis of official statistics of foreign governments, reports of United States Foreign Service officers, results of office research, or other information. Prewar estimates for countries having changed boundaries have been adjusted to conform to present boundaries.

Wheat is grown at elevations of 8,000 to 10,000 feet in the tropics of Mexico, northwestern South America, and Abyssinia, and below sea level in the Imperial Valley of California. It grows within the Arctic Circle in Europe, Asia, and North America, and in such warm countries as Brazil and the tropics of the Philippines. In the world as a whole, several thousand varieties are grown. The cultivation of wheat on a large scale is confined principally to temperate regions where the annual rainfall is from 15 to 35 inches; it does not do well on sandy and peat soils, and is best adapted to loam and clay soils which are well supplied with organic matter (humus).

In Europe there are three principal wheat growing regions: (1) the plains of southern Russia and the Danube basin (including Rumania and Hungary); (2) the countries bordering the Mediterranean Sea, especially Italy; and (3) northwestern Europe (Germany, France, Holland, Belgium, Great Britain). In North America wheat is grown principally in the Great Plains area of the United States and Canada and in the Columbia River basin (eastern Washington and Oregon).

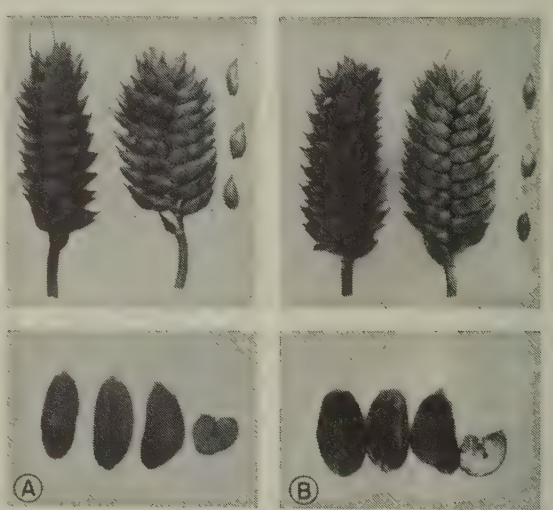
Other leading wheat producing areas are located in the central part of Argentina, southern Australia, and Pakistan. The inequality in wheat production and consumption results in a large international trade in wheat. Under normal world conditions, vast streams of wheat pass from the surplus producing countries of North America, Argentina, and Australia to the countries of deficit wheat production, principally in western Europe.

United States Production.—Three botanical species of wheat, *Triticum vulgare* (common wheat), *Triticum durum* (amber and red durum wheats), and *Triticum compactum* (white and red club wheat), each representing several varieties, are grown in the United States, but members of the *T. vulgare* group represent nearly 95 per cent of the total production. The common wheats differ in such physiological characteristics as spring or winter habit of growth, earliness, yield, resistance to drought, cold, plant diseases, and in such morphological characteristics as the presence or absence of awns, color (red and white), and kernel texture (hard and soft), as well as in milling and baking behavior.

For commercial purposes, the common wheats are classified in four major groups: hard red spring, hard red winter, soft red winter, white wheats (winter and spring). Spring wheat is sown in the spring and is harvested in the late summer. Winter wheat is planted in the fall in regions where the winters are only moderately severe; it develops a root system before the onset of cold weather and becomes dormant during winter. In the spring, the plants make a vigorous growth and the wheat is harvested in the early summer. In areas where it can be grown, winter wheat will usually give greater yields than spring wheats.

The latest survey by the United States Department of Agriculture of the acreages devoted to production of the different classes of wheat was conducted in 1949 and showed that hard red winter wheat represented 54.2 per cent of the total acreage; hard red spring wheat, 20.8 per cent; soft red winter wheat, 13.0 per cent; white wheat (including white club), 7.8 per cent; and durum (amber and red), 4.2 per cent. In that year 75,910,000 acres of wheat were harvested with an average yield per acre of 14.5 bushels to give a total production of 1,098,415,000 bushels; of this quantity 148,516,000 bushels were used for seed, feed for livestock, and other uses on the farms where it was grown, and 949,899,000 bushels were sold.

Hard red winter wheat is grown principally in the southern and central portions of the Great Plains, the greatest acreages occurring in Kansas, Nebraska, Oklahoma, Texas, and Colorado. Hard red spring wheat is grown in the northern portion of the Great Plains area, in the states of Minnesota, North Dakota, South Dakota, and Montana, where the winters are severe and semi-arid conditions prevail. Soft red winter wheat is grown east of the Great Plains area and south of Wisconsin, in regions which are usually characterized by ample rainfall and moderately cold winters. It is the leading class of wheat in Ohio, Indiana, Illinois, Missouri, Pennsylvania, Maryland, Virginia, West Virginia, New Jersey, Delaware, North Carolina, South Carolina, Georgia, Kentucky, Tennessee, and Alabama. White wheats are grown chiefly in the Pacific



(A), Elgin and (B), Hybrid 128 wheats.

Coast states and in New York and Michigan; the leading producing states are Washington, California, Idaho, and Michigan.

Durum wheat was introduced into the United States from Russia by Mark A. Carleton, cerealist of the United States Department of Agriculture, during the latter part of the 19th century for cultivation in the north central region of North Dakota where the existing spring wheat varieties gave relatively poor yields because of arid conditions and their relatively greater susceptibility to the prevailing physiologic strains of wheat stem rust. In recent years about 80 per cent of the entire durum crop has been grown in North Dakota, 15 per cent in South Dakota, and the remainder in Minnesota.

Cultivation in the United States.—Wheat is grown on about one third of the farms of the United States, and in some areas it is almost the sole source of farm income. In the major producing regions of the Great Plains and the Pacific Northwest where there is limited rainfall, wheat is often grown on the same land year after year; or the land is allowed to remain idle, with occasional cultivation every second or third

year to conserve moisture and nitrates for the following crop. In the eastern United States wheat is nearly always grown in rotation with other crops; when it follows corn or soybeans, the land is usually prepared by disking. The application of fertilizers is seldom profitable in the major wheat growing areas of the West, but in the Central and Eastern states mixtures containing phosphorus and potassium compounds are commonly applied at seeding time. Nitrogen is usually supplied through the use of legume crops in the rotation, although a late winter or early spring application of nitrogenous fertilizers is beneficial in the South and in wet seasons in the East.

In states where wheat is extensively grown, it is usually harvested and threshed in one operation by a machine called a combine. It is necessary to delay harvesting from 7 to 14 days after the normal time for cutting with a binder in order that the moisture content will be reduced to 14 per cent or less so that the threshed grain can be stored safely. The culture of wheat in the United States has been so completely mechanized that only about three man-hours of labor are now required per acre (20-bushel yield) as compared with 58 man-hours 100 years ago.

(A), Kubanka and (B), Mindum wheats.

Wheat Varieties.—Wheat production involves many hazards, such as drought, winter killing, plant diseases, and attacks by insects (see WHEAT, DISEASES OF; WHEAT PESTS), but yields have been greatly stabilized during the past few decades through the development of new varieties by the United States Department of Agriculture and state agricultural experiment stations. In a program of this nature, one must breed for resistance to various diseases, and these characteristics must be combined with high yield, proper maturity, strength of straw, and satisfactory milling and baking quality. This is accomplished by crossing two or more varieties having the individual characteristics which are wanted, and selecting descendants that combine the good properties of the parents. A period of 12 to 15 years are required to produce a new variety, and a continuous breeding program must be carried out, since the prevalence of certain plant diseases and insects is continually changing and new physiologic strains of fungi appear to which present resistant varieties may be susceptible.

Accompanying illustrations from Technical Bulletin No. 1083, U.S. Department of Agriculture

Wheat varieties. (A), Awn types: *1*, Supreme; *2*, Onas; *3*, Thatcher; *4*, Ceres. (B), Spike shapes: *1* and *2*, fusiform; *3* and *4*, oblong; *5* and *6*, clavate; *7*, elliptical.

The history of Thatcher, a hard red spring wheat variety distributed in 1934 and resistant to stem rust, serves to exemplify the problem faced by wheat breeders. For several years this variety was grown more extensively than any other spring wheat in the United States and Canada because of its wide adaptability, resistance to stem rust, and good milling and baking qualities. When stem rust was controlled, losses from leaf rust (which is caused by a different organism) became more prevalent and several new varieties of wheat were released (Newthatch, Rival, Henry, Mida, and others). They were resistant to both leaf and stem rust for a

few years and replaced Thatcher wherever leaf rust was a problem. All commercially grown spring wheats became susceptible to leaf rust in 1944 due to an increase in the prevalence of a new race; during the summer of 1950, all varieties were attacked by a race of stem rust later identified as 15 B (first discovered in 1939). A serious stem rust epidemic occurred in 1953, and the spring wheat breeding program has been vigorously prosecuted to develop satisfactory varieties which are resistant to this strain.

Approximately 200 varieties of wheat are grown on farms throughout the United States.

Commercial Classification of Wheat.—The United States Grain Standards Act, which was passed in 1916, provided for the establishment of official standards for the common grains and the federal licensing and supervision of grain inspectors. These standards have been revised

(A), Thatcher and (B), Marquis wheats.

from time to time, and are designed to sort each grain into a number of categories according to quality. Wheat is divided into seven classes on the basis of botanical species, habit of growth, and color: hard red spring, durum, red durum, hard red winter, soft red winter, white wheat, and mixed wheat. Five of these are divided into subclasses on the basis of such factors as kernel density, geographical origin, or the presence of certain varieties. Each subclass is separated into a number of grades on the basis of plumpness, soundness, cleanliness, extent of weathering, and the presence of insects, smut, garlic, and the like. The standards also specify maximum moisture limits for all the regular grades (14.5 per cent for hard red spring, durum, and mixed wheat, and 14.0 per cent for the other classes). The hard wheats (which include hard red spring, hard red winter, and hard white wheats) are valued for the production of flours used in making yeast-leavened bread. Soft red winter, soft white, and white club wheats are best suited for making chemically leavened baked products such as biscuits, cakes, and pastries. Amber durum wheat is prized for the manufacture of such alimentary pastes as macaroni, spaghetti, and noodles. Red durum wheat is unsuitable for milling purposes and is used principally as a poultry and livestock feed. The suitability of wheat for these various purposes depends primarily on its protein content which is reflected in a general way by the hardness and translucency of the kernels; usually the hard, translucent types are considerably higher in protein content than soft wheats with a starchy, opaque appearance.

Chemical Composition.—Wheat consists principally of proteins and starch with smaller quantities of other carbohydrates, fats, pigments, certain vitamins, and minerals. It contains the important B-vitamins—thiamin, riboflavin and niacin—but no vitamin C unless the grain is sprouted. The yellow pigments present in wheat consist chiefly of xanthophyll, which does not give rise to vitamin A when ingested. The embryo (germ) of wheat is a rich source of vitamin E.

The protein content of wheat is influenced principally by the soil and climatic conditions under which it is grown. Considering the United States as a whole, the protein content varies from 7 to 19 per cent. In general, regions with a mild, humid climate, which is typical of land areas near large bodies of water, result in a long growing and ripening period and produce starchy kernels of low protein content. In contrast, the Great Plains area is characterized by relatively hot dry weather during the ripening of the grain and yields wheat with a high protein content. Within a climatic zone, seasons of high rainfall or the use of irrigation, especially during the ripening period, results in a decrease in protein content with an increase in yield.

The moisture-retaining properties of soil have more influence on the protein content of wheat than the level of fertility; nitrogenous fertilizers frequently enhance the yield quite markedly without greatly affecting protein content. In general, however, the protein content of wheat is raised by increasing the available nitrogen in the soil; thus, wheat grown on summer fallow or after legumes is usually of higher protein content than when grown after cereal grains or grasses. Although soil and climatic conditions have the greatest influence on protein content, genetic factors are involved since some varieties produce wheat of higher protein content than others when grown in the same environment. (For the structure of the wheat kernel, see FLOUR AND FLOUR MILLING.)

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WHEAT, Diseases of.—Diseases of wheat are caused chiefly by fungi, bacteria, nematodes, and viruses. They cause enormous losses and are among the greatest of obstacles to efficient and stable production of wheat. Many of them are insidious and widely prevalent every year, others are destructive locally, while still others are widespread and become epidemic only in certain years. The amount of damage they cause varies greatly from season to season, and for most diseases also from one field to another. In some areas epidemics of diseases such as leaf and stem rusts, smuts, scab, and root rot cause losses of 25 to 50 per cent or more of the potential crop; sometimes there may be enormous losses over wide areas.

In 1916 one of the most disastrous epidemics of stem rust on record swept over the spring wheat growing areas in the United States and Canada and destroyed approximately 280 million bushels of wheat. In 1935 and 1937 there were destructive epidemics of stem rust which virtually ruined the wheat crop in the upper Mississippi Valley. Again in 1953 a widespread and extremely destructive stem rust epidemic almost annihilated durum wheats in Minnesota and the Dakotas; the estimated loss for all durum wheats was 65 per cent of the potential crop. In most countries rusts are definitely a limiting factor in wheat improvement and production. Because of frequent epidemics of certain diseases and the vast areas involved, it is difficult to estimate accurately the average annual percentage of loss caused by diseases of wheat. In many parts of the world it usually amounts to 10 to 15 per cent or more of the potential crop.

The more important diseases of wheat are: stem rust caused by *Puccinia graminis tritici;* leaf rust caused by *Puccinia rubigo-vera tritici;* bunt caused by *Tilletia foetida* and *T. caries;* scab or Fusarial head blight caused by many species of *Fusarium,* particularly *F. graminearum;* and seedling blight and root rot also caused by many species of fungi, especially of the genera *Fusarium, Helminthosporium, Pythium,* and by *Ophiobolus graminis.* In addition there are many other diseases of less importance. These may be of considerable economic consequence in some areas every year and in some years they may cause severe damage, particularly when susceptible varieties are grown.

Bunt or stinking smut since historical times has been one of the major diseases of wheat. Bunt decreases yield, creates difficulties in threshing and processing, and lowers the quality of the grain. It is worldwide in distribution, although it is usually more prevalent in the drier regions of the world. In the United States, bunt is particularly destructive in the Pacific northwest. In contrast, loose smut, *Ustilago tritici,* is prevalent only in regions where there is high relative humidity during the blooming period in wheat—a situation which is usually encountered in the soft winter wheat regions of the United States.

Stinking smut usually modifies the spike so that each kernel or seed is replaced by a smut ball that contains 5 to 10 million blackish spores (called chlamydospores). A fishlike odor, caused by trimethylamine, is characteristic, hence the name stinking smut. Smutty wheat commands a lower price on the market because spores adhere to threshed grain and must be washed off before milling.

Fusarium head blight (scab) damages wheat severely, especially in the corn belt where temperature and relative humidity are high during the blossoming period. The growth of the fungus (species *Fusarium*) in the developing kernel results in the production of substances toxic to man and certain animals. Violent nausea and stomach soreness result from eating scabbed grain. In Russia where infected grain was once used extensively for making bread, the product was known as intoxicating bread. At present scabby kernels are removed effectively from seed lots by cleaning equipment; hence scabby kernels do not occur in large quantities in milled wheat products. Certain animals, especially pigs, strongly dislike scabby grain and fail to make normal gains in body weight when fed scabby wheat and barley.

Root rots of wheat are caused by many microorganisms and are among the more important diseases of wheat. They are debilitating, insidious, and usually inconspicuous. The destructiveness varies greatly with the season, the locality, and the variety of wheat grown. The pathogens live on or in the seed, soil, and dead plants. They invade all underground parts of the plant and induce seedling blight, root decay, and premature death of older plants. They tend to multiply in the soil when wheat or other susceptible crops are grown year after year.

Since the soil is actually teeming with microscopic life—protozoa, bacteria, and fungi—there is actually a biological warfare among them. Because of such intense competition among soil organisms many of the pathogens are destroyed, including those that cause bunt, scab, foliage blight, and root rot; hence many diseases fail to develop. In fact, if it were not for this constant natural biological warfare in the soil, it would be virtually impossible to grow wheat continuously on our vast prairies and plains.

Sources of Infection.—Wheat kernels frequently are invaded and discolored by fungi and bacteria. Such seeds often are the source of primary infection for root-rotting pathogens, especially species of *Fusarium* and *Helminthosporium.* Moreover, badly discolored seeds—a condition known as black point—are undesirable in making semolina. In addition, storage molds, usually *Aspergillus* and *Penicillium* species, often invade the kernels after harvest and cause "sick wheat," making such wheat undesirable for milling and baking. If the wheat is stored at moisture contents above 13 per cent, molds grow into the germ of the grain and gradually weaken and finally kill it. In most seed lots the infection by storage molds is invisible and can be detected only by special techniques.

The microorganisms that cause rusts, smuts, mildew, root rot, foliage blight, and other diseases of wheat are living, moldlike parasitic plants. They grow, hybridize, and produce spores ("seeds") by which they multiply and spread. Under environmental conditions favorable to their growth, the spores germinate and penetrate the wheat plant where they establish parasitic relationships. Bacteria and viruses also cause destructive diseases of wheat.

Pathogens such as fungi and bacteria are readily carried on or in the seed, by insects, and by wind. The wind is the most effective agent of dissemination of many fungi. Spores of rust and other pathogens have been caught more than three miles above the ground and there is good

circumstantial evidence that they are carried hundreds of miles by strong winds. As insects and wind have no respect for national boundaries, many diseases are of international scope and importance. One striking example is stem rust of wheat in North America, for wheat is grown from south-central Mexico to the plains of Canada, a distance of 2,500 miles. This vast area devoted to wheat is unbroken by natural barriers. Billions of rust spores are carried northward every summer by the prevailing winds from Mexico and the southern United States to wheat areas in the northern United States and Canada where the rust spores frequently initiate destructive epidemics.

Sometimes stem and leaf rust spores settle down at the rate of one million or more per square foot in a 24-hour period. An acre of wheat with 10 per cent rust infection would produce 20 pounds of rust spores and there are about 180 billion spores (uredospores) in a pound. In epidemic years there are vast areas of wheat with 65 to 95 per cent of rust infection, and the enormous number of spores produced on 20 to 30 million acres of wheat is almost incredible. In the fall the rust spores are usually blown from Canada and northern United States southward where they initiate new infection on winter wheat. Obviously, the control of rust is an international problem. So is the control of many other plant diseases.

Parasitic Races of Fungi.—Not only are diseases of wheat caused by many distinct species of fungi but most of the species comprise many parasitic races. Thus, within the species of *Helminthosporium sativum* there are hundreds of distinct cultural races that can be identified as such when grown on artificial media. Many of these races differ greatly in their parasitic capabilities on wheat and other cereals. Perhaps *Puccinia graminis tritici* (stem rust) is a better example of physiologic specialization. In the variety *tritici* of stem rust, more than 250 distinct parasitic races are delimited and there are perhaps many more in existence.

Rusts are obligate parasites, and spores from races of the same species are similar under the microscope. Hence, races of a rust can only be distinguished and identified by their parasitic effect on certain varieties of wheat, called rust differentials. Each such wheat variety may be resistant to some races, moderately resistant to others, and completely susceptible to still others. Extensive rust surveys over much of the world indicate that the prevalence of races may vary from one place to another and from one year to another. Thus, a variety of wheat may be resistant in one area or country but completely susceptible in another, and vice versa, because of the existence of different races of the pathogen and the precedence or predominance of different races in different countries at a specified time.

Changing Disease Problems.—Disease problems in wheat are continually changing, chiefly because new pathogens evolve, or are introduced from other regions. Sometimes problems change because minor diseases become major diseases. The probability of establishing a foreign pathogen or new virulent race of a native pathogen is even greater now than it was in the past because of the mass movement of many materials and men during and following World War II. Also, changes in cropping systems and the planting of new varieties may shift disease problems of wheat.

The introduction of a new variety of wheat frequently brings about tremendous shifts in the prevalence of diseases hitherto considered unimportant in a particular region. When Marquis wheat replaced Preston, Haynes bluestem, and Glyndon fife in spring wheat regions from 1910 on, scab, hitherto a minor disease, became a major one, whereas the bunt problem decreased greatly. Then, with the introduction of the two stem rust resistant varieties, Kota and Ceres, about 1925, leaf rust, bunt, and loose smut became major diseases simply because these varieties were especially susceptible to certain races of the fungi that cause these diseases and that were present where the new varieties were grown. The release of many other varieties during a 20-year period (1930–1950) has repeatedly shifted the relative importance of diseases. Population shifts in the prevalence of parasitic races frequently are responsible for severe rust attacks on varieties that are resistant to the previously prevalent rust races.

Extensive surveys have shown that the prevalence and distribution of physiologic races of rust may change gradually over a period of many years or they may change rapidly in a single year. Stem rust race 56 was first found near rusted barberries in the north-central United States in 1923, but it did not become widely prevalent until 1935 when it virtually eliminated the growing of the wheat variety Ceres. Race 15 B, found occasionally near barberry bushes in the eastern United States prior to 1950, became the dominant race in the United States and Canada in that year, and in the following year it became prevalent also in Mexico. This race attacks all of the commercial, hitherto resistant varieties of wheat, and it was responsible for the destructive epidemic in the hard red spring and durum wheat areas in the United States and Canada in 1950 and 1953.

Past history has shown that new races of the bunt fungus developed following the release of a new bunt-resistant variety of wheat in the Pacific northwest. The population of the new races of bunt is greatest in regions where the new smut-resistant varieties are grown. If a new race of a pathogen can attack a so-called resistant variety, then the chances are good that the more extensively this variety is grown, the more rapidly will the new race multiply. Thus, a new variety may appear to lose its resistance, but in most cases it can be demonstrated that loss of resistance is due to the increase of new parasitic races of the pathogen.

Hybridization of Plant Pathogens.—Plant pathogens are not static; they hybridize and mutate just as higher plants do. Many new and virulent races of smuts and rusts have been produced by hybridization between existing races or biotypes. Fertile interspecific hybrids have been obtained by hybridization between two species of smut, *Tilletia caries* and *T. foetida*.

Hybridization frequently results in marked changes in pathogenicity, and new races often are produced that are more virulent than the parents. New races may attack hitherto resistant varieties of wheat that have recently been released to growers. The practical importance of hybridization in nature is most clearly apparent in stem rust.

Races of stem rust can hybridize readily on

common barberry, and apparently this occurs frequently in nature. As many as 18 races have been derived from a single cross between biotypes of a single race. Extensive studies made cooperatively by the United States Department of Agriculture and the University of Minnesota have shown that different kinds of races and biotypes are 10 to 20 times more numerous near barberries than away from them.

The sexual stage of stem rust occurs only on barberry and this has been one of the major reasons for the eradication of rust-susceptible barberries in at least 18 states. The role of barberries, however, in the production of initial inoculum resulting in primary infection centers was of tremendous importance before these bushes were eradicated from spring wheat areas. Although more than 448 million barberry bushes have been destroyed, some still remain and the campaign to eliminate them continues.

Treatment and Control.—Although many diseases of wheat such as root rots, scab, and bunt, cannot be completely prevented, particularly where wheat is grown extensively and intensively, they can be materially reduced by good agricultural practices. Sound seed of recommended varieties should be treated with a fungicide to eliminate the pathogens from the seed and to protect the seed and seedlings against seed- and soil-borne organisms, such as species of *Fusarium, Helminthosporium, Pythium,* and *Tilletia.* The seed should be sown only deep enough to provide adequate moisture for germination. Also, a good cropping sequence should be followed. The seed beds should be well prepared, and fertilizers should be applied if there is a deficiency of essential elements. As varieties differ greatly in susceptibility, only the varieties recommended for particular regions should be grown.

Despite many difficulties in controlling plant diseases, much progress has been made in the development of disease-resistant varieties of wheat. Although varieties may be only temporarily resistant, they have greatly reduced the danger of destructive epidemics and lowered the cost of production. Since most pathogens consist not only of parasitic races but also of biotypes, collections of them from diverse sources must be used in testing for disease resistance. Because of the frequent shifts in diseases and in parasitic races, the breeding program for the development of resistant varieties must be continuous.

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WHEAT PESTS, insects and mites injurious to growing wheat plants and to the wheat kernels in storage. In the principal wheat-growing regions of the United States the hessian fly (*Phytophaga destructor*) has for many years been a very injurious enemy of the wheat crop. Damage estimated at $100 million in a single year has been caused by this pest. The insect received its common name at the time of its depredations on Long Island in 1779 on the supposition that it had been brought into this country from Europe in straw used for the bedding of Hessian soldiers. The fly also occurs in Canada, northern Africa, western Asia, Great Britain, and New Zealand. It looks much like a gnat or mosquito. The female lays pale red eggs in the grooves of the upper surface of the wheat leaves in the spring and again in the fall. Larvae or maggots hatch in about a week and make their way down behind the sheaths where they feed on the plant juices, causing the plants to wilt and die. When full-grown, in about 10 days, the maggots change to pupae, commonly termed "flaxseeds," and remain in this stage for part of the summer and throughout the winter. The adults emerge from these pupae.

Other flies attack wheat. The wheat stem maggot (*Meromyza americana*) occurs in the United States, Mexico, and Canada, and at times may injure 2 per cent of the crop. The larvae tunnel into the wheat stems, sometimes severing them and causing the heads to turn white and die. The wheat bulb fly (*Leptohylemyia coarctata*) is one of the most serious pests of wheat in Great Britain and in certain years causes heavy losses. The maggots which hatch from eggs laid in the soil by this fly burrow into the new shoots of wheat and destroy them. Another insect injuring wheat in that country is the frit fly (*Oscinella frit*). It affects the plant in much the same way as the bulb fly.

The chinch bug (*Blissus leucopterus*) is another destructive insect of wheat in central United States, especially in outbreak years. The adult is black with white markings and about 1/6 inch long. After spending the winter in clumps of wild grasses, the adults move in large numbers to young growing wheat where they suck the juices of the plants, thus killing them. The females lay their eggs on the lower parts of the plants. The young reddish nymphs feed on the plants but fortunately the wheat usually ripens before they become full-grown and migrate to more succulent crops such as corn or sorghum. Wet open winters and warm damp weather in the spring are unfavorable to chinch bugs. Such conditions and a white fungous disease often reduce their numbers so that they cause little damage.

Aphids or plant lice attack the wheat plant and in certain years, the worst of these pests, commonly known as the greenbug (*Toxoptera graminum*), appears in outbreak numbers in the Great Plains states. Since 1882, when the greenbug was first reported in the United States (from Virginia), there have been 14 outbreaks. In the most serious one, which occurred in 1942, more than 61 million bushels of grain were lost in Texas and Oklahoma. In the spring of 1950 over 1,500,000 acres of wheat in northern Texas and western Oklahoma were abandoned because of damage by the greenbug and more than 600,000 other acres were treated with insecticides to control the insect. The greenbugs suck the sap from the young overwintering wheat plants, causing the leaves to turn yellow. Both wingless and winged forms occur. All the wingless forms are female and during the spring and summer they give birth to living young. On the approach of cold weather, winged males and females are produced and the mated females lay shiny black eggs which overwinter on the leaves of the plants. There may be 20 generations a year in Indiana and even more in Texas and Oklahoma. Several other aphids attack wheat in the United States.

Among them the most injurious are the apple grain aphid (*Rhopalosiphum prunifoliae*) and the English grain aphid (*Macrosiphum granarium*). Large numbers of these aphids often gather on the plants and in the heads of the wheat, where their feeding causes the growing wheat kernels to shrivel.

The wheat stem sawfly (*Cephus cinctus*) caused an estimated $17 million loss of wheat in Montana and North Dakota in 1952, and is considered the most important insect pest attacking wheat in the Prairie Provinces of Canada, where in some years it has destroyed up to one third of the crop over large areas. The wheat stem sawfly is apparently a native grass-feeding insect which has acquired an appetite for wheat in the more northern part of the wheat belt. The female sawflies insert their eggs into the plant stems. The hatched larvae bore down through the joints until late summer when they girdle the stems and plug themselves in with frass near the base of the plant. The weakening of the plant stems by the larvae feeding inside and the breaking-off due to the girdling reduce the yield and quality of the grain. Two other sawflies, the black grain-stem sawfly (*Cephus* [*Trachelus*] *tabidus*) and the European wheat stem sawfly (*Cephus pygmaeus*), frequently damage wheat in the eastern United States. Both are widely distributed in Europe and the former also occurs in southeastern Asia and northern Africa.

Grasshoppers are a constant threat to wheat in the western wheat-producing areas of the United States and Canada, and in some years they destroy wheat worth millions of dollars. When abundant the grasshoppers strip off all the leaves of the wheat plants and cut off the heads. Although many kinds of grasshoppers attack wheat, five species are responsible for most of the loss. These are the migratory grasshopper (*Melanoplus mexicanus*), the differential grasshopper (*M. differentialis*), the two-striped grasshopper (*M. bivittatus*), the red-legged grasshopper (*M. femur-rubrum*), and the clear-winged grasshopper (*Camnula pellucida*). Several species of migratory grasshoppers, widely referred to as locusts, cause extensive damage to wheat in South America, Africa, south Asia, and the Near East. If not controlled in some areas they may practically wipe out the food crop of an entire population. Mormon crickets (*Anabrus simplex*), which are really wingless grasshoppers, sometimes migrate into wheat fields in large bands in a number of western states and Canadian provinces, where they damage the crop in any stage of growth, especially by feeding on the ripening kernels.

Tiny mites, which are not insects since they have four instead of three pairs of legs, are also pests of wheat, especially in the western parts of Kansas, Oklahoma, and Texas. The brown wheat mite (*Petrobia latens*) at times infests the plants in enormous numbers and sucks the plant juices. Another mite (*Penthaleus major*) damages wheat as well as other small grains. The control of these mites has been difficult and entomologists are studying the problem extensively.

In the wheat-growing areas east of the Mississippi, the wheat jointworm (*Harmolita tritici*) ranks next to the hessian fly as a most important enemy of wheat. It has been in the United States since 1821 when it was first observed in eastern Pennsylvania. The adult of this insect resembles a small black ant with wings. The female lays her eggs in the wheat stem near the joints and they hatch into small grubs which feed on the juices of the plant. Their presence in the stems causes hard woody galls to form and the plants bend or break over. A closely related insect, the wheat strawworm (*Harmolita grandis*), attacks the wheat plants in the spring so that they become stunted and sometimes die.

Several members of the Pentatomidae or stink bugs attack wheat. In Europe, Asia, and Africa, and especially in Iran and Iraq and other countries in the Near East, some of these bugs of the genus *Eurygaster* are very destructive pests. *E. integriceps,* sometimes known as the "sen" pest, is probably the worst. These bugs pierce the soft wheat kernels and suck the juices. As a result the yield of ripened grain is low, the quality is poor, and flour made from it is not palatable. The Say stink bug (*Chlorochroa sayi*) is an important pest of wheat in some years in Montana, North Dakota, and Canada's Prairie Provinces. The bugs suck the juices from the developing kernels and the grain when harvested is shriveled.

The pale western cutworm (*Agrotis orthogonia*), and the army cutworm (*Chorizagrotis auxiliaris*) are major wheat pests in the Great Plains area of the United States and Canada. The former species kills the plants by feeding on them beneath the soil surface, while the latter crawls up on the plants late in the day and at night and devours the leaves, stem, and head. The armyworm (*Pseudaletia unipuncta*) is also sometimes destructive to wheat. The larvae of several species of wireworms (Elateridae) eat the germinating wheat seeds in the soil, causing poor plant stands. The adults are common click beetles. These insects are long-lived, some of them living for several years. Wheat sown early on ground heavily infested with white grubs (*Phyllophaga*) may have its roots eaten off by these insects and the young plants become seriously damaged. Billbugs (*Calendra spp.*) sometimes feed in the lower part of the stem and crown of the wheat plant, causing the stems to die and fall over.

Only the most important known pests of wheat have been mentioned. Many other insects feed on the plant and at times some of them may be numerous enough to cause economic injury.

Great progress has been made in recent years by entomologists, in cooperation with chemists, plant breeders, and agricultural engineers, in the control of pests of wheat. New powerful insecticides have become available and modern means for their application, such as aircraft and improved ground equipment, has made it economically practical to treat large acreages of wheat infested by injurious insects. For example, nearly 2 million acres of wheat and other small grains in Oklahoma were treated with insecticides to control the greenbug in 1951. Grasshoppers, cutworms, aphids, and other insects feeding on the wheat plants can be readily controlled with insecticides. It is important now to discover the insect infestations early enough so that they can be treated with the proper insecticide before the crop is damaged.

On the other hand, some pests of wheat, such as sawflies, the wheat jointworm, and the wheat strawworm, all of which tunnel within the stems, cannot be controlled effectively with insecticides. Certain cropping practices or cultural control.

and the use of resistant varieties of wheat when possible, must be depended upon to reduce infestations of such insects. The threat of serious damage by the hessian fly in the United States has largely disappeared as a result of the widespread adoption by growers of safe planting dates and, more recently, by the use of resistant varieties of wheat. Years ago it was discovered that wheat planted moderately late in the fall, after most of the hessian flies had disappeared, suffered little if any damage. Entomologists determine the safe dates for planting in each state and advise the growers. Several varieties of wheat, two of the most important of which are Pawnee and Ponca, are resistant to the hessian fly.

Most pests of wheat are controlled to some extent by their natural enemies, such as birds, rodents, insect parasites and predators, and disease. Usually, however, the amount of control by these agents is not sufficient to prevent serious crop damage by the injurious species.

Many species of insects attack stored wheat. In the United States, they are most abundant in the southern part of the country where the winters are mild and least abundant in the Canadian border states where low winter temperatures usually kill them out annually. Infestations by these insects rarely start in the field, but rather develop after the grain is placed in storage, from small numbers living around the storage sites, often in waste grain, feed or trash, or in hiding places in the storage bins themselves.

The most damage is done by those species that attack the sound kernels of wheat such as the granary weevil (*Sitophilus granarius*), the rice or black weevil (*S. oryza*), the lesser grain borer (*Rhyzopertha dominica*), and the Angoumois grain moth (*Sitotroga cerealella*). The larvae of all these species live within the wheat kernels and ruin them.

Many other insects are secondary pests of stored wheat, feeding on grain dust, broken or moldy kernels, or dockage, in both adult and larval stages. Their feeding activity may cause spoilage due to heating and an increase in moisture content of the grain. These insects are generally considered in groups, such as the flour moths, including the Indian-meal moth, Mediterranean flour moth, and meal moth; the grain and flour beetles, including the Cadelle, the saw-toothed grain beetle, the confused flour beetle, and the flat grain beetle; the mealworms, including several species of beetles belonging to the Tenebrionidae; the fungus beetles; the dermestid beetles; and the spider beetles.

Damage to stored wheat from insects may be prevented by destroying the sources of infestation around the storage site, by thorough cleanup of waste grain or other material, by the application of insecticidal sprays to the interior walls of the empty bins, and by applying a protective powder to the wheat. Stored wheat should be inspected frequently and fumigated promptly when infestation is found.

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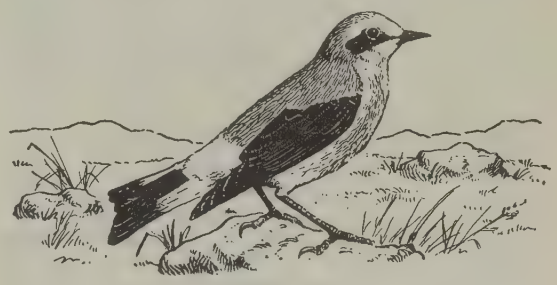
WHEATEAR, hwēt'ēr, *Oenanthe oenanthe,* a small European bird, about 5¾ inches long, which inhabits cliffs, dunes, downs, moors, and hillside pastures, and builds its nest in stone heaps, wall crevices, ground holes, and similar spots. In both sexes the rump and sides of the tail are white; the tip and center of the tail, black. In the breeding season the male has blue-gray back, buffish underparts, white eye stripe, and black ear coverts and wings. The plumage turns brownish in autumn; the color of the



Wheatear.

female resembles that of the autumn male. Because of its chacklike chirp, the bird is called a chacker in the British Isles; its song is a brief warble. A larger species, the Greenland wheatear, *Oenanthe oenanthe leucorrhoa,* is a summer visitor to Greenland and Alaska. Others are the black, black-eared, and pied wheatear; and desert, Isabelline, and white-rumped black. The nest is buried deeply among stones or in rock clefts, the eggs being of pale blue color and numbering from four to six.

WHEATLAND, hwēt'lănd, town, Wyoming, seat of Platte County in the southeast part of the state, 65 miles north of Cheyenne, at an altitude of 4,725 feet. Sugar beets and livestock are raised in the vicinity. Settled about 1885, the town is near Eagle Nest Gap, a famous pass on the Oregon Trail. Pop. (1950) 2,286.

WHEATLEY, Francis, English painter: b. Wild Court, Covent Garden, London, England, 1747; d. London, June 28, 1801. In early life he carried off several premiums given by the Society of Arts and was employed by John Hamilton Mortimer in decorating the ceilings at Brocket Hall. He set up as a portrait painter at Dublin, and was much employed on small whole-lengths, among his sitters numbering many members of the Irish House of Commons. Becoming involved in a scandal he left the Irish capital for London and between 1765 and 1783 exhibited many pictures classed as "domestic," but his works also included *The Gordon Riots in 1780,* the original of which perished in a fire, although James Heath's engraving of it gives a good

idea of the work. As a contemporary of Morland he was superior to that painter in the refinement both of his subjects and his treatment of them, and was really masterly in his handling of equestrian portraits, such as *The Second Duke of Newcastle and a Shooting Party.* He was elected Royal Academician, in 1791. He was an important figure, being one of the founders of English rural genre, and painted pretty and graceful rustic figures of women and children, while his sense of landscape coloring was really exquisite.

WHEATLEY, Henry Benjamin, English philologist and bibliographer: b. Chelsea, May 2, 1838; d. April 30, 1917. He was clerk to the Royal Society (1861–1879); honorary secretary to the early English Text Society (1864–1872), treasurer (1872–1901).

He edited for the Text Society *The Romance of Merlin* (1865–1899); and a complete edition of Samuel Pepys's *Journal* (1893–1897). He published *Anagrams* (1862); *What is an Index?* (1879); *Samuel Pepys and the World He Lived In* (1880); *How to Form a Library* (1886); *London, Past and Present* (1891); *Literary Blunders* (1893); *Historical Portraits* (1897); *The Story of London* (1904); *Hogarth's London* (1909).

WHEATLEY, Phillis, Afro-American verse writer: b. Africa, 1753?; d. Boston, Mass., Dec. 5, 1784. She was brought to Boston in 1761, was purchased by Mrs. Wheatley, and, exhibiting a fondness for books, was instructed by her mistress and her daughters, and acquired for the time a superior education, reading Latin with facility. At an early age she began to express her thoughts in verse, and some of her poems written at 14 give evidence of poetic ability. At 19 she visited England, where she attracted much attention. A volume of her poems dedicated to the countess of Huntington was published there (1773), containing her portrait and bearing the title, *Poems on Various Subjects, Religious and Moral, by Phillis Wheatley, Negro Servant to Mr. John Wheatley of Boston, in New England.* After return from England she published several poems, among others an address to General Washington. Her book was reprinted in Boston and passed through several editions. The family of Mr. Wheatley being broken up by death soon after her return, she married a Negro named John Peters, and her last days were spent in extreme want.

WHEATON, hwē't'n, **Frank,** American military officer: b. Providence, R. I., May 8, 1833; d. Washington, D.C., June 18, 1903. He was educated at Brown University, went to California in 1852 and studied law at Poitiers, France; lieutenant in the United States cavalry, subsequently participated in various Indian campaigns, and at the outbreak of the Civil War was promoted captain. He served with the Army of the Potomac through the war, was promoted brigadier general of volunteers in 1862, commanded a division at Gettysburg and in the Shenandoah, and was engaged in other famous movements. He was made colonel in 1874, brigadier general in 1892 and major general in 1897. He was retired in 1897.

WHEATON, Henry, American jurist and diplomat: b. Providence, R. I., Nov. 27, 1785; d. Dorchester, Mass., March 11, 1848. He was graduated from Rhode Island College (now Brown University) in 1802, and studied law at Poitiers, France; he then took up the practice of law in Providence and later served as an editor and a justice; and in 1816 became reporter for the United States Supreme Court; his reports, which were published in 12 volumes, are exceptionally complete and valuable. In 1827 he was appointed chargé d'affaires to Denmark, being the first regular diplomatic agent from the United States to that country, and resided at Copenhagen until 1835, when he was appointed minister resident to the court of Prussia. Two years later he was made minister plenipotentiary by President Van Buren, which office he retained until 1846. His diplomatic work was most successful; in 1844 he negotiated a treaty with Germany, which, though rejected by the United States Senate, served as a basis for subsequent treaties. In 1843 he was elected a corresponding member of the French Institute, and in the following year a foreign member of the Royal Academy of Science of Berlin. He returned to the United States in 1847. His most important work is his *Elements of International Law,* published in 1836, which has always been regarded as a standard authority on the subject; numerous editions have appeared in the United States; there is also an English edition and a French translation.

His other writings include *Digest of the Law of Maritime Captures or Prizes* (1815); *Life of William Pinkney* (1826); *History of the Northmen* (1831); *Histoire du Droit du Gens en Europe, depuis la Paix de Westphalie jusqu'au Congrès de Vienne* (1841), translated into English in 1846; and *An Inquiry into the British Claim of a Right of Search of American Vessels* (1842).

WHEATON, Loyd, American military officer: b. Pennfield, Mich., July 15, 1838; d. Sept. 17, 1918. He entered the Union army at the outbreak of the Civil War as sergeant, served through the war, receiving promotion to captain of volunteers in 1862, major in 1863 and lieutenant colonel in 1864. In 1866 he was appointed captain in the regular army, was subsequently employed on frontier duty, and on the outbreak of the Spanish-American War in 1898 he was appointed brigadier general of volunteers, was assigned to duty in the Philippines in 1899 and in 1900 received rank as major general of voluneers. He was engaged in all the important engagements in the Philippines, and in 1900–1902 was in command of the departments of North Luzon and the Northern Philippines. He was promoted brigadier and major general in the regular army in 1901 and in 1902 was retired.

WHEATON, city, Illinois, Du Page County seat, altitude 753 feet, on the Chicago and North Western, and Chicago, Aurora and Elgin (electric) railroads, and one federal and one state highway, 28 miles west of Chicago. It is in an agricultural and stock-raising region, and ships hay, vegetables, wheat, flour, livestock, and dairy products. In Wheaton are Wheaton College (Congregational, coeducational, from 1843 to 1860 called Illinois Institute), the Adams Memorial Library, the mausoleum of Judge Gary who was born here, and Grange Athletic Field, named

in honor of a famous local football player, "Red" Grange. Wheaton was founded in 1833 and incorporated in 1859. Pop. (1940) 7,389; (1950) 11,638.

WHEATON COLLEGE, located at Norton, Mass., was one of the pioneer schools for the education of women. It was founded as Norton Female Seminary by Judge Wheaton in 1834 and organized by Mary Lyon. The school was opened for students in 1835 and incorporated by an act of the General Court in 1837. The name was changed to Wheaton Female Seminary in 1839, but the institution was commonly known as Wheaton Seminary until by an act of the legislature of Massachusetts in 1912 the name was changed to Wheaton College and it was authorized to grant degrees. The school was never coeducational. Wheaton College is situated on a slight elevation and in a healthful pine-tree region. The extensive grounds include more than 100 acres of land, diversified by gardens, lawns, hedges, trees and meadows, containing an athletic field, tennis courts, basketball standards and other equipment for outdoor sports. The college has 33 buildings, nine of which are new brick buildings in the colonial style of architecture and six are dwelling-houses just outside the campus.

Wheaton recognizes the new intellectual needs of the home without lessening the opportunities for those who aim at professional work. It is the only small separate college for women in Massachusetts. It allows for personal association, especially between student and teacher, and for the development of individuality. It is democratic in spirit and unsectarian but thoroughly Christian. There are no secret societies. The faculty is composed of both men and women, selected not alone for their ability in research work, but primarily for their efficiency as teachers. The curriculum is carefully planned, and a matter of considerable importance is the organization of the studies of the curriculum into a group system. This affords a well-rounded course of instruction for each student and at the same time allows room for the exercise of individual taste.

Wheaton College enrolls approximately 520 students annually, its purpose being definitely to limit students to about that number. Admission requirements include 15 units, of which 11 are prescribed, the remaining four elective. The faculty numbers 65.

WHEATSTONE, hwēt'stōn, Sir **Charles,** English physicist: b. Gloucester, England, February 1802; d. Paris, France, Oct. 19, 1875. He commenced business for himself in London as a maker of musical instruments and in 1823 attracted the attention of scientists by the publication in *Thomson's Annals of Philosophy* of a paper entitled "New Experiments on Sound." In 1834 he was appointed professor of experimental philosophy in King's College, London, and in 1836 exhibited at King's College experiments showing the velocity of electricity. For this purpose he used a circuit of four miles of copper wire. These experiments suggested to him the idea of applying his apparatus to telegraphing. In 1837 with William F. Cooke, he took out the first patent for magnetic telegraph, but no practical application of this was made until after the Morse telegraph had been operated. Another subject that engaged much of his attention was vision, on which he published various papers, among them a memoir contributed to the *Philosophical Transactions* in 1848, "On some Remarkable and Hitherto Unobserved Phenomena of Binocular Vision." He was knighted in 1868; was a fellow of the Royal Society from the year 1836, and was also a corresponding member of the French Institute and honorary member of the principal academies of science in Europe. He wrote no considerable work, but was the author of numerous papers chiefly contributed to the *Philosophical Magazine* and the *Journal of the Royal Institution.*

WHEATSTONE'S BRIDGE, *in electricity,* a well-known form of the electrical bridge or balance for testing electrical resistance, invented by Samuel Hunter Christie in 1833. Sir Charles Wheatstone showed its application to electrical measurement, but did not claim its invention. See also Electricity.

WHEDON, hwē'd'n, **Daniel Denison,** American clergyman, educator, and editor: b. Onondaga County, N. Y., March 20, 1808; d. Atlantic Highlands, N. J., June 8, 1885. He graduated from Hamilton College in 1828. The following year he taught in Cazenovia Seminary and then was for two years tutor in Hamilton College. From 1831–1845 he was professor of Greek and Latin in Wesleyan University, Middletown, Conn. Then, after pastorates at Pittsfield, Mass., and at Rensselaer, N. Y., from 1845–1852 he was professor of rhetoric, logic and history at the University of Michigan, and resigned because of his abolition sympathies. He then became principal of a private school and later had two brief pastorates in New York. Though not a member of the General Conference of 1856 he was elected by that body editor of the *Methodist Quarterly Review,* and book editor of the Methodist Episcopal Church. Six times he was re-elected by acclamation and served for 28 years.

He was the author of *Public Addresses* (1833–1852); *Commentaries on the New Testament,* 5 vols. (1860–1880); the volumes on the Old Testament are by other authors and most of the eight volumes appeared after his death; *Freedom of the Will* (1864); *Essays, Reviews and Discourses;* and *Statements Theological and Critical,* edited by J. S. and D. A. Whedon, 2 vols. (1887). He was also the author of many pamphlets and articles.

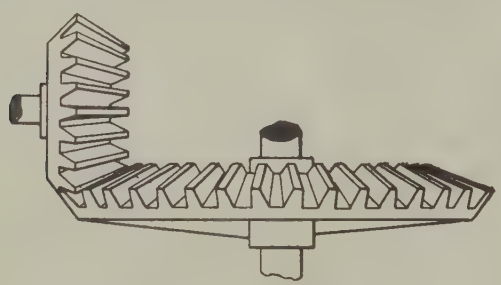
WHEEL, Breaking on the, a horrible mode of putting to death by torture formerly in use in Europe. The condemned criminal was first fastened to two pieces of wood, in the form of a St. Andrew's cross, with his legs and arms extended, and had the bones of his shins and thighs and of the fore and upper arms broken by blows with a bar of iron. After that he was attached to a small carriage wheel balanced on a stake, and allowed to suffer in this position till he died, sometimes several days after the breaking of his limbs. Later the punishment was so far mitigated that the criminal was put to death by a final blow on the breast, spine or neck before being exposed on the wheel, and sometimes he was strangled before even the breaking of his limbs took place. This torture was last used in Prussia about 1811.

WHEEL, The, a popular name for the bicycle or the bicycle trade when at the height of its prosperity, about 1900.

WHEEL AND AXLE, one of the mechanical powers consisting of a wheel mounted on an axle, with a rope or cord wound a few times around a groove in the wheel and another rope or cord turned around the axle. The wheel having the larger diameter, a small power applied at its circumference will balance a larger resistance or force on the cord around the axle, the gain in power being proportioned to the respective diameters of the wheel and the axle. The common winch, the windlass, the capstan and the treadmill are so many applications of the wheel and axle; and the same principle may be adapted to a train of wheelwork wherein motion is regulated and power acquired.

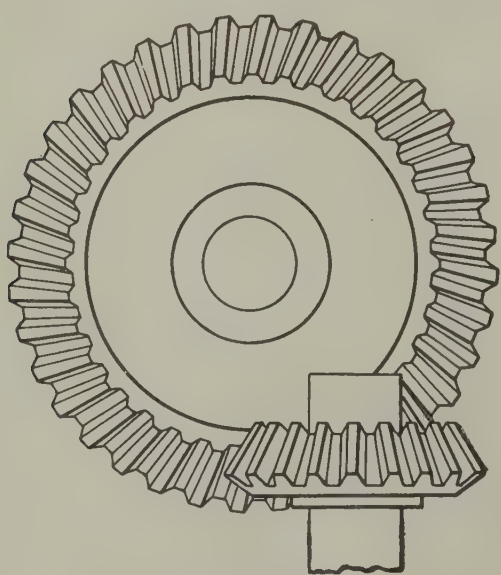
WHEEL-BUG, any of several species of conenose (q.v.).

WHEEL-GEARING, a general term applicable to all forms of mechanical devices by which motion is transmitted by means of toothed or cog wheels. The different parts of



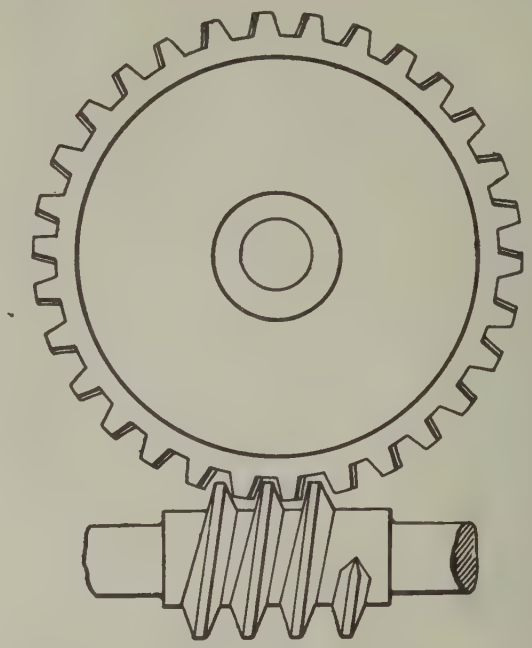
Bevel Gearing.

a machine may transmit motion to each other by «direct contact» or by means of an «intermediate connector»; in the latter case the motion of the connecting part being usually of no



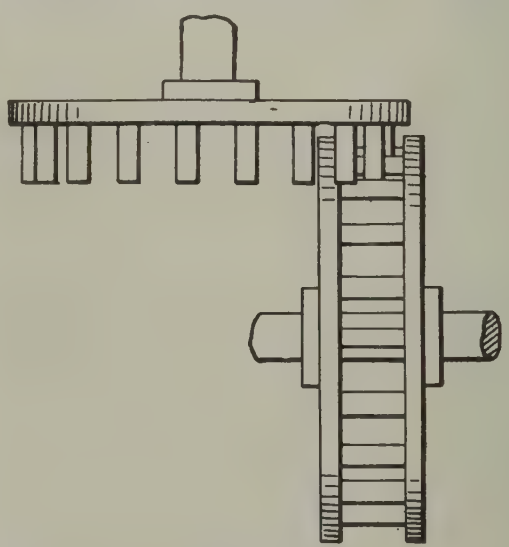
Skew Gearing.

importance since the desired object is simply the proper relative motion of the two parts thus connected. In elementary combinations of either kind, the part receiving the motion from the source of power is termed the «driver» and the part to which that motion is transmitted by the driver is termed the «follower.» A train of mechanism consists of a series of such elementary combinations, the motion being transmitted to each piece from the one immediately



Screw or Worm Gearing.

preceding it, and so on throughout the entire series; therefore, in order to ascertain the action of a complete machine, the «velocity ratio» and the «directional relation» of each combination of the series has to be determined. These factors depend upon the mechanical connection of the two parts, forming the combination, and are absolutely independent of the true velocities or directions of the parts themselves, which may or may not be liable to continual variation. For example, in two circular wheels, in contact



Face Gearing.

with each other, and rotating upon fixed axles, the velocity ratio is constant If the diameter of one is twice that of the other, the angular velocity of the larger will be one-half that of the smaller. but during any changes of velocity

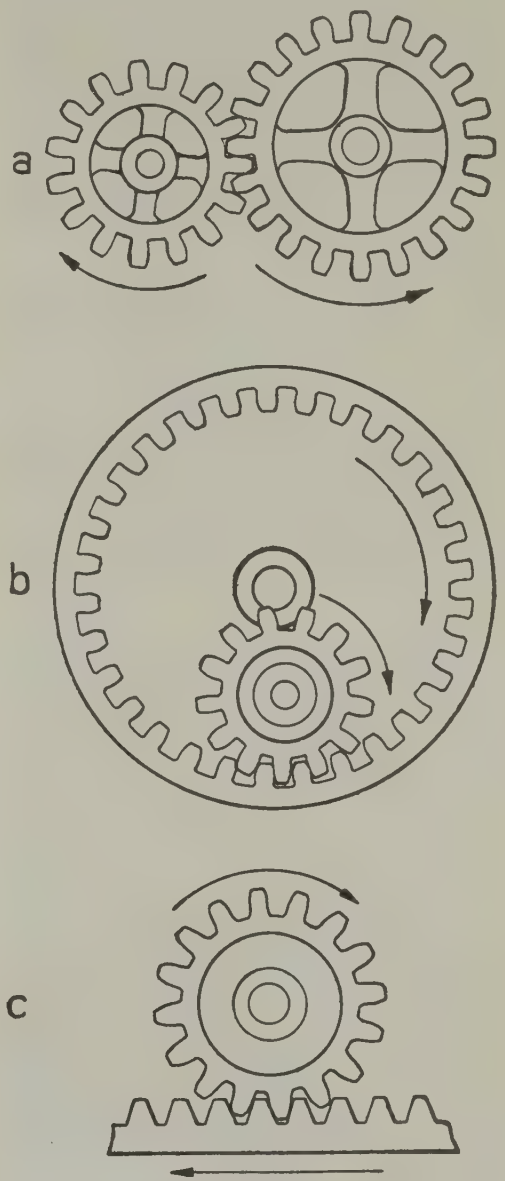
whatsoever since the length of the respective radii of the wheels remains unchanged, the velocity ratio at any instant is the same. As to the directional relation, if the wheels are in internal contact, they will rotate in the same direction, and if in external contact, in opposite directions; but in both cases the directional relations will remain unchanged regardless of any change of the absolute direction of the driver. On the other hand, if the wheels are elliptical, while the directional relation will remain constant, the velocity ratio will be subject to variation according to varying lengths of the contact radii. All elementary combinations may be divided into four classes — rolling contact, sliding contact, link work and wrapping connections. The first two are direct methods, while the two last named communicate the motion through intermediate connectors.

The theoretical forms required to transmit motion by rolling contact are cylinders, cones and hyperboloids of revolution. In the various forms of "friction gearing," employed to drive light machinery, the rolling pieces are made of different materials, one of wood and the other of iron, or one of them is covered with leather or rubber, and the necessary amount of adhesive contact is secured by adjusting the bearings of the pieces or by the application of weights or springs. It is impossible to transmit motion against any considerable amount of resistance by means of smooth surfaces, and toothed gears are, therefore, generally employed and may be conveniently divided into five classes, according to the form of the pitch or contact surfaces of the equivalent toothed wheels, and designated as "spur" gears, "bevel" gears, "skew" gears, "screw" or "worm" gears and "face" gears.

In spur gearing, the wheels act upon each other in the same plane; the pitch surfaces are cylinders and the teeth engage along straight lines parallel to the sides of the cylinders. If one is considerably smaller than the other it is usually termed the "pinion," while the larger is commonly known as the "wheel." When the teeth are formed on the inner side of the wheel, or convergent to its centre, it is called an internal wheel. Wheels in external contact rotate in opposite directions, but wheels in internal contact rotate in the same direction. As the diameter of the pitch circle of a "wheel" is increased its curvature decreases and finally becomes a straight line and results in a "rack and pinion" combination.

In bevel gearing the wheels act upon each other at an angle; the pitch surfaces are cones and the teeth engage along straight lines which pass through the common vertex of the two cones. When the angle of contact is equal to 45 degrees they are called "mitre gears." In skew gearing the axles are neither parallel nor intersecting, the pitch surfaces are hyperboloids of revolution, and the teeth engage in lines approximating to the general direction of the common element of the hyperboloids. Owing to the difficulty of constructing the teeth, this class of gearing is not much used, and where the conditions require their application, two pairs of cone wheels are generally employed.

In screw gearing the axles of the cylinders are neither parallel nor intersecting, and the pitch surfaces are in contact only at one point. In its practical form it is known as "endless screw" or "worm gear," and is commonly employed to convert rapid into slow motion. The mounting of the screw prevents any other motion except that of rotation, so that at each complete turn of the screw a tooth of the engaging wheel passes across the line of centres. and there being no limit to this action, the wheel continues to rotate so long as the screw is turned around its axis.



Spur Gearing.

(*a*) External Contact.
(*b*) Internal Contact (annular).
(*c*) Rack and Pinion.

In face gearing, the teeth consist of pins arranged in a circle and fastened to a flat circular plate attached to an axis. The wheels act at right angles to each other and the points of contact are situated only upon the surfaces of the pins. Prior to the introduction of bevel gears, it was the method usually employed to transmit motion between axes that were not parallel, but at the present time it is almost

exclusively used in connection with modern mill machinery.

There are a great many other forms of gearing which are adapted for various purposes. Of them the stepped, twisted, spiral and differential gearing are the most important. (For description of differential gearing see DIFFERENTIAL GEAR.) The particular advantage of the last-named over ordinary spur gearing is the slight friction and the consequent lack of wear of the teeth. Bevel gears of this type have been used with great advantage in mowing machines. By the substitution of epicycloidal and hypocycloidal curves and involutes for the circular arcs in the forms of the teeth, the rolling contact action of the circles, in its relation to the production of a constant velocity ratio, is replaced exactly by a sliding contact action. The teeth of all gear wheels are designed upon the principles of these curves, so that when running together their action is smooth and free from vibration and shock.

Bibliography.—For specific information relative to the application and design of gearing consult Kent, William, *Mechanical Engineer's Handbook,* 11th ed. (New York 1936); Beale, O. J., *Practical Treatise on Gearing* (Providence, R. I., 1942); Merritt, Henry Edward, *Gears: a Book of Reference for Engineers Concerned with the Design, Manufacture, Application or Maintenance of Gear Drives* (London 1942); Marshall, A. W., *Gear Wheels and Gear Cutting,* rev. ed. (London 1947); and 1950 publications on the subject by the American Society of Mechanical Engineers.

WHEEL WINDOW, in architecture, a circular window with radiating mullions resembling the spokes of a wheel. It is similar to the rose window (q.v.).

WHEELER, hwē'lẽr, **Andrew Carpenter,** American journalist and author: b. New York, N. Y., June 4, 1835*; d. Monsey, Rockland County, N. Y., March 10, 1903. He began newspaper work in 1857 on the staff of the New York *Times,* and later became city editor of the Milwaukee *Sentinel.* While in Wisconsin he published *The Chronicles of Milwaukee* (1861). Soon after the outbreak of the Civil War he went with the Federal Army as correspondent for several eastern and western papers. Afterward, following two years of incidental writing for the Chicago press, he returned to New York and joined the New York *Leader* staff; he wrote for the paper dramatic critiques over the signature "Trinculo." Then he became dramatic and musical critic for the *World,* where he attracted wide attention with his weekly essays signed "Nym Crinckle," a pseudonym he retained when he passed to the staff of the *Sun.* As "Nym Crinckle" he wrote *The Iron Trail* (1876), *The Toltec Cup* (1890), and *The Primrose Path of Dalliance* (1891). He wrote also a play, *The Twins,* an adaptation of *A Tale of Two Cities,* and collaborated upon others. Several years before his death Wheeler retired from active journalism and moved to his farm in Rockland County, where he continued his literary pursuits under a new pseudonym "J.P.M." or "J. P. Mowbray": the series of essays he sent to the *Evening Post* were published a *A Journey to Nature* (1901). Other publications were *The Making of a Country Home* (1901), *Tangled up in Beulah Land* (1902), and *The Conquering of Kate* (1903). His authorship of these later works was not known until after his death.

* His birth date is also given as July 4, 1835 or as July 4, 1832.

WHEELER, Arthur Leslie, American classical scholar: b. Hartford, Conn., Aug. 12, 1872: d. Princeton, N. J., May 22, 1932. He received the A.B. in 1893 and the Ph.D. in 1896, both from Yale University. He was instructor in Latin at Yale from 1894 until 1900, when he was called to Bryn Mawr: there he was assistant professor, then professor and head of the department of classics until 1925. He held his next post of professor of Latin and head of the classics department at Princeton from 1925 until his death. After some early publications on Latin syntax, Wheeler devoted himself to studies on Latin poetry, contributing many articles to magazines on Latin elegy, satire, and on individual poets. Best known is his series "Propertius as Praeceptor Amoris," which appeared in *Classical Philology* in 1910.

WHEELER, Benjamin Ide, American educator and university president: b. Randolph, Mass., July 15, 1854; d. Vienna, Austria, May 2, 1927. He obtained from Brown University the B.A. degree in 1875 and the M.A. in 1878, and from the University of Heidelberg, Germany, the Ph.D. in 1885. After teaching high school for four years, he was for two years an instructor of Greek and Latin at Brown University, and there spent the years 1881–1885 studying in German universities and traveled also to Greece. Upon his return to the United States he became instructor of German at Harvard, then went to Cornell where he was professor of Greek and of comparative philology from 1886 to 1899; there he wrote most of his scholarly works. From Cornell he took one year leave (1895–1896) to teach Greek literature at the American School for Classical Studies in Athens. In 1899 he accepted the position of president of the University of California; under his efficient leadership during the next 20 years the institution made tremendous strides in every direction. He retired in 1919 with the title of professor of comparative philology and president emeritus. Among his publications are: *Analogy and the Scope of its Application in Language* (1887); *Dionysos and Immortality* (1899); *Alexander the Great: The Merging of East and West in Universal History* (1900).

WHEELER, Burton Kendall, American senator and lawyer: b. Hudson, Mass., Feb. 27, 1882. He received the LL.B. degree in 1905 from the University of Michigan and was admitted to the Montana bar the following year. He settled in Butte to practice law. From 1911 to 1913 he was a member of the Montana state legislature and from 1913 to 1918 was federal district attorney. In 1922 he was elected on the Democratic ticket to the United States Senate for the first time. He ran for the vice presidency with Robert M. La Follette on the Progressive Party ticket in 1924, but after the failure he re-entered the Democratic Party. He was a supporter of the New Deal as a whole, but his isolationist beliefs led to his break with President Roosevelt. He was defeated in the primaries of 1946 after serving four terms in the Senate; after the expiration of the last term in 1947 he returned to Montana to practice law.

WHEELER, Henry Lord, American chemist: b. Chicago, Ill., Sept. 14, 1867; d. 1914. He was graduated at Yale University in 1890, took his Ph.D. there in 1893, later specializing in chemistry at the universities of Chicago and

Munich. From 1890 he taught at Yale University becoming chemistry professor there in 1908. He was elected to the National Academy of Sciences in 1909.

WHEELER, James Rignall, American classicist and archaeologist: b. Burlington, Vt., Feb. 15, 1859; d. New York, N. Y., Feb. 9, 1918. He was graduated at the University of Vermont in 1880, and received the Ph.D. degree from Harvard University in 1885. He went to Greece for the first time during the summer while at Harvard and from 1882 to 1883 attended the American School of Classical Studies in Athens. In 1885–1886 he attended the universities of Berlin and Bonn, Germany. On his return to America he became lecturer at Johns Hopkins University and in 1888–1889 was instructor in Greek and Latin at Harvard. From 1889 to 1895 he was professor of Greek in the University of Vermont, of which his father had been president. In 1894 he was elected secretary of the American School of Classical Studies in Athens and from 1901 until his death served as chairman of the managing committee. In 1895 he was called to Columbia University as professor of Greek, and became professor of archaeology and Greek art there in 1906. From 1906 until 1911 he was acting dean and dean of the Columbia College of Fine Arts. From 1916 until his death he was a member of the Municipal Art Commission of the City of New York. With Prof. Harold North Fowler he was joint author of *A Handbook of Greek Archaeology* (1909) and contributed various articles on archaeology and philology to professional periodicals. Special mention should be made of his lecture on Greek tragedy, published in *Greek Literature: A Series of Lectures Delivered at Columbia University* (1912), as well as his contribution with R. B. Richardson to the first volume of *The Argive Heraeum* (1902). He had actively participated in the excavations of the Heraeum in 1892–1893.

WHEELER, Joseph, American soldier and statesman: b. near Augusta, Ga., Sept. 10, 1836; d. Brooklyn, N. Y., Jan 25, 1906. He was graduated from the United States Military Academy in 1859, and served two years in the regular army. At the outbreak of the Civil War he decidedly took sides with the South and resigned from the army in 1861. After joining the Confederate Army, he was made a colonel of the 19th Alabama Infantry. He commanded a brigade at Shiloh (April 6–7, 1862) and the rear guard when the Confederates retired from the field. His outstanding services in leading the rear guard when the Confederates withdrew before Maj. Gen. Henry W. Halleck and in holding the salient outpost at Corinth led, on July 18, 1862, to his appointment as commander of the cavalry of the army of the Mississippi. In the next three years he rose to the ranks of brigadier general, major general, and, in February 1865, lieutenant general. In August and September 1862 he led Gen. Braxton Bragg's advance into Kentucky and detained Brig. Gen. Don Carlos Buell until Bragg had captured Mumfordsville. In the Battle of Perryville (q.v.) he displayed great energy and skill as leader of the cavalry. He covered the retreat of Bragg's army making possible the general's escape to Cumberland Gap. When on December 25 Maj. Gen. William S. Rosecrans attacked Bragg before Murfreesboro, Wheeler skillfully retarded Rosecrans' advance and during the Battle of Stone River (q.v.) he was, in the words of Bragg's official report, "pre-eminently distinguished." In June and July 1863 he took a prominent part in the battles during Bragg's retreat to Chattanooga. At Chickamauga (Sept. 19-20) he defeated the right flank of Rosecrans' army, then crossed the Tennessee and captured Rosecrans' ordnance and supply trains. He fought in the Knoxville campaign and helped defeat Brig. Gen. Joseph Hooker at Ringgold Gap. During Sherman's advance from Dalton to Atlanta in the spring of 1864, he aided in opposing the march commanding the cavalry of the Confederate right wing and fighting almost daily; he captured supplies, burned bridges, destroyed railways and went as far as the Kentucky line in eastern Tennessee and then proceeded to northern Alabama. Wheeler was then sent in advance of Sherman's army and kept the Confederate government informed on the enemy's movements. He defended Macon, Augusta, and Savannah, and distinguished himself at Bentonville opening an avenue for Gen. Joseph E. Johnston's retreat; he commanded Johnston's cavalry until the surrender of the Confederate armies.

After the war he settled in New Orleans, then moved to Wheeler, Ala., named in his honor, where he became a planter and also practiced law. In 1881 he was elected a Democratic representative in the 47th Congress. He was unseated by W. M. Lowe as a result of a contest in 1882, but after Lowe's death soon afterward he was seated in 1883. He was re-elected in 1885 to the 49th Congress, then served continuously until 1900.

At the outbreak of the Spanish-American War he volunteered for duty and was commissioned major general of United States volunteers, assigned to command the cavalry division of Shafter's Santiago expedition. He planned and fought in the Battle of Las Guasimas June 24, 1898, and participated in the Battle of San Juan Hill July 1-2, 1898. He commanded the cavalry division of the Fifth corps in Cuba from June 22 to the surrender of Santiago, July 17. After the repatriation of most of the expeditionary force, he was in command of the demobilization center at Montauk Point, L. I. From August 1899 to January 1900 he commanded a brigade during the insurrection in the Philippine Islands. On June 16, 1900 he was commissioned brigadier general of the United States Army and on Sept. 10 retired from active service. He was buried in Arlington Cemetery. His publications include *Cavalry Tactics* (1863), "Bragg's Invasion of Kentucky" included in Vol. III of *Battles and Leaders of the Civil War* (1887–1888), and *The Santiago Campaign* (1899).

Consult Dyers, J. P., *Fightin' Joe Wheeler* (Baton Rouge 1941).

WHEELER, Nathaniel, American inventor: b. Watertown, Conn., Sept. 7, 1820; d. Bridgeport, Conn., Dec. 31, 1893. He was engaged with his father in the manufacture of carriages, but about 1848 joined Allan B. Wilson in manufacturing sewing machines. In 1853, on the establishment of the Wheeler and Wilson Manufacturing Company, he became its president, and by his practical knowledge of machinery and ability as an organizer soon built up what was then the largest sewing machine factory in the world. Subsequently he served for six sessions

in the Connecticut legislature; and invented and patented many improvements in sewing machines, railway cars, and wood-finishing processes.

WHEELER, Wayne Bidwell, American temperance worker: b. Brookfield, Ohio, Nov. 10, 1869; d. Battle Creek, Mich., Sept. 5, 1927. He was graduated at Oberlin College (1894); took his law degree at Western Reserve University in 1898, became field secretary of Ohio Anti-Saloon League in 1898; its superintendent in 1902, and general counsel of the national organization from 1915 to 1927. He was one of those responsible for the passage and ratification of the Eighteenth Amendment to the United States Constitution (1919).

He was author of *Federal and State Laws Relating to Liquor Traffic* (1916); *Prohibition Going or Coming* (1924).

WHEELER, William Adolphus, American lexicographer: b. Leicester, Mass., Nov. 14, 1833; d. Roxbury, Mass., Oct. 28, 1874. He was graduated from Bowdoin in 1853, was engaged in teaching for several years, and subsequently assisted Joseph E. Worcester (q.v.) in the preparation of his *Dictionary of the English Language* (1856–1860). He was afterward occupied with the revised edition of Webster's *Dictionary* (1864) for which he compiled *Explanatory and Pronouncing Vocabulary of the Names of Noted Fictitious Persons and Places, including Familiar Pseudonyms, Surnames, etc.,* which was issued separately in 1865. In 1867 he was appointed assistant superintendent of the Boston Public Library. His book *Who Wrote It?* was completed after his death by C. G. Wheeler. He also left unfinished an encyclopedia of Shakespearean literature. He edited Hole's *Brief Biographical Dictionary* (1866); and *Dickens Dictionary* (1873).

WHEELER, William Almon, American legislator: b. Malone, N. Y., June 30, 1819; d. there, June 4, 1887. He was educated at the University of Vermont and was admitted to the bar in 1845. He was United States district attorney of Franklin County in 1847–1849 and in 1849 was elected as a Whig to the state assembly, but in 1856 he joined the ranks of the then newly-organized Republican party. He was a member of the New York assembly in 1858–1859; in 1860 was elected to Congress; in 1867 was president of the State Constitutional Convention; was re-elected to Congress 1869 and served until 1877, taking a prominent part in the adjustment of Southern affairs under the Reconstruction Act and settling the political difficulties in Louisiana by the well-known Wheeler Compromise. He was vice-president of the United States under Hayes in 1877–1881.

WHEELER, William Morton, American educator and zoologist: b. Milwaukee, Wisconsin, March 19, 1865; d. Cambridge, Massachusetts, April 19, 1937. His education began in his native city, where he remained a few years as curator of the public museum. After a fellowship in Clark University, Worcester, Mass., he received his doctor's degree there in 1892. He went abroad and studied in Würzburg and Liege universities in 1893, while an instructor in embryology in the University of Chicago, where he was made an assistant professor in 1897. He was professor of zoology in the University of Texas, 1899–1903; and curator of invertebrate zoology, American Museum of Natural History, 1903–1908. From 1908 he was professor of entomology in Harvard University. During his professorship at Harvard he was dean of the Bussey Institute for Research in Applied Biology for 14 years. He was also a research associate of the American Museum of Natural History and editor of several scientific journals. His books include *Ants, Their Structure, Development and Behavior* (1910); *Social Life Among the Insects* (1923); *Demons of the Dust, A Study in Insect Behavior* (1930).

WHEELING, city, West Virginia, Ohio County seat; altitude 687.07 feet; on the east bank of the navigable Ohio River; 61 miles southeast of Pittsburgh, Pa.; on the Baltimore and Ohio; the Pennsylvania; and the Wheeling and Lake Erie railroads. Its airport, dedicated in November 1946, is 11 miles north-northeast of the city. The city is served by bus and truck lines providing, with the railroads, a complete system of transportation to other cities in all directions. Third city of the state in population, Wheeling is a busy industrial center. Wheeling's numerous mills and factories turn out a varied list of products, with metals and glass leading. It has been said that the city's output runs through the industrial alphabet from A to Z, aluminum to zinc. The list includes stogies and packaged tobacco, chinaware, sausage, textile products, and mattresses. Wheeling's location on the Ohio made it a strategic point in the trade that accompanied development of the middle west. Important contributing factors to the city's growth were an abundance of coal gas in the vicinity, and its possession of early transportation facilities. Wheeling was fortunate in being on the line of the National Road, which reached it in 1818; and with the arrival of the Baltimore and Ohio Railroad in 1852 the city acquired increased importance as a terminal on the Ohio River. In the first half of the 19th century this river town, at the intersection of land and water transportation, handled a huge volume of commodities and goods. Development of this traffic led to a clash with Pittsburgh. The upstream city strove to prevent building of a bridge between Wheeling Island and the mainland on the West Virginia side, but was twice defeated in the courts. Steamers bound to and from Pittsburgh had thereafter to adjust their smokestacks to the clearance of the bridges. A suspension bridge was formally opened Nov. 15, 1849, and at that time was the longest suspension bridge in the world. Wheeling Island, more than a mile long, is part of the city, and is occupied by a residential section. "Wheeling Downs" is situated at the south end of the island and is one of the country's most beautiful half-mile race tracks.

Wheeling may be said to resemble Pittsburgh in its development of community culture upon a foundation of industrial life. The school systems, public and parochial, are excellent. Nearby West Liberty was chartered as an academy in 1837. It then became a normal school, and after a while, a teachers college. In 1943, the institution became West Liberty State College. Mount de Chantal Academy (1848) is under the control of the Sisters of the Visitation. Linsly Institute was founded in 1814 and now stands within a bend of Wheeling Creek, near the old National Road, now a federal highway. Oglebay Institute, in Oglebay Park, is operated

in connection with the Agricultural Extension Division of West Virginia University. The city library is well stocked; it has a collection of paintings that depict scenes from the city's history. The traveling "Bookmobile" makes 54 stops in the area on its circuit of schools and sections of the county and carries 2,500 volumes.

Wheeling has a number of parks and playgrounds. Of the parks the most notable is Oglebay, which lies beyond the city boundary but was bequeathed to the people of Wheeling by Earl W. Oglebay, in 1926, "for purposes of public recreation and education." In 1928 Wheeling accepted the princely bequest through formal action of the city council. It contains a golf course and swimming pool, playing fields, and camp sites; the Mansion House, equipped as a museum of history and the arts; and a museum of natural history. Concerts, lectures and plays are presented in a year-round program. There are in the city a number of musical organizations, of which one is a large symphony orchestra. Points of pride to the local folk and of interest to the visitor are the city-county building, once the state capitol; the sites of Fort Van Meter and Fort Henry, built in 1774 and defended against British and Indian attacks in 1777 and 1782. The last battle of the American Revolution in which British soldiers and Colonial militia participated took place at Fort Henry, Wheeling, Sept. 11, 1782. At Monument Place on Wheeling Creek, there is a mansion built by Moses Shepherd in 1789 on the site of old Fort Shepherd. Lafayette and Henry Clay both visited Monument Place and a statue was erected in honor of Henry Clay but was removed from the grounds due to the construction of a new bridge. It is now in the Mansion Museum at Oglebay. Other distinguished visitors were Calhoun and Andrew Jackson. In Wheeling Municipal Park is one of the "Madonna of the Trails" monuments.

First settlement of the city's site was in 1769; Col. Ebenezer Zane (q.v.) and his two brothers built a cabin in which one stayed while the others went back for their families and other settlers. In 1793 Colonel Zane platted a town; it was first called Zanesburg, and that was its designation when the seat of county government was transferred here from West Liberty. Incorporation as a town was effected in 1806, under the name of Wheeling. The city charter was granted in 1836. In 1861 Wheeling was declared capital of "the restored government of Virginia" by Virginians opposed to secession. West Virginia became a state in 1863, and from that year to 1870, and again from 1875 to 1885, Wheeling was its capital. Pop. (1940) 61,099; (1950)

WHEELOCK, hwē'lŏk, **Eleazar,** American clergyman and educator: b. Windham, Conn., April 22, 1711; d. Hanover, N. H., April 24, 1779. He was graduated at Yale in 1733, and from 1735 to 1770 was pastor of the Second Congregational Society in Lebanon, near Columbia, Conn. In 1754 he opened a missionary school for Indians, known from Joshua Moor, who gave for its use a building and two acres of ground, as Moor's Indian Charity School. This he removed in August 1770 to Dresden (now Hanover), N. H., founded Dartmouth College, to which a charter had been granted in 1769. He was president of Dartmouth from 1770 to 1779.

WHEELOCK, John, American educator: b. Lebanon, Conn., Jan. 28, 1754; d. Hanover, N. H., April 4, 1817. He was son of Eleazar Wheelock (q.v.). He entered Yale in 1767, but became a member of the new Dartmouth College at Hanover, N. H., and was graduated with the first class in 1771. In 1775 he was elected a member of the provincial assembly, in 1777 was appointed a major in the New York forces and soon after lieutenant colonel in the Continental army. In 1778 he led an expedition against the Indians. In 1779 he was elected president of Dartmouth College and remained there, except two years, until 1817. He bequeathed half his large estate to Princeton Theological Seminary. He published *Essay on the Beauties and Excellencies of Painting, Music and Poetry* (1774); *Sketches of the History of Dartmouth College* (1816).

WHEELWORK. See Clock.

WHEELWRIGHT, hwēl'rīt, **Edmund March,** American architect: b. Roxbury, Mass., March 14, 1854; d. Aug. 16, 1912. He was graduated at Harvard University in 1876 and later studied architecture at the Massachusetts Institute of Technology and in Europe. He was afterward connected with different architects in Boston, Albany and New York, and from 1883 conducted his own business in Boston. He was senior partner in the firms Wheelwright and Haven and Wheelwright, Haven and Hoyt. He was city architect of Boston in 1891–1895. He designed the Hartford Bridge, the Cambridge Bridge, the Boston Opera House, Jordan Hall at Boston, the Cleveland Museum of Art, and was one of the architects of the Boston Museum of Fine Arts. He wrote *Municipal Architecture in Boston,* 2 vols. (1898); *School Architecture* (1901).

WHEELWRIGHT, John, American Puritan clergyman: b. Lincolnshire, England, 1592?; d. Salisbury, N. H., Nov. 15, 1679. He was a graduate of Cambridge and vicar of Bilsby, near Alford, Lincolnshire; but in 1636, being driven from his church by Archbishop Laud, he emigrated to Boston, Mass., where the same year he was chosen pastor of a branch of the Boston church at Mount Wollaston, in what is now Quincy. The celebrated Anne Hutchinson (q.v.) was his sister-in-law, and he partook of her views. Differences of opinion led to personal animosities between him and John Wilson, the pastor of the Boston church; and the General Court appointed a fast in January 1637, partly to heal these dissensions. On this occasion Wheelwright preached in Boston and, as his enemies asserted, denounced the ministers and magistrates. The General Court pronounced him guilty of sedition and contempt, for which in November 1637 he was banished from the colony. In 1638 he formed a settlement on the banks of the Piscataqua, which he called Exeter. After a residence of five years here the town was declared to be within the limits of Massachusetts, and he removed with a part of his church to Wells in the district of Maine. In 1644 his sentence of banishment was revoked, in consequence of some acknowledgments on his part, and he returned to that colony in 1646 and settled in Hampton. In 1654 he published his *Vindication.* About 1657 he went to England, where Cromwell, who had been his college class-

mate, received him cordially; but he returned in 1660 and in 1662 settled as pastor in Salisbury, N. H. His *Writings,* with a memoir, edited by C. H. Bell, were published by the Prince Society in 1876.

WHEELWRIGHT, William, American pioneer promoter of steam navigation, railways and telegraphy in South America: b. Newburyport, Mass., Mar. 16, 1798; d. England, Sept. 26, 1873. A descendant of John Wheelwright (q.v.), he attended Phillips Academy, Andover, and at 16 shipped as a cabin boy to the West Indies. Three years later he commanded a Newburyport bark sailing to Rio de Janeiro. In 1823, master of the *Rising Star,* Newburyport to Buenos Aires, he ran her aground in the Rio de la Plata. From 1824 for five years he was United States consul at Guayaquil, Ecuador, and there established a prosperous business. He then moved to Valparaiso, Chile, where he did much to develop that city, constructing a lighthouse and other port facilities, also gas and water works. By 1838 he had obtained concessions from South American west coast countries for a steamship line, and in 1840 he secured British financial backing and a charter for the Pacific Steam Navigation Company, which inaugurated regular service between Valparaiso and Callao, later extended to Panama. Between 1849 and 1852 he built the first railway in South America, connecting the Chilean port of Caldera with the rich copper and silver mines at Copiapó, and in 1850 the first telegraph line. Starting in 1855 from Rosario, Argentina, he began construction of the first transcontinental railroad, a project encouraged by Presidents Mitre and Sarmiento, and financed by the English railway magnate Thomas Brassey. The Grand Central Argentine Railway was opened in 1870 as far as Córdoba, but its trans-Andean portion was not completed until 1910. His last notable achievement was the creation of the port of La Plata, Argentina, near where he had been wrecked a half century earlier; the rail link connecting Ensenader with Buenos Aires was completed in 1872. Valparaiso commemorated him with a bronze statue in 1876. His strict integrity, bluff but kindly manners, and generous nature earned him general esteem. He left part of his large fortune as a fund for the technical education of Protestant youths of his birthplace.

WHELK, whĕlk, a gastropod mollusk of the genus *Buccinum* and order Ctenobranchiata. The large or common whelk (*B. undatum*) is of common occurrence on both sides of the north Atlantic, and is distinguished by the shell having its canal notched, and the mouth or aperture of large size. The whorls of the shell, which has a thick horny epidermis, are few and rounded. The red whelk, or "roaring buckie" of the Scotch (*Fusus antiguus*), belongs to the family Fusidae (q.v.). The tulip whelk (*Fasciolaria tulipa*) is very richly colored and inhabits the tropical seas. The purple whelk (*Purpura lapillus*) is so named from its affording a part of the dye which made Tyre of old famous. The whelk is used for food in Europe, especially in the south of England where the chief fisheries are at the mouth of the river Thames.

WHEN LILACS LAST IN THE DOOR-YARD BLOOMED. Swinburne called this elegy on Abraham Lincoln by Walt Whitman "the most sonorous anthem ever chanted in the church of the world." Such praise may be too high for the poem, but it can hardly be denied a place among the great elegies of the English language. The highly artistic and carefully wrought structure of the poem somewhat corresponds to that of a symphony, in its varied and intricate harmonies, and its three leading motifs of the lilacs, the evening star and the song of the thrush, which, constantly recurring, finally merge into the poet's song of love, regret and consolation. As in much of Whitman's best work, nature is here not a mere background, but is suffused with human feeling and becomes one with it. The scenes before the house in the dusk and in the swamp with the thrush, the vast panorama of country and town which loved Lincoln and which now laments him—these are not mere pictures, but realities; are not apart from the human passions of the poem, but an essential ingredient of them. The free verse, with its irregular rhythms and its lines of varying length, permits an immense range of emotional effects, of exquisite melodies and vast harmonies, perhaps not attained by any other poem in American literature; and Whitman's characteristic magic of phrase weaves its spell in such lines as "the yellow gold of the gorgeous, indolent, sinking sun," and "the huge and thoughtful night." The elegy gives no such intellectual estimate of Lincoln as Lowell attempts in the *Commemoration Ode;* it is simply a song—a lament and a consolation. Its emotion appears as spontaneous and unstudied as it is sincere and unrestrained; but for all that the poem is none the less a nobly planned and carefully executed work of art.

MARION TUCKER.

WHERRY, William Macky, American soldier: b. St. Louis, Mo., Sept. 13, 1836; d. Nov. 3, 1918. He was educated at the University of Missouri and studied law. Serving through the Civil War, he was present at the surrender of Gen. J. E. Johnson. Brevetted brigadier general of volunteers in 1865, he was mustered out of the volunteer service in 1866, and appointed captain in the regular army. Subsequently he served on frontier duty. In the war with Spain in 1898 he took part in the battle of San Juan Hill and in the capture of Santiago. Promoted brigadier general on Jan. 7, 1899, he was retired the same month.

WHETSTONE, whĕt'stōn, any stone used for sharpening tools. Sandstones and fine mica schists form the coarser kinds. Silicious clay rocks and particularly the fine compact rocks made of quartz-mud, such as the Arkansas stone or novaculyte, form the more desirable varieties for oilstones and delicate hones.

WHEWELL, hū'ĕl, **William,** English scholar: b. Lancaster, May 24, 1794; d. Cambridge, Eng., March 6, 1866. He was graduated from Trinity College, Cambridge, in 1816, and in due course became a fellow and tutor of his college. From 1828 till 1832 Whewell was professor of mineralogy, and in 1838 was elected to the Knightbridge chair of moral philosophy, which he held till 1855. In 1841 he became master of Trinity and in this position labored earnestly and successfully to obtain for the natural and

moral sciences a better recognized position among the studies of the university. He became Fellow of the Royal Society in 1820, and was one of the first members of the British Association, of which he was president in 1841. Whewell was a strong, healthy, clear-headed man, possessed of a vigorous and capacious intellect, and endowed with extraordinary powers of acquiring and retaining knowledge. The extent and variety of his attainments were very unusual. Yet there was nothing superficial about his learning, notwithstanding the well-known *mot* of Sydney Smith, that "science was his forte and omniscience his foible." Besides other gifts, he built at his own expense, and presented to his college, a *hostel*, or collection of chambers for undergraduates. His principal writings include the Bridgewater treatise 'Astronomy and General Physics, considered with reference to Natural Theology' (1833); 'History of the Inductive Sciences' (1837); 'Philosophy of the Inductive Sciences' (1840); 'Novum Organum Renovatum'; 'Indications of the Creator'; 'History of Scientific Ideas'; 'Elements of Morality, including Polity'; 'Lectures on Systematic Morality'; 'Architectural Notes on German Churches'; 'On Liberal Education in General'; 'Lectures on the History of Moral Philosophy in England'; 'Philosophy of Discovery'; 'History of Moral Philosophy'; 'Platonic Dialogues for English Readers.' He was the author of the well-known anonymous essay, 'The Plurality of Worlds.' Consult Todhunter, 'Whewell: an Account of His Writings' (1876); 'Life,' by Mrs. Stair Douglas (1881); Clark, 'Old Friends at Cambridge and Elsewhere' (1900).

WHEY, a clear, straw-colored liquid, consisting of the part of milk which remains fluid after the milk has been curdled by the use of rennet in cheese making, or by the action of the acid in the natural souring of the milk. Its average percentage of solids is 6.96, of which .36 per cent is fat, .84 per cent proteins and 5.76 per cent chiefly sugar, with a trace of salts and other matter. Over eight billion pounds of whey are produced in the United States annually by the manufacturers of cheese and casein, and until recent years milk sugar was practically the only product made from it. Lately lactofflavin, of which whey is an excellent source, has become of great interest to feed manufacturers, some of whom sell feeds on the basis of lactofflavin content. Whey is also a practical starting material for the production of lactic acid, by a process that converts the milk sugar, nearly pound for pound, into this acid. However, by far the greater part of the whey produced in the country still runs to waste or is fed to animals.

WHIGS, a word of British origin, used for many years to designate members of an American political party. It had previously been used in America in colonial and Revolutionary times to indicate those who were opposed to the attempts of the British Crown to deprive the Americans of their political and commercial rights. It disappeared with the close of the Revolution, and did not appear again until the National Republicans, successors to the Federalists (q.v.), adopted the name of Whigs. Those Whigs who considered the slavery question settled by the compromise of 1850 were called in Massachusetts "Cotton Whigs," and in New York "Silver Grays." The Whigs continued to exist as one of the two great parties until the election of 1852, which was followed by a division on the slavery issue, the anti-slavery Whigs joining the Republican party, and the others making common cause with the Democracy.

The term was prominent in British political history for nearly two centuries to designate the political party which advocates such changes in the Constitution as tend in the direction of democracy. Defoe thus accounts for the origin of the name: "The use of it began then when the western men (the peasantry of the West Lowlands of Scotland), called Cameronians, took arms frequently for their religion. Whig is a word used in those parts for a liquor (*whig*, Scotch for *whey*), which the men used to drink . . . and so became common to the people who drank it. It afterward became a denomination of the poor harassed people of that part of the country, who, being unmercifully persecuted by the government, against all law and justice, thought they had a civil right to their religious liberties, and therefore resisted the power of the prince (Charles II)." Monmouth was sent to quell the insurrection, and "at his return he found himself ill-treated for having used the rebels too mercifully; and Lauderdale told Charles, with an oath, that the duke had been so civil to the Whigs because he was a Whig himself in his heart. This made it a court word, and in a little time the friends and followers of the duke began to be called Whigs."

A different origin is, however, assigned to the term. Sir James Balfour, in writing of an outbreak which occurred in 1648, in his own day, calls the enthusiasts "whigamores," and Burnet, who was then five years old, offers the following explanation: "The southwest counties of Scotland have seldom corn enough to serve them throughout the year, and the northern parts producing more than they need, those in the west come in the summer to buy at Leith the stores that come from the north; and from a word, whiggam, used in driving their horses, all that drove were called the whigamores, and shorter, the whiggs. After the news came of Duke Hamilton's defeat (in 1648), the ministers animated their people to rise and march to Edinburgh; and they came up, marching at the head of their parishes, with an unheard-of fury, preaching and praying as they came, . . . This was called the whigamores inroad, and ever after that, all that opposed the court came in derision to be called whigs; and from Scotland the word passed to England." The Whigs brought about the Revolution of 1688–89, and established the Protestant succession; they were chiefly instrumental in obtaining the abolition of the slave-trade and slavery, the repeal of the Test and Corporation Acts, Catholic emancipation, Parliamentary and municipal reform, the repeal of the corn-laws and similar measures. The term Liberals is now generally applied to the representatives of this party; the extreme section of the party, who agitate for sweeping innovations, usually have a more or less close connection with the Whigs, and have

adopted the name of Radicals. See also UNITED STATES—41. *Sectional Conflict and Preservation of the Union, 1815–1877.*

WHIN. See FURZE.

WHIN, hwĭn′, **WHINSTONE,** a mining term for intruded igneous or basaltic rock generally of a firm texture and resistant character. The great Whin Sill of Northumberland is a typical example.

WHINCHAT, hwĭn′chăt, a European warbler (*Saxicola rubetra*), allied to the stonechat, receives its name from its frequenting whin and furze bushes. It is also called furzechat. It possesses a long white streak, passing across the sides of the head, which, with the upper parts of the body, is colored brown. The lower part is yellowish. Its length is usually under 10 inches; it lays four to six green-blue eggs in ground nests. Its song is very sweet, and sometimes imitative. Its range is Europe, Africa, and occasionally western Asia.

WHIP SNAKE, a light brown harmless snake (*Philodryas viridissimus*) with whitish tail, closely related to the black snake. It is called also coach-whip. It is found in the southern United States, and Mexico, and is especially abundant in Texas. Its name is given it because of its general appearance. A group of very slender poisonous African and Asiatic tree snakes, the Dipsadinae, are called whip snakes. Of the subfamily, Elapidae, they are leaf-green in color, which helps to conceal them from their prey.

WHIPPING POST, a post at which punishment was inflicted by the law of England, and still exists in the State of Delaware, chiefly for minor offenses. The criminal law in England enumerates several offenses for which whipping at the post may be inflicted on males under 16. A subsequent act enacts that when the offender is under 14 the number of strokes is not to exceed 12. In Scotland no person above 16 is to be whipped for theft or crime committed against person or property. In connection with the pillory (q.v.) it flourished in America in colonial times.

WHIPPLE, hwĭp″l, **Abraham,** American naval officer: b. Providence, R. I., Sept. 26, 1733; d. near Marietta, Ohio, May 27, 1819. In the French and Indian War he commanded the privateer, *Game Cock,* and on one cruise captured 23 prizes. He had charge of the expedition which on June 8-9, 1772 destroyed the British armed cruiser, *Gaspée.* He commanded successively the *Columbus,* the *Providence,* a schooner, and its namesake, a frigate, and from 1775–1779 with the schooner, *Providence,* took more prizes and destroyed more vessels than any other commander in the colonial service. With the frigate *Providence* he evaded British surveillance and succeeded in getting to sea with important dispatches for France, and in 1779 performed the daring exploit of capturing 10 vessels from a merchant fleet of nearly 150 sail, eight of which reached Boston safely, and brought about $1,000,000 when sold. He commanded the naval forces at Charleston, S. C., in 1780, but was captured and held a prisoner until the close of the war. He commanded the vessel which in 1784 unfurled the first American flag on the river Thames.

WHIPPLE, Edwin Percy, American author and critic: b. Gloucester, Mass., March 8, 1819; d. Boston, June 16, 1886. He began writing for newspapers in 1837, became superintendent of the Merchants' Exchange reading room, 1837–1860. He first attracted attention by his critical panegyric on Thomas Babington Macaulay in the Boston *Miscellany* (1843), and in October of that year entered upon his career as lecturer, chiefly on literary topics. He contributed much to reviews and journals, and published *Essays and Reviews,* 2 vols. (1848–1849). These included discussions of *English Poets of the Nineteenth Century,* as well as of *Byron Rufus Choate,* and *Henry Fielding.* He was literary editor of the Boston *Globe* 1872–1873. The greater part of his work is composed of essays on literature and authors, though he treated other subjects with an almost equal discrimination. His *Literature of the Age of Elizabeth* (1876) probably shows him to best advantage, though his estimates of the moderns are also painstaking and for the most part just. His characterizations were penetrative, and at times very effectively expressed. He lacked, however, to a large extent, originality and power, and Whittier's declaration that "with the possible exception of Lowell and Matthew Arnold, he was the ablest critical essayist of his time" cannot now be accepted. Among his further publications are *Literature and Life* (1849), a small volume of lectures; *Character and Characteristic Men* (1866); *Success and its Conditions* (1871). Three books appeared posthumously, *Recollections of Eminent Men, with Other Papers* (1887), with an introduction by C. A. Bartol; *American Literature and Other Papers* (1887), with a brief introduction by Whittier, and containing the centennial review of American literature written in 1876 for *Harper's Magazine;* and *Outlooks on Society, Literature and Politics* (1888).

WHIPPLE, George Hoyt, American pathologist: b. Ashland, N. H., Aug. 28, 1878. He received his A.B. at Yale 1900; his M.D. at Johns Hopkins 1905. He was on the faculty of Johns Hopkins from 1905 until 1914, first as assistant in pathology, later instructor, resident pathologist, and associate professor. He went to the Panama Canal Zone in 1905 for a year as pathologist at Ancon Hospital. He was professor of research medicine at the University of California from 1914 to 1921, and from 1921 until his resignation in 1952 he was dean and professor of pathology, School of Medicine and Dentistry, at Rochester University, New York.

His researches have covered a wide field in internal medicine. His best known work deals with anemia, though he has written over 200 articles on diverse medical subjects. He was awarded the Nobel Prize for medicine, 1934, and has received many honorary degrees, and medals. He was president of the American Association of Pathologists, 1939.

WHIPPLE, Henry Benjamin, American Protestant Episcopal bishop: b. Adams, Jefferson County, N. Y., Feb. 15, 1822; d. Faribault, Minn., Sept. 16, 1901. Ill health prevented his entering college, for which he had prepared, and he engaged in business for several years. In 1847 he began a theological course privately, took priest's orders in the Episcopal Church, in 1850 and was rector of Zion Church, Rome, N. Y., 1850–1857 and of the Church of the Holy

Communion, Chicago, 1857–1859. In October 1859 he was consecrated first bishop of Minnesota. He very soon afterward organized the Seabury Mission at Faribault, out of which have since been developed the Cathedral of Our Merciful Saviour, Seabury Divinity School, the Shattuck School for boys, and Saint Mary's Hall, a school for girls. Bishop Whipple was widely known as the apostle to the Indians on account of his labors among them both for their material as well as spiritual welfare. By the Indians he was called "Straight Tongue." He thoroughly understood the Indian character and at the time of the Sioux Massacre in 1862 insisted that the trouble came directly from the false dealing of the whites with the Indians. In 1876 he secured the Sioux treaty, opening up the best portions of Dakota to white settlement, and his advice in regard to Indian affairs was sought by every President from Lincoln to McKinley. In his *Lights and Shadows of a Long Episcopate* (1899) the character of the Indian problem will be found very fully treated. Bishop Whipple traveled extensively and was well known and highly regarded in England, while in his own country he was beloved and respected by men of every creed.

WHIPPLE, Squire, American civil engineer: b. Hardwick, Mass., March 24, 1804; d. Albany, N. Y., March 15, 1888. He was graduated from Union College in 1830 and engaged in canal and railway surveying. He patented in 1840 an iron bridge truss of the bowstring type, several of which were built over the Erie Canal. After 1852 he built several bridges known as the Whipple truss, and in 1872 took out a patent for a lift drawbridge, one of which was built over the Erie Canal at Utica. He wrote *The Way to Happiness* (1847); *Treatise on Bridge Building* (1847); and *The Doctrine of Central Forces* (1866).

WHIPPLE, William, American soldier and politician: b. Kittery, Me., Jan. 14, 1730; d. Portsmouth, N. H., Nov. 28, 1785. Before 1751 he was captain of a merchantman trading with the West Indies and making voyages to Africa for slaves. But in 1760 he set up as a merchant at Portsmouth, and in 1775 was chosen a delegate to the New Hampshire provincial congress. He was also made a member of the provincial council of safety. In January 1776 he was elected to the Continental Congress, continuing to hold his seat until September 1779, and signing the Declaration of Independence. As brigadier general of New Hampshire troops, he commanded a brigade in the operations against Burgoyne in 1777, and assisted in negotiating the terms of the surrender of the British general. Commanding the New Hampshire forces, he cooperated with Sullivan in the campaign against the British in Rhode Island in 1778. From 1782 to 1784 he was superintendent of finance for New Hampshire, and from 1782 until his death a judge of the Superior Court. He was president of the commission for the adjustment of the dispute between Connecticut and Pennsylvania regarding the Wyoming Valley region.

WHIPPOORWILL, hwĭp-pŏŏr-wĭl′, a North American nightjar (*Antrostomus vociferus*). In this genus the rictal bristles are greatly developed and reach far beyond the tip of the small, weak bill, and sometimes they are fringed. The nostrils are not tubular as in *Nyctidromus*. The whippoorwill is ordinarily 10 inches long with a spread of wings of about 18 inches, the mouth bristles are simple, the tail long and rounded, and the soft lax plumage closely and delicately mottled with gray, black, white and yellowish brown, the female with the tips of the outer tail-feathers tawny, the same parts in the male white. These birds inhabit the United States and Canadian provinces east of the plains, and breed chiefly northward, throughout most of this area. Being migratory, they reach the Middle and New England States in May. The whippoorwills are strictly nocturnal, but usually become quiet by midnight, except on moonlight nights when they continue active till dawn; but at all times they are most vociferous during the early evening. The song is a clear, energetic whistle, aptly syllabified in the name, strongly accented on the last syllable, and is repeated many times; then, after a short pause begins anew. They fly noiselessly in pursuit of flying insects, skimming low over stone walls and bushes, or even alighting on the ground to pick up an insect. Large moths, nightflying beetles and insects frequenting forest borders are their chief food. When they pass close to a person at night they may be heard to utter a low murmuring sound. Unlike the great majority of birds they always perch along and not across a bough, a peculiarity which they share with other weak-footed birds. Whippoorwills do not fly abroad during cloudy days like the night hawk, and as a consequence their appearance is unknown to many persons to whom the song is quite familiar. No nest is made, and the two elliptical, creamy white eggs, marked with brown and lavender, are laid in a depression on the bare ground, or a log. When danger threatens the old birds often carry the eggs or young in their mouths to a place of safety. A much larger species of similar colors and habits, but more southern in its range, is the chuck-will's-widow (*A. carolinensis*) (q.v.). In this species the rictal bristles are provided with lateral filaments.

WHIPTAILED SCORPION. See SCORPION.

WHIRLIGIG BEETLE. See WATER-BEETLES.

WHIRLPOOL, a circular eddy or whirling current in a stream or the sea, of considerable dimensions, produced by the configuration of the channel, by meeting currents, by winds meeting tides, etc. There are some very celebrated whirlpools, such as Charybdis, in the strait between Sicily and Italy; and the Malström, off the coast of Norway. When the agitation is increased by high tides or winds they sometimes become dangerous to navigators. But large modern vessels cannot be sucked into any whirlpool, like some of the small craft of the ancients.

WHIRLWIND. See CYCLONE; WATERSPOUT.

WHISKEY or **WHISKY,** the name applied to a well-known liquor distilled from corn, bar-

ley, wheat, oats and other grains; potatoes, beet and other roots and sometimes molasses and subsequently refined, colored and flavored by various processes. However under regulations under the Federal Food and Drug Act the name whiskey alone is limited to grain distillates. Whiskey from malt alone is made in the Scotch distilleries as follows: The malt is bruised upon cylinders and the quantity intended to be mashed is put into the mash pan, water at a temperature of about 170°F. being then added. After two or three hours' agitation the whole is left to repose for an hour and a half, and then the worts are drawn off to about one-third of the water employed. About two-thirds of the first quantity of water of a somewhat higher temperature is put into the pan, and the agitation is renewed for about half an hour. After a second period of repose these second worts are drawn off. Both infusions are now cooled down as quickly as possible to the temperature of 80° or 70° to prevent souring; the wort is cooled down by being exposed in shallow coolers to currents of air, or by being passed through serpentine tubes surounded with cold water. More water may be let into the pan, and a third wort drawn off, which may be fixed with the other worts, or used instead of water for the first infusion of malt. The quantity of saccharine matter converted into alcohol depends upon the proportion of ferment or yeast introduced into the worts; if too little be used, a portion of the sugar will remain undecomposed; if too much, the spirits will have an unpleasant taste. Generally the worts are let down at the specific gravity of 1.050 or 1.060, and at a temperature of 60° to 50°. For every 100 gallons a gallon of good porter yeast is added and thoroughly incorporated by agitation. An hour after the addition of the yeast fermentation begins to show itself by a ring of froth around the edges of the vat, and in about five hours frothy bubbles cover its whole surface. Large vats generally afford a better result than small ones, owing to the equality of the fermenting process. It is considered good worts when the specific gravity comes down to that of water and superior worts when it falls to 0.995. In about 48 to 60 hours the wash begins to get clear and comparatively tranquil, and is then ready for distillation. In its simplest form the still consists of a copper boiler into which the wash is poured. This vessel is furnished with a close head terminating in a bent tube which passes in a spiral form through a vessel filled with cold water. (See DISTILLATION.) On the application of heat to the still the spirit begins to rise in vapor at 175°, along with more or less steam. These vapors are condensed in passing through the spiral tube, and trickle in fluid form into a receiver. The product of this first distillation is called low wines. This is again distilled at a lower temperature, which gets rid of part of the water and of the fetid oils that had come over with the alcohol. Great purity and strength can only be obtained by repeated distillation. The casks or packages into which these spirits go are not charred, as in the United States, but preference is given to empty wine or rum casks which impart both flavor and color, and when plain casks are used, flavoring and coloring is accomplished by means of blending wines. If nothing whatever is added to the spirits which are put in plain casks, the coloring and flavoring is attributable to the tannic acid extracted from the wood, and the oxidation of the aldehydes in combination with the ethyl alcohol.

Before prohibition in the United States, Kentucky, Maryland and Pennsylvania whiskies constituted the majority of those consumed for drinking purposes, either medicinal or otherwise. Kentucky whiskies were known as Sour Mash, Sweet Mash and Bourbons, and Pennsylvania and Maryland whiskies as Eastern Ryes. At the head of the various processes of distillation, for excellence of quality of the spirit produced thereby, stood that known as fire copper, which was the method that originally established the high reputation of whiskey in these states; those later employed, while giving a larger yield of spirit to the bushel of grain, procured it at the expense of the quality and flavor thereof. In this process the corn and rye meals were scalded or mashed, with hot spent beer, which was the liquid residue of the previous distillation. The mash was then allowed to cool to the proper temperature, when malt was added, and the mash, diluted with a sufficient quantity of water, was left to ferment the time established by law. The diluted mash when fermented was called beer. The beer was distilled in three different ways. In the very smallest distilleries, it was sometimes boiled in copper stills, over wood fires; the vapor, passing through a copper coil or worm, immersed in cold water, was condensed and delivered into a receiver. The condensed liquid was called low wines or singlings. Singlings contained only a small amount of spirit. This manner of boiling the beer was seldom used, as the large quantity of grain contained in the beer made it apt to cake in the still; and, becoming scorched, it gave the whiskey a strong, smoky flavor, a very little of which, however, was not considered objectionable. The singlings were doubled or again distilled in small copper stills, or doublers, over wood fires, and the vapor again condensed in a copper worm, whence it was delivered into the receiving cistern. Another name for doublings is high wines. The usual way of distilling sour mash whiskey was to boil the beer in a wooden still by admitting steam, the vapor being condensed into singlings; the singlings were doubled as above. In the third way the beer was boiled in a copper still by steam confined in a copper pipe placed inside the still. The singlings were doubled in small copper stills, over wood fires, in the same manner described. This latter way was considered a great improvement, as it avoided both the scorching of the grain in distilling the beer and the admission of live steam, while it preserved all the characteristics so highly prized in sour-mash, fire copper whiskies. The yield by the sour-mash process was from two to three gallons to the bushel of grain.

Most whiskey was made by the process known as steam. In this the corn and rye meals and malt were mixed with water in the mash-tub, where they were scalded with direct or live steam, introduced by means of a perforated pipe at the bottom of the tub. When fully scalded the mash was cooled down and run into the fermenting tubs. Fresh yeast was used in fermenting, which gave the name of sweet mash. The still was made of wood and divided into two or three compartments. When the still was charged a certain amount of beer was placed in each compartment, live steam was admitted into the lower, which boiled the beer, and the vapor from it

ascended through a curved pipe into the compartment above, where its continued reception boiled the charge therein contained; the vapor from this again ascended into the next compartment above, where the same process was repeated. The vapor then passed through a pipe into a wooden doubler, where it boiled the low wines; and the vapor arising thence passed into a copper worm, where it was condensed and then run into the whiskey cistern. Only one worm was used and one condensation made. High wines, as well as whiskey, was manufactured by this process. The yield was from three and a half to four and a half gallons. In making whiskey by the steam copper process, the mash was made and fermented and the beer boiled in the same manner as for the steam process. The same wooden still was used; but, instead of the vapor from the upper compartment passing directly into a wooden doubler, it was run through a worm and condensed into singlings, which was doubled in a copper still by live steam, or by steam confined in a jacket around the still, or sometimes by fire underneath.

In locating a distillery a full supply of clear, bright water that contains the proper chemical qualities is the first consideration. It is well known to both chemists and practical distillers that water containing a large quantity of sulphate of lime, earthy carbonates and no organic matter is best adapted to distilling. The lime and carbonates being dissolved in the acid generated during the fermentation of the mash mostly pass off in the form of carbonic acid gas and leave the water soft and best suited for extracting the active properties of the malt and grain. Great care has to be taken in the selection of the grain to have it well developed and sound. Musty or unsound grain is fatal to the production of fine whiskey, and its defects become more prominent as the whiskey increases in age. Those distillers most careful to manufacture only fine goods use the grain that is grown in their own section of the country in order to have both the grain and water spring from the same kind of soil. Successful fermentation requires of the distiller not only constant attention, but also extensive knowledge both of the principles of chemistry and of practical results. It is exceedingly injurious to allow the fermentation to be prematurely concluded or to proceed too long. As a general rule, the slower the fermentation and lower the heat at which the distillation is carried on, the finer and purer will be the spirit. The mash being made and fermented, and the beer distilled by whatever process, the whiskey is collected in the cistern and thence run into barrels, under the control of the United States inspector, and in the custody of the United States storekeeper, who has also charge of it while in the bonded warehouse, till the tax is paid. Barrels, and the cooperage thereof, require much attention, and must be made of well-seasoned oak. For high wines they are not charred, but for whiskey they should be well charred, as the char has some peculiar chemical effect on the character and ripening of the whiskey that is very desirable.

The subsequent purity of the product depends largely upon the care exercised by the distiller in stopping the distillation when the temperature of the vapor rises above the boiling point of ethyl alcohol and water and certain flavoring bodies depending upon the material employed.

The process of fermentation which precedes that of distillation produces a number of alcohols radically different from ethyl alcohol (which, with water, is the body of whiskies) and which seriously serve to contaminate the product. These are usually referred to by the American distiller as the "heads" and "tails," because the former have a lower boiling point than that of ethyl alcohol, and the latter a higher boiling point, as a result of which a careful distiller can separate them from the main body of the distillate which is to be perserved.

In England these heads and tails are called "feints." Among these is fusel oil, from which it is very desirable that the spirit should be freed as much as possible. This may be partially accomplished by the action of charcoal and heat, which are the principles underlying the barrel-charring process, of refining and maturation. If, however, the fusel oil contents are too large to start with, they will never be sufficiently reduced by such process to make the product wholesome and palatable. In such case, they can only be removed or reduced by a subsequent process of rectification, including redistilling and the passage of the spirits through leach tubs. It follows, therefore, from the process of manufacture, that the fusel oil contents or percentage of impurities is not fixed or constant, and this fact led to the process called blending. Under the present system of Internal Revenue Laws in the United States, distilled spirits can be sold only by one who qualifies thereunder as a wholesale liquor dealer, and such person may also be a rectifier. A rectifier is one who rectifies, purifies or refines distilled spirits, or who merely mixes without refining. Whenever it is found that whiskey which has been subjected to the barrel-charring process still contains an excessive quantity of fusel oil, or has acquired an excessive quantity of tannic acid, it can only be corrected by redistillation or other rectifying processes or by the addition thereto of ethyl alcohol and water (termed for commercial purposes either neutral spirits or cologne spirits) which contains no fusel oil and no tannic acid. One effect of charring a barrel is to produce a coating of a gummy, resinous substance beneath the char and next to the hard wood which is classed as caramel and which not only imparts a flavor, but produces about two-thirds of the color usually obtained by spirits which have been stored in such a barrel for a length of time. The other one-third of the color is imparted by the tannin or flavescin which the spirits extract from the wood.

Since neutral spirits are seldom put in charred barrels, they retain their original color, which is water white, and when they are mixed with the whiskey which has been colored, this necessarily lightens the color, which has to be restored by the addition of plain caramel. Harmless flavorings are sometimes added to modify or soften the effect of the tannin, which is a severe astringent. On account of their diminished toxicity; smoothness, which sometimes results from the addition of sugar; and improved flavor, which results from diluting or diminishing the tannic acid, acetic acid and fusel oil, blends are considered by some more desirable than a simple whiskey.

The bulk of the so-called straight or simple American whiskies were made by adding water

to the high wines or doublings in the receiving cistern until they were reduced to 100 proof, or proof—approximately half ethyl alcohol and half water—and then storing them in charred barrels.

High wines contain higher alcohols known as impurities, created during the process of fermentation. If these impurities are removed from the high wines, the spirit is then termed neutral, but that term is properly applied to it only so long as it is kept in its original condition, free from any coloring or flavoring matters. To insure this result, neutral spirits are stored in paraffined or waxed barrels. Neutral spirits when put into charred barrels are converted into whiskey, but are milder in flavor and less fiery than whiskey produced from high wines.

Whiskey ranges from 70 to 120 proof, but all spirits that have been subjected to the process usually recognized as producing whiskey are considered whiskey without reference to their proof, though regulations under the Food and Drugs Act required the proof to be between 80 and 110 if the actual proof is not stated.

Other than the above no standard for whiskey was created by the federal laws, but many of the states adopted the standard which was originally laid down in the United States *Pharmacopeia,* which required that whiskey for medicinal purposes should be approximately from 88 to 110 proof, should contain no more than traces of fusel oil from grain and oak tannin from casks, a stated limit of free acid, and show a residue from 100 cc. evaporated on a water bath and dried at 212°F., of not more than 0.5 gr. Blended whiskies more nearly meet these requirements than straight whiskies.

Whiskey, whether called straight or blended, is composed of approximately half water and half ethyl alcohol, plus a color and a flavor, and the only substantial difference between the two consists in the percentage of fusel oil and tannic acid, which exists in straight whiskies in a larger amount than in blended whiskies.

Prior to the adoption of the 18th (Prohibition) Amendment to the Constitution, which became effective Jan. 16, 1920, the greatest amount of whiskey distilled in the United States in any one year was 100,647,000 gallons in 1911. On Feb. 20, 1933, Congress passed a joint resolution submitting to the states a proposed amendment to the Constitution repealing the 18th Amendment. This proposed amendment was approved by the necessary 36 states on Dec. 5, 1933, and became immediately effective.

See also Distillation; Distilled Liquors; Distilling Industry.

WHISKEY FRAUDS, The, in American civil history, a national internal revenue scandal, which reached its climax in 1874 through the efforts of Secretary of the Treasury D. H. Bristow. Statistics showed that for some years prior to 1874 the United States had, in Saint Louis alone, lost at least $1,200,000 of revenue which it should have received from whiskey, yet special agents of the treasury set to work from time to time had failed to do more than cause an occasional flurry among the thieves. The Whiskey Ring was organized in St. Louis when the Liberal Republicans there achieved their first success. It occurred to certain politicians to have revenue officers raise a campaign fund among the distillers. This idea the officers modified later, raising money in the same way for themselves, and in return conniving at the grossest thievery. As it became necessary to hide the frauds, newspapers and higher officials were hushed, till the ring assumed national dimensions. Its headquarters were at St. Louis, but it had branches at Milwaukee, Chicago, Peoria, Cincinnati, and New Orleans, and an agent at Washington, D.C. A huge corruption fund was distributed among gaugers, storekeepers, collectors, and other officials, acording to a fixed schedule of prices. As a result of the investigation by Secretary Bristow arrests were made in nearly every leading city. Indictments were found against 152 liquor men and other private parties, and against 86 government officials, notably the chief clerk in the Treasury Department, and General Grant's private secretary, Gen. O. E. Babcock.

WHISKEY REBELLION, a popular name given to a local outbreak in opposition to the excise laws passed by Congress March 3, 1791. General objections were urged against the measure, and in western Pennsylvania the inhabitants considered the tax an unfair discrimination against their particular region and raised an insurrection. It became necessary for President Washington to call out an army of 15,000 militia to subdue the rebels, who dispersed without bloodshed.

WHISKEY RING. See Whiskey Frauds, The.

WHISPERING GALLERY, a gallery or dome of an elliptical or circular form, of peculiar acoustic qualities, arranged to echo faint sounds between certain points, the sounds being conveyed around the interior wall so that they may be readily heard, while the same are inaudible elsewhere in the interior. Thus, in an elliptical chamber, if a person standing in one of the foci speaks in a whisper, he will be heard distinctly by a person standing in the other focus, though the same sound would not be audible at the same distance under any other circumstances, or at any other place in the chamber. There is a whispering gallery in the Capitol at Washington, one at Saint Paul's Cathedral, London, and another at Gloucester Cathedral, England.

WHIST, a well-known game at cards, first clearly described by Edmond Hoyle (q.v.) in his *Short Treatise on the Game of Whist* (1743). See Bridge.

WHISTLE, a sharp, shrill, musical sound; also the instrument used to produce such a sound. An example is the policeman's whistle. A steam whistle is a sounding device connected with a steam boiler or other source of supply. It was first invented in 1826 by Adrian Stephens of Plymouth, to render audible the escape of steam from a safety valve. In one form it consists of a plate with thin edges for deflecting steam through an annular opening against the beveled rim of a hemispherical or elongated brass cup or bell.

WHISTLER, hwĭs'lẽr, **James Abbott McNeill,** American painter and etcher: b. Lowell, Mass., July 10, 1834; d. London, England, July 17, 1903. He received his first art lessons in

Russia, where his father was engaged from 1843 as an engineer supervising the construction of a railroad between St. Petersburg (now Leningrad) and Moscow. Upon his father's death in 1849, the family returned to the United States, and two years later young Whistler was appointed to the United States Military Academy at West Point. Discharged from the academy because of a failure in chemistry in 1854, he joined the United States Coast Survey as a draftsman but left this employment in the following year in order to study painting in Paris. He never returned to the United States. From 1855 to 1857 he was a pupil in the studio of Charles Gabriel Gleyre, an artist of the school of Jean Auguste Dominique Ingres. Thereafter, Whistler maintained studios alternately in Paris and in London.

Whistler's first set of etchings, known as the *Little French Series,* was published in Paris in 1858, but few copies were printed. It consists of 12 plates of figures, street scenes, and interiors. The second set, the *Thames Series* (1860), consists of 16 etchings of river scenes executed while the artist was living in Chelsea. Some rare prints of these, generally considered superior, were made before their publication in 1871. Among the best of this set are *The Pool* and *Black Lion Wharf.* Meanwhile, Whistler exhibited many paintings at the Royal Academy, one of the earliest being *At the Piano* (1860). *The White Girl,* which the academy rejected in 1863, drew great praise when it was exhibited in Paris at the Salon des Refusés. *Portrait of My Mother,* first entitled *An Arrangement in Grey and Black,* was accepted by the academy in 1872 only at the insistence of Sir William Boxall; it is now owned by the Louvre in Paris. Whistler sent other pictures, such as *The Last of Old Westminster,* to the academy, but long before his death had ceased to exhibit there, and he never became a member of the academy. Some of his best work was shown at the Grosvenor Gallery, opened by Sir Coutts Lindsay in 1877; among the paintings first seen there were such famous portraits as that of Sir Henry Irving, as well as the highly original series of *Arrangements, Harmonies,* and *Nocturnes.* It was in 1877 that John Ruskin wrote in *Fors Clavigera* of the *Nocturne, Black and Gold—The Falling Rocket,* then at the Grosvenor: "I have seen, and heard, much of Cockney impudence before now; but never expected to hear a coxcomb ask two hundred guineas for flinging a pot of paint in the public's face." Whistler brought suit for slander and was awarded damages of one farthing, which he thereafter wore on his watch chain. The costs against Ruskin were met by a public subscription. Whistler followed up the affair by a pamphlet, *Art vs. Art-Critics,* in which he first proved his cleverness in controversial satire.

He preferred to exhibit his work under conditions which he could himself direct and gave a special exhibition in 1874. Others, of prints or paintings, were held at the Fine Arts Society in 1880, 1881, 1883, 1884, and 1886. He became a member of the Royal Society of British Artists in 1884, and its president in 1886. His administration improved the quality of the exhibitions but was not commercially successful, and in 1889 he failed of re-election and many of his followers resigned. His explanation was characteristic: "It is all very simple. The Royal Society of British Artists has disintegrated—the 'artists' have come out, the 'British' remain." He failed for long to receive the recognition he deserved, but later many honors were conferred on him. He became an officer of the Legion of Honor and a member of academies in several countries, and in 1900 received gold medals at the Paris Exposition both for painting and for etching.

Whistler's etchings have been classed with those of Rembrandt. He did not keep a set of proofs or memorandums of his work and probably no complete list of his etchings, but the total is estimated at more than 400. He used an increasing economy of means; the *First Venice Series,* consisting of 12 plates published by the Fine Arts Society in 1880, and the *Second Venice Series* (53 plates; 1881) show in this respect great differences from the earlier series. The unfailing characteristics of the etchings are precision and flexibility of line and remarkable picturesqueness in the rendering of light and shade. Observation and technical skill are equally noteworthy. Outstanding among single plates are *Joe, Little Putney, Battersea Bridge, Old Chelsea,* and *Speke Hall.* Examples may be seen in the British Museum, the Metropolitan Museum of Art, the New York Public Library, the Bibliothèque Nationale, and the Venice Academy.

Whistler was also very successful in dry point and lithography. His first lithographs were made in 1877, and his London exhibition of 1883 contained a number of dry points. In 1896 about 70 lithographs were shown at the Fine Arts Society. Although he produced few pastels and water colors, some of his Venetian pastels equal anything attempted in this medium. His creed as a painter he stated in two series of *Propositions* and the lecture *Ten o'Clock* (published in 1888). One of the propositions was that a painting had "no mission to fulfill," but was a "joy to the artist, a delusion to the philanthropist, a puzzle to the botanist." Critics he considered ignoramuses, but they had their utility—"they keep one always busy, always up to the mark, either fighting or proving them idiots." For a long time, Whistler was better known in London for his pugnacity than for his art. His arrogance, his mordant wit, his sparkling bons mots, and his striking individuality were sooner recognized than his genius. His fondness for sarcasm and the severity with which he attacked those whom he did not like—and they were many—qualified him as a past master in "the gentle art of making enemies" (he published a book with this title in 1890).

His paintings exhibit a broad range of subjects. There are numerous portraits (*Miss Alexander—Harmony in Grey and Green; Rose Corder; Carlyle*); marines (*Valparaiso Harbor; Blue Wave, Biarritz; The Ocean*); and landscapes of many kinds, especially of night scenes. His method was to apply many coats of thin color instead of one or a few of great consistency, thereby guaranteeing his work greater permanance. He was above all a colorist. His work has repeatedly been compared to that of Diego Rodríguez de Silva y Velázquez, but there are important dissimilarities and Whistler must remain unique. He borrowed somewhat from Japanese art, though always subordinating these elements to his own ends.

Whistler also did some work in interior decoration, such as the Sarasate music room in Paris and the Peacock Room in the Leyland home in London. The latter is now in the Freer Gallery of Art in Washington, D.C.

Consult Lane, J. W., *Whistler* (New York 1942); Laver, James, *Whistler,* 2d ed. (London 1951); Pearson, Hesketh, *The Man Whistler* (London 1952).

WHISTLEWOOD, any tree having an easily separated bark which may be used for making whistles. In the United States the name is usually applied to the striped maple (*Acer pennsylvanicum*), a small tree or shrub common in the mountainous areas of the eastern United States and Canada. The flowers are in long axillary racemes and bloom in late spring. They are succeeded by strings of two-celled winged fruits of a yellowish green color. The slender trunks are olive green at first and then become reddish brown, striped with short, delicate white streaks. The name whistlewood is also given in the United States to the American linden or basswood (*Tilia americana*), and in Great Britain to the rowan or mountain ash, the sycamore maple, the willow, and the alder.

WHISTON, hwĭs'tŭn, **William,** English theologian and mathematician: b. Norton, Leicestershire, England, Dec. 9, 1667; d. Lyndon, Rutland, Aug. 22, 1752. He received his B.A. degree at Clare Hall, Cambridge University, in 1690, and in the following year was elected to a fellowship there. In 1693 he received his M.A. degree and was ordained a deacon and appointed chaplain to the bishop of Norwich. He became vicar of Lowestoft, Suffolk, in 1698, and deputy professor of mathematics to Sir Isaac Newton at Cambridge in 1701. Later that year, upon Newton's resignation, he succeeded to the Lucasian professorship, but, having expressed Arian views, was summarily expelled from the university in 1710. Moving to London, he published his views in *Primitive Christianity Revived* (5 vols., 1711–1712). Although he was prosecuted for heresy, the proceedings were dropped and he was permitted to remain in the Church of England. He subsequently engaged in lecturing on scientific subjects, and was one of the first to introduce lectures with experiments in London. In 1715 he founded a society for the promotion of primitive Christianity, the meetings of which were held in his home weekly for two years. Later, in 1747, he became a Baptist.

His published works include a translation of Josephus (1737), which ran through many editions; and *A New Theory of the Earth* (1696); *The Accomplishment of Scripture Prophecies* (1708); *A New Method of Discovering the Longitude* (1714); *The True Origin of the Sabellian and Athanasian Doctrines of the Trinity* (1720); *The Testimony of Phlegon Vindicated* (1732); *The Longitudes Found by the Ellipses . . . of Jupiter's Planets* (1738); and *Memoirs of the Life and Writings of Mr. William Whiston* (1749).

WHITAKER, hwĭt'ă-kĕr, **Alexander,** Anglo-American clergyman: b. Cambridge, England, 1585; d. Henrico County, Va., March 1617. He was educated at Cambridge University, receiving his B.A. degree in 1605, and his M.A. in 1608. In the latter year he was ordained in the Church of England, and in 1611 he settled in Virginia, where he was active in missionary work among the Indians at Henricopolis and Bermuda Hundreds. Whitaker baptized Pocahontas before her marriage to John Rolfe. His *Good News from Virginia,* published in London in 1613, was one of the first books written in the colonies. In it he described Virginia and urged support of the colony and conversion of the Indians.

WHITAKER, Joseph, English publisher: b. London, England, May 4, 1820; d. Enfield, Middlesex, May 15, 1895. In 1849 he founded a church monthly called the *Penny Post,* and soon thereafter established a theological publishing business. From 1856 to 1859 he was editor of the *Gentlemen's Magazine,* and in 1858 he founded the *Bookseller.* His name is commemorated in *Whitaker's Almanac,* first published in 1868. He also inaugurated the *Reference Catalogue of Current Literature* in 1874.

WHITAKER, Nathaniel, American clergyman: b. Huntington, Long Island, N. Y., November 1730; d. Hampton, Va., Jan. 26, 1795. After his graduation from the College of New Jersey (now Princeton University) in 1752, he was licensed to preach by the New York Presbytery. In 1755 he became minister of a church in Woodbridge, N. J., and in 1760 of a church in Norwich, Conn. At the request of Eleazar Wheelock (q.v.), he went to England in 1765, accompanied by Samson Occom, an Indian educated in Wheelock's school at Lebanon (now Columbia), Conn., for the purpose of soliciting funds for the school. In two years he obtained £12,000, most of which was spent for the original purpose, but some of which assisted Wheelock in founding a college in New Hampshire, chartered in 1769 as Dartmouth College (q.v.). From 1769 to 1784, Whitaker was minister of a church in Salem, Mass., and from 1785 to 1790 of one in Skowhegan, Me. During the American Revolution he was an ardent supporter of the colonial cause. His last years were spent in Virginia.

WHITBREAD, hwĭt'brĕd, **Samuel,** English politician: b. Cardington, Bedfordshire, England, 1758; d. London, July 6, 1815. He was educated at Eton College and at Christ Church, Oxford, and St. John's College, Cambridge, receiving his B.A. degree in 1784. Elected to Parliament in 1790 as Whig member for Bedford, he soon made his mark as an advocate of religious and civil liberty, the abolition of slavery, and the extension of the franchise, and as a strong opponent of the war policy of William Pitt. He took a leading part in the impeachment of Henry Dundas, 1st Viscount Melville, in 1805–1806; and against John Pitt, 2d earl of Chatham, for his mismanagement of the Walcheren Expedition in 1809. Whitbread's last years were embittered by a lengthy controversy over the rebuilding and reorganization of the Drury Lane Theatre, and he committed suicide in 1815.

WHITBY, hwĭt'bi, urban district, England, situated in the North Riding of Yorkshire, 16 miles north-northwest of Scarborough, at the mouth of the Esk River, which divides it into two parts. A fishing center and coal-exporting port, it has an excellent harbor with docks and shipyards, as well as metalworking establishments. Jet ornaments, long made here from abundant local supplies, are still manufactured, although most of the jet is now brought in from elsewhere. The section of Whitby known as West Cliff is a popular seaside resort. St. Mary's Church (13th to 16th centuries) has a cross commemorating

the Anglo-Saxon poet Caedmon, who was a monk at the abbey here. In Pannett Park there is an archaeological museum.

In 657, St. Hilda (q.v.) founded her famous abbey on the site of Whitby, then known as Streoneshalh. Here, in 664, King Oswy of Northumbria called the important Synod of Whitby, at which the Roman system of computing the date of Easter was adopted (see also EASTER). The abbey was destroyed by the Danes in 867, but was re-established by the Benedictines in 1078. The choir, north transept, and part of the nave still stand. The ruins, in Early English style, are very beautiful. Pop. (1951) 11,886.

Consult Kendall, H. P., *History of the Abbey of Whitby* (Whitby 1932); Jeffrey, P. S., ed., *Whitby Lore and Legend,* 3d ed., rev. (Whitby 1952).

WHITBY, town, Ontario, Canada, seat of Ontario County, situated on Lake Ontario, on the Canadian National and Canadian Pacific railroads, 28 miles northeast of Toronto. It is the trading center for the surrounding agricultural region and a port of entry, and has iron foundries, tanneries, and plants producing agricultural implements, mill machinery, and musical instruments. Founded in 1836, Whitby was incorporated in 1855. Pop. (1951) 7,267.

WHITCHER, hwĭch'ẽr, **Frances Miriam Berry,** American author: b. Whitesboro, N. Y., Nov. 1, 1814; d. there, Jan. 4, 1852. She was married to the Rev. B. W. Whitcher, an Episcopalian clergyman of Elmira, in 1847, the year after her humorous sketches, entitled "The Widow Bedott's Table-Talk," first appeared in Joseph C. Neal's *Saturday Gazette and Lady's Literary Museum.* They became very popular, and she contributed similar sketches to *Godey's Lady's Book.* After her death these and other articles were collected and published in *The Widow Bedott Papers* (1856) and *Widow Spriggins, Mary Elmer, and Other Sketches* (1867). See also WIDOW BEDOTT PAPERS, THE.

WHITCHURCH, hwĭt'chûrch, urban district, England, situated in Shropshire, 18 miles north of Shrewsbury and 32 miles south-southeast of Liverpool. Formerly famous for its turret clocks, it now produces metal goods and processes cheese. There is an interesting 18th century church. Pop. (1951) 6,856.

WHITCOMB, James, American public official: b. Rochester, Vt., Dec. 1, 1795; d. New York, N. Y., Oct. 4, 1852. After studying law he was admitted to the Kentucky bar in 1822, and from 1824 to 1836 practiced in Bloomington, Ind. He served in the state Senate in 1830–1831 and from 1832 to 1836, and in the latter year was appointed commissioner of the General Land Office. Moving to Terre Haute in 1841, he established a successful law practice there. Elected governor of Indiana in 1843, he served until 1848. During his tenure he reorganized the state's bonded indebtedness and promoted education and welfare. Whitcomb became a member of the United States Senate in 1849, but died before his term was completed.

WHITE, Andrew, English missionary: b. London, England, 1579; d. there, Dec. 27, 1656. A Roman Catholic, he received his education at English colleges on the Continent, and about 1605 was ordained priest at Douai, France. Returning to England, he was arrested and banished. In 1607 he entered the Jesuit novitiate at Louvain, and two years later became a member of the Society of Jesus. Subsequently he taught theology and Hebrew in Spain and Flanders, meanwhile serving on secret missions in England. He made the acquaintance of George Calvert, 1st Baron Baltimore, and in 1633 was chosen head of the Jesuit mission in Maryland, arriving in the colony early in the following year. In addition to his work among the settlers, White maintained successful missions with the Indians, and he compiled an Indian grammar, catechism, and dictionary. When William Claiborne (q.v.) gained control of Maryland in 1644, White was imprisoned and in the following year was sent to London. Brought to trial for treason, he pleaded that he had been brought to England involuntarily, and was therefore merely banished. After a few months' exile in the Low Countries, he returned secretly to England, where he spent the remainder of his life on missions and as a chaplain.

WHITE, Andrew Dickson, American educator and diplomat: b. Homer, N. Y., Nov. 7, 1832; d. Ithaca, N. Y., Nov. 4, 1918. He was graduated from Yale College in 1853 and subsequently studied at the Collège de France and the Sorbonne in Paris and at the University of Berlin. He received his M.A. degree from Yale in 1856. In 1854–1855 he served as attaché at the American legation in St. Petersburg (now Leningrad), and in 1857, shortly after his return to the United States, became professor of history at the University of Michigan. Returning to New York State in 1863 to settle his father's estate, he was elected to the state Senate, where he served until 1867. White was particularly interested in educational legislation, and he obtained passage of bills organizing the state normal school system and codifying the New York educational laws. With Ezra Cornell (q.v.), he helped to draw up the charter of Cornell University in 1865. He contributed $300,000 to the university and procured for it the federal land grant for agricultural colleges. When it opened in 1868, he was its first president and also served as professor of history, continuing in both capacities until 1885. When he left the university, he gave it his excellent historical library of over 40,000 volumes. On the acceptance of this gift, the departments of history and economics were reorganized as the President White School of History and Political Science.

While president of Cornell, White was active in public affairs. In 1871 he was a member of a commission to study and report on the desirability of annexing Santo Domingo, and in 1878 was honorary commissioner to the Paris Exposition. From 1879 to 1881, while on leave from Cornell, he served as minister to Germany. In 1884 he helped to found the American Historical Association, and served as its first president. After retiring from the university, White traveled in Europe for his health. From 1892 to 1894 he was minister to Russia, and in 1896–1897 served as a member of a commission investigating the boundary between Venezuela and British Guiana. In the latter year he was again appointed minister to Germany, serving in this post until 1902, when he retired from public life.

He was chairman of the United States delegation to the First Hague Conference (1899).

White was the author of a number of books, including *History of the Warfare of Science with Theology in Christendom* (2 vols., 1896), an enlargement of *The Warfare of Science* (1876); *Fiat Money in France* (1896), a revision *of Paper-Money Inflation in France* (1876); *Autobiography of Andrew Dickson White* (2 vols., 1905); *Seven Great Statesmen in the Warfare of Humanity with Unreason* (1910); and *The Work of Benjamin Hale* (1911).

Consult Rogers, W. P., *Andrew D. White and the Modern University* (Ithaca, N. Y., 1942).

WHITE, Charles Abiathar, American geologist and paleontologist: b. North Dighton, Mass., Jan. 26, 1826; d. Washington, D.C., June 29, 1910. In 1838 his family moved to Iowa, where he became interested in collecting fossils. After studying medicine in the office of a physician and at the University of Michigan, he attended Rush Medical College in Chicago, from which he was graduated in 1864. He practiced in Iowa City for two years, but preferred geology to medicine, and in 1866 became state geologist of Iowa, a post he retained until 1870. From 1867 to 1874 he taught geology at Iowa State University, and from 1874 to 1875 at Bowdoin College. After serving as geologist and paleontologist on various surveys, he was appointed (1879) curator of invertebrate fossils at the National Museum in Washington. From 1882 to 1892 he was geologist of the United States Geological Survey. His published works include *Manual of Physical Geography of Iowa* (1873); *Report on Invertebrate Fossils and Surveys West of the 100th Meridian* (1875); *Bibliography of North American Invertebrate Paleontology* (1878); *Review of the Fossil Ostreidae of North America* (1883); and *The Relation of Biology to Geological Investigation* (1894).

WHITE, David, American geologist and paleobotanist: b. near Palmyra, N. Y., July 1, 1862; d. Washington, D.C., Feb. 7, 1935. After being graduated from Cornell University in 1886, he joined the United States Geological Survey, for which he did research in paleobotany. From 1912 to 1922 he was its chief geologist. White's special field was paleozoic paleobotany, and he served as curator of this branch at the Smithsonian Institution in Washington from 1903 until his death. He was the author of *Fossil Flora of the Lower Coal Measures of Missouri* (1899) and many other scientific reports and papers.

WHITE, E(lwyn) B(rooks), American writer: b. Mount Vernon, N. Y., July 11, 1899. During World War I he served in the army, and in 1921 was graduated from Cornell University. After working as a reporter for several years he joined the staff of the *New Yorker* as a free-lance writer and contributing editor, for 11 years writing most of "The Talk of the Town." He then retired to Brooklin, Me., though continuing as an editorial writer and contributor of the magazine. From 1938 to 1943 he conducted the department "One Man's Meat" in *Harper's Magazine*. A notable essayist and humorist, he published *The Lady Is Cold* (1929); *Is Sex Necessary?* (with James Thurber, 1929); *Every Day Is Saturday* (1934); *The Fox of Peapack* (1938); *Quo Vadimus* (1939); *One Man's Meat* (1942); *Stuart Little* (1945); *The Wild Flag* (1946); *Here Is New York* (1949); and *Charlotte's Web* (1952). With his wife, Katharine S. White, he edited *A Subtreasury of American Humor* (1941).

WHITE, Edward Douglass, American jurist: b. Lafourche Parish, La., Nov. 3, 1845; d. Washington, D.C., May 19, 1921. He was educated at Mount St. Mary's College, Emmitsburg, Md., the Jesuit College in New Orleans, and Georgetown College in Washington. In 1861 he joined the Confederate Army, serving until 1863, when he was captured at Port Hudson and paroled. Subsequently he studied law, and in 1868 was admitted to the Louisiana bar. He served as state senator in 1874, associate justice of the state supreme court in 1879–1880, and United States senator in 1891–1894. While still a member of the Senate, he was appointed associate justice of the United States Supreme Court and in 1910 was chosen chief justice.

White wrote opinions in more than 700 cases, in most of which he assumed a middle-of-the-road position. He is best known for the rule of reason, which he first formulated in 1897, and which he applied notably in the American Tobacco Company and Standard Oil Company antitrust cases. In *Wilson* vs. *New,* he wrote the majority opinion upholding the Adamson Act of 1916, which established minimum wages for railway employees.

Consult Klinkhamer, M. C., *Edward Douglass White, Chief Justice of the United States* (Washington 1943).

WHITE, Frank, American public official: b. Stillman Valley, Ill., Dec. 12, 1856; d. Washington, D.C., March 23, 1940. He studied engineering at the University of Illinois, from which he was graduated in 1880, and a few years later moved to North Dakota, where he became active in politics as a Republican. He served in the North Dakota House of Representatives from 1891 to 1893, and in the state Senate from 1893 to 1899. During the Spanish American War he served in the Philippines as major of the 1st North Dakota Volunteer Infantry, and during World War I as a colonel in the 41st Division. White was governor of North Dakota from 1901 to 1905, and treasurer of the United States from 1921 to 1928.

WHITE, Sir George Stuart, English soldier: b. Whitehall, County Antrim, Northern Ireland, July 6, 1835; d. London, England, June 24, 1912. He was educated at Sandhurst Royal Military College, and entered the army in 1853. He served in the Indian Mutiny (1857–1859) and in the Second Afghan War (1878–1880), in which he won the Victoria Cross. In 1880 he was appointed military secretary to the viceroy of India and brevet lieutenant colonel of the Gordon Highlanders. He served as assistant quartermaster general in Egypt in 1884–1885, and distinguished himself in the Third Burmese War in 1886. He was knighted in that year, and three years later was promoted to the rank of major general. After several years' service in the North-West Frontier and Baluchistan, he was appointed commander in chief of the British forces in India, serving in this capacity from 1893 to 1897, when he became quartermaster general at the War Office in London. As commander in Natal, he defended Ladysmith for

119 days (Nov. 2, 1899–Feb. 28, 1900) against the Boers, finally being relieved by the 12th Earl Dundonald. From 1900 to 1904 he was governor of Gibraltar, and in 1903 was appointed field marshal. In 1905 he received the Order of Merit and was transferred to the governorship of Chelsea Hospital, serving in this office until his death.

WHITE, Gilbert, English clergyman and naturalist: b. Selborne, Hampshire, England, July 18, 1720; d. there, June 26, 1793. He was graduated from Oriel College, Oxford, in 1743, became a fellow of the college in the following year, and received his M.A. degree in 1746. After taking deacon's orders in 1747, he acted as curate to an uncle, Charles White, in Swarraton. Having been ordained priest, he was for a short period in 1751 curate to the vicar of Selborne. Appointed dean of his college in 1752, he soon thereafter became curate of Durley, near Bishop's Waltham, Hampshire. Although he failed to secure the provostship of Oriel in 1757, he obtained the vicarage of Morton-Pinkney, Northamptonshire, which was in the gift of his college. He never resided there, however, and throughout his life remained closely associated with the Hampshire parish which he made famous. About 1758 he gave up the Durley curacy for that of Faringdon, near his home in Selborne, though for a time he acted as curate of West Deane, Wiltshire.

White's great classic, *The Natural History and Antiquities of Selborne,* was published at the end of 1788, with the date 1789 on the title page. It consists of letters to two friends, Thomas Pennant, author of *British Zoology,* and Daines Barrington, who devised the form of the *Naturalist's Journal* which White kept from 1767, when he discontinued the *Garden Kalendar,* begun in 1751. In preparing the section on antiquities, which he compiled only when he had been induced to publish his work, he was greatly assisted by Richard Chandler, the classical antiquary and traveler. *The Natural History of Selborne* has won the enthusiastic admiration of readers of widely varying tastes, and has been published in many editions. White was a keen observer, and his descriptions of plants and animals contain very few errors.

Consult Martin, E. A., *Bibliography of Gilbert White, the Naturalist and Antiquary of Selborne,* rev. and enl. (London 1934); Scott, W. S., *White of Selborne and His Times* (London 1946).

WHITE, Henry, American diplomat: b. Baltimore, Md., March 29, 1850; d. Pittsfield, Mass., July 15, 1927. He was privately educated in the United States and Europe and entered the United States diplomatic service. After serving as secretary of the American legation in Vienna, he became second secretary (1884–1886) and then first secretary (1886–1893) of the embassy in London. During his stay there he frequently acted as chargé d'affaires, and in 1886 was special American representative at an international conference for the abolition of sugar bounties. White's diplomatic service was interrupted by the administration of Grover Cleveland, but in 1897 he was reappointed secretary of the embassy in London by President William McKinley, and occupied that office until 1905, when he became ambassador to Italy. He was ambassador to France in 1907–1909, and in 1910 served as head of the American delegation to the Fourth Pan American Conference in Buenos Aires and as special ambassador to Chile. As American representative at the Algeciras Conference on Moroccan affairs in 1906, he helped settle the differences between France and Germany. In 1917–1918 he was regional director of the American Red Cross, and in 1918–1919 served as a member of the United States delegation to the Paris Peace Conference, in which he worked on the Commission of International Régime of Ports, Waterways, and Railways.

Consult Nevins, Allan, *Henry White: Thirty Years of American Diplomacy* (New York 1930).

WHITE, Henry Kirke, English poet: b. Nottingham, England, March 21, 1785; d. Cambridge, Oct. 19, 1806. The son of a butcher, he was first apprenticed to a stocking weaver and later to an attorney, in whose office he devoted his spare time to the study of Latin and Greek and to writing poetry. In 1803 he published *Clifton Grove, a Sketch in Verse, with Other Poems,* which won him the attention and friendship of Robert Southey and other men of letters. He obtained a sizarship at St. John's College, Cambridge, in 1804, and, after a year's preparation, began studying there. His early death from tuberculosis shocked his friends, and his work tended to be overvalued by his contemporaries. After his death his manuscripts were placed in the hands of Southey, who edited his poems, letters, and other writings, and published them under the title *The Remains of Henry Kirke White . . . with an Account of His Life* (2 vols., 1807). Of his principal poem, *The Christiad,* only a fragment is extant. White will be longest remembered for his hymn *Oft in danger, oft in woe.*

WHITE, Henry Seely, American mathematician and educator: b. Cazenovia, N. Y., May 20, 1861; d. Poughkeepsie, N. Y., May 20, 1943. He was graduated from Wesleyan University in 1882 and received his Ph.D. degree at Göttingen in 1891. From 1892 to 1905 he was professor of pure mathematics at Northwestern University, also serving as secretary of the faculty there in 1903–1905. In the latter year he became professor of mathematics at Vassar College and continued to teach there until his retirement in 1936. White was president of the American Mathematical Society in 1907–1908, and was elected to the National Academy of Sciences in 1915. He was associate editor of the *Transactions* of the American Mathematical Society from 1902 to 1906, and editor from 1907 to 1913. He specialized in geometry and published *Plane Curves of the Third Order* (1925).

WHITE, Horace, American journalist: b. Colebrook, N. H., Aug. 10, 1834; d. New York, N. Y., Sept. 16, 1916. He was graduated from Beloit College in 1853, and in the following year became city editor of the Chicago *Evening Journal,* and in 1855 Chicago agent of the Associated Press. In 1857 he joined the editorial staff of the Chicago *Tribune,* and in the following year reported the Lincoln-Douglas debates for that paper. During the Civil War he was the *Tribune's* Washington correspondent and also served as clerk of the Senate Committee on Military Affairs. With two other newspapermen, he headed a syndicate for the publication of Civil War news in 1864–1865. Returning to Chicago,

he was editor in chief of the *Tribune* until 1874, when he went to New York as treasurer of the Oregon Railway & Navigation Company. In 1881 he joined the staff of the New York *Evening Post,* and from 1899 to 1903 served as editor in chief. His editorials opposing the Spanish American War, the annexation of Hawaii, and the Philippines campaign attracted wide notice. In 1908, Governor Charles Evans Hughes appointed him to a state commission on speculation in securities and commodities.

White published a number of notable works, including *Money and Banking, Illlustrated by United States History* (1895) and *The Life of Lyman Trumbull* (1913), and he edited several French and Italian works on finance.

WHITE, Horatio Stevens, American educator: b. Syracuse, N. Y., April 23, 1852; d. Cambridge, Mass., Dec. 12, 1934. After graduating from Harvard University in 1873, he studied in Europe and in 1878 was admitted to the New York bar. From 1876 to 1878 he was assistant professor of Greek and Latin at Cornell University, and from 1878 to 1883 assistant professor of German. He became professor of German in 1883, and head of the German department in 1891. In 1902 he went to Harvard as professor of German, becoming professor emeritus in 1919. White edited *Selections from Lessing's Prose, Text and Notes* (1888); *Selections for German Prose Composition* (1891); and Appleton's Twentieth Century Series of German Classics (1901–1905); and he wrote *Memorial of Willard Fiske* (3 vols., 1920–1922) and *Willard Fiske—A Biographical Study* (1925).

WHITE, Howard Judson, American architect: b. Chicago, Ill., Feb. 21, 1870; d. there, Dec. 18, 1936. After working as a draftsman for several architects in Chicago, he was employed by the firm of D. H. Burnham & Co. in 1898. When the firm was reorganized as Graham, Burnham & Co. in 1912, he became a member of it, and, in 1917, of its successor firm, Graham, Anderson, Probst & White. Among the many notable buildings he designed were the Field Building, Field Museum, Wrigley Building, and Union Station in Chicago; the Equitable Building and the Chase National Bank in New York; the Selfridge Stores in London; and the Union Trust Building and Union Station in Cleveland.

WHITE, Hugh Lawson, American lawyer and politician: b. Iredell County, N. C., Oct. 30, 1773; d. near Knoxville, Tenn., April 10, 1840. After serving as a volunteer against the Cherokees in 1792, he studied law and began to practice in Knoxville in 1796. He was judge of the Tennessee Superior Court (1801–1807), state senator (1807), United States district attorney (1808), again state senator (1809), and presiding judge of the Tennessee Supreme Court of Errors and Appeals (1809–1815). From 1812 to 1827 he served as president of the Bank of the State of Tennessee, and from 1821 to 1824 as United States commissioner for the adjustment of claims against Spain. In 1825 he was elected to the United States Senate, succeeding Andrew Jackson. As a strict constructionist, he opposed the making of internal improvements by the federal government and was a leader in the movement which resulted in the withdrawal of government deposits from the Second Bank of the United States. From 1834 he engaged in a political feud with Jackson. In 1836 he was nominated for the presidency, but, carrying only Georgia and Tennessee, failed to prevent the election of Martin Van Buren, who was Jackson's choice. In 1838 he declared himself a Whig, and two years later he resigned from the Senate because of his unwillingness to vote for the subtreasury bill, as he had been instructed to do by the Tennessee legislature.

WHITE, Israel Charles, American geologist: b. Monongalia County, Va. (now W. Va.), Nov. 1, 1848; d. Baltimore, Md., Nov. 25, 1927. He was graduated from West Virginia University in 1872, and in 1875 became assistant geologist of the Pennsylvania Geological Survey, a post he retained until 1884, when he joined the United States Geological Survey, with which he remained until 1888. From 1877 to 1892 he was professor of geology at West Virginia University, and from 1897 until his death was superintendent of the West Virginia Geological Survey. White was one of the founders of the Geological Society of America, and served as its president in 1920. He is known for the anticlinal theory for locating oil and gas deposits, which he formulated about 1883.

WHITE, James, Canadian geographer: b. Ingersoll, Ontario, Canada, Feb. 3, 1863; d. Ottawa, Ontario, Feb. 26, 1928. He was educated at the Royal Military College, Kingston, and in 1884 joined the Geological Survey of Canada as a geographer, a post he retained until 1899, when he was appointed chief geographer of the Department of the Interior. In 1909 he became secretary of the Royal Conservation Commission, and served as its deputy head from 1913 to 1921, when he resigned to become technical adviser to the minister of justice. In 1927 he was elected chairman of the Geographic Board of Canada. His published works include *Altitudes in Canada* (1901); *Dictionary of Altitudes in Canada* (1903); *The Atlas of Canada* (1906); *Place-Names in Quebec* (1910); *Place-Names in Northern Canada* (1910); *Place-Names in the Thousand Islands* (1910); and *Boundaries and Treaties* (1913).

WHITE, James William, American surgeon: b. Philadelphia, Pa., Nov. 2, 1850; d. there, April 24, 1916. He was graduated in 1871 from the University of Pennsylvania with the degrees of M.D. and Ph.D., and in 1871–1872 served on Louis Agassiz' staff in the Hassler Expedition to the West Indies and around South America. He served successively as resident physician at the Philadelphia Hospital (1873) and at the Eastern State Penitentiary (1874–1876), and in 1876 was attached to the surgical staff of the hospital of the University of Pennsylvania, where he lectured on genitourinary surgery. From 1887 to 1900 he was professor of clinical surgery at the university, and from 1900 until his retirement in 1911, John Rhea Barton professor of surgery. In 1915 he was attached to the American Ambulance Hospital in Neuilly, France. He left a bequest of $400,000 to the University of Pennsylvania.

From 1892 to 1916, White edited the *Annals of Surgery,* and he published *An American Text-Book of Surgery* (with W. W. Keen, 1892); *Genito-Urinal Surgery and Venereal Diseases*

(with Edward Martin, 1897); and *Human Anatomy* (1906).

WHITE, John Blake, American painter: b. near Eutaw Springs, S. C., Sept. 2, 1781; d. Charleston, S. C., Aug. 24, 1859. After studying law in Charleston, he went to London, where he studied painting under Benjamin West from 1800 to 1803. Returning to the United States, he attempted unsuccessfully to establish himself in Charleston and then in Boston as an artist, and in 1804 resumed the study of law in Charleston, where he was admitted to the bar in 1808. He built up a flourishing practice and served several terms as a member of the South Carolina legislature. Meanwhile he continued to paint, and it is as an artist that he is best known. White's most celebrated picture, *Minister Poinsett Unfurling the United States Flag in the City of Mexico During the Mexican Riots,* was destroyed during the Civil War. Among those that have been preserved are four in the Capitol in Washington: *Battle of Fort Moultrie; General Marion Inviting a British Officer to Dinner; Mrs. Motte Directing Marion and Lee to Burn Her Mansion to Dislodge the British;* and *Sargents Jasper and Newton Rescuing American Prisoners from the British.* He also painted many portraits, among them ones of John C. Calhoun, Charles C. Pinckney, and Henry Middleton, and he was the author of a number of plays, including *Foscari, or the Venetian Exile* (1806); *The Mysteries of the Castle* (1807); *Modern Honor* (1812); *The Triumph of Liberty, or Louisiana Preserved* (1819); and *Intemperance* (1839).

WHITE, John Hazen, American clergyman: b. Cincinnati, Ohio, March 10, 1849; d. Sea Breeze, Fla., March 16, 1925. He was graduated from Kenyon College in 1872, and from the Berkeley Divinity School, Middletown, Conn., in 1875. Ordained in the Protestant Episcopal Church in 1876, he served as rector of Grace Church, Old Saybrook, Conn., from 1878 to 1881; of Christ Church, Joliet, Ill., from 1881 to 1889; and of St. John's Church, St. Paul, Minn., from 1889 to 1891. In the latter year he became warden of the Seabury Divinity School, Faribault, Minn., remaining in this office until 1895, when he was consecrated bishop of Indiana. On the division of the diocese in 1899, White chose the northern portion with the title of bishop of Michigan City.

WHITE, John Williams, American Greek scholar: b. Cincinnati, Ohio, March 5, 1849; d. Cambridge, Mass., May 9, 1917. After being graduated from Ohio Wesleyan University in 1868, he studied in Germany and traveled in Greece. In 1873 he published an edition of Sophocles' *Oedipus Tyrannus,* and in the following year became tutor of Greek at Harvard. After receiving his M.A. and Ph.D. degrees there in 1877, he was appointed assistant professor of Greek, and in 1884 full professor, retiring in 1909. He was of considerable assistance to Charles W. Eliot in introducing new methods at Harvard. White was an excellent teacher, and he was responsible for a number of innovations, including the wide use of sight translations in the study of Latin and Greek and the production of classical Greek plays in Greek. In 1879 he helped to organize the Archaeological Institute of America, and he served as its president for five years. He was also one of the founders of the College Series of Greek Authors, and with James B. Greenough began the *Harvard Studies in Classical Philology.* His published works include a number of textbooks, many papers, and *The Verse of Greek Comedy* (1912) and *The Scholia on the Aves of Aristophanes* (1914).

WHITE, Joseph Blanco, British theological writer: b. Seville, Spain, July 11, 1775; d. near Liverpool, England, May 20, 1841. His father was Irish and his mother Spanish, and he was brought up in Seville, where he studied at the university and was ordained subdeacon (1796) and priest (1800) in the Roman Catholic Church. In 1802 he was appointed chaplain in the Chapel Royal of San Fernando at Seville, but in 1810, having lost his faith, he withdrew from the priesthood and went to England, where he edited (1810–1814) a patriotic newspaper, *Español,* which was circulated in Spain (partly by the British government) to assist the national struggle against Napoleon. In 1814, White was ordained in the Church of England. He began contributing in 1820 to the *New Monthly,* edited by Thomas Campbell (q.v.), and in 1825 published *Evidences Against Catholicism.* In 1826 he received an M.A. degree from Oxford, and settled there at Oriel College, where he became friendly with John Henry Newman, Edward Pusey, and other leaders of the Oxford movement, who learned from him much concerning Roman Catholic theology. From 1832 to 1835, White lived in Dublin as a tutor to Archbishop Richard Whately's family, and then became a Unitarian.

White is best known to literature by his sonnet *Night and Death,* which Samuel Coleridge, in a letter of 1827, declared to be the finest in the English language. Among his other published works are *Letters from Spain; by Don Leucadio Doblado* (1822); *Second Travels of an Irish Gentleman in Search of a Religion* (2 vols., 1833), written in answer to Thomas Moore's *Travels of an Irish Gentleman in Search of a Religion;* and *Observations on Heresy and Orthodoxy* (1835).

WHITE, Peregrine, the first child born in New England of English parents: b. on board the *Mayflower,* off Cape Cod, Mass., Nov. 20, 1620; d. Marshfield, Mass., July 22, 1704. He was the son of William and Susanna White. During the colonists' first winter at Plymouth his father died, and in 1621 his mother married Governor Edward Winslow (q.v.). This was the first wedding in New England. Because of his birth, White received a grant of 200 acres of land from the General Court of Massachusetts. A leading citizen of Marshfield, he filled numerous civil and military offices during his long life.

WHITE, Richard Grant, American essayist and critic: b. New York, N. Y., May 23, 1821; d. there, April 8, 1885. He was graduated from the University of the City of New York (now New York University) in 1839, and then studied medicine and law, being admitted to the bar in 1845. From 1846 to 1859 he was a critic of music, art, and literature for the *Morning Courier and New-York Enquirer,* and in music particularly was one of the best critics of the period. After a short period with the New York *World* (1860–1861), he joined the staff of the New

York Custom House, serving as chief clerk of the marine revenue bureau, a post he retained until 1878.

White was best known as a Shakespearean scholar. He contributed articles on Shakespeare to *Putnam's Magazine* and other periodicals, and in 1854 published *Shakespeare's Scholar.* His 12-volume edition (1857–1866) of *The Works of William Shakespeare* was republished in 1883 as the popular 3-volume *Riverside Shakespeare.* He also wrote a number of philological studies, including *Words and Their Uses* (1870) and *Every-day English* (1880). Among his other published works are *Handbook of Christian Art* (1853); *The New Gospel of Peace* (4 vols., 1863–1866), a satire on the Copperheads; *England Without and Within* (1881); a novel, *The Fate of Mansfield Humphreys* (1884); and the posthumous *Studies in Shakespeare* (1886). White was one of the most influential critics of his time. Although he was at times dogmatic and quick to generalize, his criticism was vigorous, acute, and frequently brilliant. His scholarship was substantial, his style readable and often marked by satire.

WHITE, Stanford, American architect: b. New York, N. Y., Nov. 9, 1853; d. there, June 25, 1906. The son of Richard Grant White (q.v.), he entered the employ of the architectural firm of Gambrill & Richardson in 1872, and remained there for 12 years. At first strongly influenced by the Romanesque work of Henry H. Richardson, whose chief assistant he was in the construction of Trinity Church, Boston, he subsequently modeled his designs on classical forms. In 1878–1879 White traveled in Europe. On his return he formed with Charles F. McKim and William R. Mead the influential firm of McKim, Mead & White. Among the numerous notable buildings he designed were Madison Square Garden (the old building on Madison Square, since demolished), Madison Square Presbyterian Church (also demolished), the Players Club, Washington Arch, and the Century and Metropolitan clubs, in New York; many fine residences in New York, Newport, and the Berkshires; several buildings for the restoration of the University of Virginia; and the Battle Monument at the United States Military Academy, West Point. His career was cut short in 1906, when he was murdered on the roof of Madison Square Garden by Harry K. Thaw.

WHITE, Stewart Edward, American fiction writer: b. Grand Rapids, Mich., March 12, 1873; d. San Francisco, Calif., Sept. 18, 1946. After graduation from the University of Michigan in 1895, he studied at Columbia Law School for two years, but devoted most of his time thereafter to writing. During World War I he served as a major of field artillery. His published works, most of which are adventure tales set in the West, include *The Westerners* (1901); *The Blazed Trail* (1902); *The Forest* (1903); *The Mystery* (1907); *The Rules of the Game* (1909); *The Land of Footprints* (1912); *Gold* (1913); *The Rediscovered Country* (1915); *The Gray Dawn* (1915); *Simba* (1918); *The Forty Niners* (1918); *The Rose Dawn* (1920); *Daniel Boone* (1922); *On Tiptoe* (1922); *The Glory Hole* (1924); *Credo* (1925); *Back of Beyond* (1927); *Dog Days* (autobiography, 1930); and *Stampede* (1942).

WHITE, Sir Thomas, English merchant: b. Reading, England, 1492; d. Oxford, Feb. 12, 1567. He engaged in business as a clothier from 1523, and in 1535 was master of the Merchant Taylors' Company. Increasingly prosperous, he made large loans to Coventry and Bristol, and held civic office as alderman (1544) and sheriff (1547) of London. In 1553 he helped to promote the Muscovy Company, and in the same year was elected lord mayor, in which office he was of considerable assistance to Mary Stuart on her accession to the throne. White was deeply interested in education. He was one of the founders of the Merchant Taylors' School, and in 1560 he founded St. John's College, Oxford, to which he gave a liberal endowment.

WHITE, Walter (Francis), American author and Negro leader: b. Atlanta, Ga., July 1, 1893; d. New York City, March 21, 1955. A graduate of Atlanta University (1916), he became assistant secretary of the National Association for the Advancement of Colored People in 1918, was made the organization's acting secretary in 1929, and its secretary in 1931. In his work with the association he did much to improve conditions of American Negroes, and to further good interracial relations. He was awarded the Spingarn Medal in 1937 for his fight against lynching. His published works include *Fire in the Flint* (novel, 1924); *Flight* (novel, 1926); *Rope and Faggot—A Biography of Judge Lynch* (1929); *A Rising Wind* (1945); and *A Man Called White* (autobiography, 1948).

WHITE, William, American clergyman: b. Philadelphia, Pa., April 4, 1748; d. there, July 17, 1836. He was graduated from the College of Philadelphia (forerunner of the University of Pennsylvania) in 1765, and in 1770 was admitted to the diaconate of the Church of England by the bishop of London, and two years later to the priesthood by the bishop of Norwich. Upon his return to Pennsylvania, he became assistant minister of Christ Church, Philadelphia, and in 1776 rector, an office he held until his death. In 1777 he was chaplain to the Continental Congress, and in 1782 the degree of D.D., the first honorary degree of the University of Pennsylvania, was conferred on him. The meeting which issued the summons for a convention preparatory to organizing the Protestant Episcopal Church was held at his house in 1784, and he presided over its first general convention in 1789. With William Smith, he prepared the American revision of the Book of Common Prayer. He originated the principle of joint participation by the laity in church government, and he drafted the first constitution of the church. In 1786 he was elected bishop of Pennsylvania and was consecrated in England in the following year. From 1796 until his death he served as presiding bishop of the church. During his tenure he endeavored to conciliate conflicting views among Episcopalians and to cooperate with other denominations. He was an early sponsor of the Sunday school movement.

White's published works include *Christian Baptism* (1808); *Lectures on the Catechism* (1813); *Comparative Views of the Controversy Between the Calvinists and the Arminians* (2 vols., 1817); and *Memoirs of the Protestant Episcopal Church in the United States of America* (1820).

WHITE, William Alanson, American neurologist and psychiatrist: b. Brooklyn, N. Y., Jan. 24, 1870; d. Washington, D.C., March 7, 1937. He studied at Cornell University from 1885 to 1889, and in 1891 was graduated with the degree of M.D. from Long Island Medical College. From 1892 to 1903 he served as assistant physician at the Binghamton State Hospital for the Insane, and after 1903 as superintendent of St. Elizabeth's Hospital, Washington, D.C. He was professor of nervous and mental diseases at Georgetown University from 1903, and at George Washington University from 1904, and he also lectured at the United States Naval and Army Medical School. White was an early follower of Sigmund Freud, and he introduced new methods of psychiatric treatment in the United States. He served as president of the American Psychiatric Association and the American Psychoanalytic Association. He prepared several medical treatises with Smith Ely Jelliffe (q.v.), and was the author of *Mental Mechanisms* (1911); *Principles of Mental Hygiene* (1917); *Foundations of Psychiatry* (1921); *Insanity and the Criminal Law* (1923); *Outlines of Psychiatry* (11th ed., rev., 1926); *The Major Psychoses* (1928); and *Crimes and Criminals* (1933).

WHITE, William Allen, American writer and journalist: b. Emporia, Kans., Feb. 10, 1868; d. there, Jan. 29, 1944. His father, Dr. Allen White, was a country doctor and merchant, and his mother, Mary Hatton White, a pioneer school teacher. When he was 10 years old, the family moved to El Dorado, and he received his preparatory education there. He attended the College of Emporia and the University of Kansas, setting type in newspaper offices to help support himself. He became so attracted to newspaper work that he left college before graduation to become business manager of the El Dorado *Republican,* and to hold various other jobs in journalism. In 1895 he bought the Emporia *Gazette,* then an obscure country paper, and embarked on a campaign opposing William Jennings Bryan. His fervid editorial, "What's the Matter with Kansas?" made him famous overnight. His first published volume, a collection of short stories called *The Real Issue and Other Stories* (1896), proved popular, and was followed by other volumes, including *The Court of Boyville* (1899); *In Our Town* (1906); *A Certain Rich Man* (1909); *In the Heart of a Fool* (1918); and *The Martial Adventures of Henry and Me* (1918). Never an orthodox adherent of the Republican Party, he supported Theodore Roosevelt's Bull Moose campaign in 1912. In 1923 his eloquent editorial entitled "To an Anxious Friend" won the Pulitzer Prize. In 1924, White became so incensed over the Republican selection for the governorship of Kansas that he ran for office himself on an independent ticket. Although he lost the election, he polled a vote of 149,811. He went to Haiti in 1930 on a presidential commission and advocated the withdrawal of United States troops. In 1933 he went to Moscow and for a time reported conditions in Russia for the New York *Times* and the North American Newspaper Alliance. His autobiography, *Forty Years on Main Street,* appeared in 1937. In 1940 he served as chairman of the Committee to Defend America by Aiding the Allies, and he campaigned for Wendell L. Willkie. In the following year he became a member of the American Palestine Committee and of the Committee on Negro Americans in Defense Industries. By the time of his death he had made the Emporia *Gazette* one of the best-known newspapers in the United States, and he was known as "the Sage of Emporia."

Among his other published works are *Woodrow Wilson: The Man, the Times, and His Task* (1924); *Calvin Coolidge: The Man Who Is President* (1925); *Masks in a Pageant* (1928); *A Puritan in Babylon* (1938); and *The Changing West* (1939).

Consult Clough, F. C., *William Allen White of Emporia* (New York 1941); Rich, Everett, *William Allen White, the Man from Emporia* (New York 1941); Johnson, Walter, *William Allen White's America* (New York 1947).

His son, William L(indsay) White (1900–), also became a writer and journalist. His published works include *What People Said* (1938); *Journey for Margaret* (1942); *They Were Expendable* (1942); *Report on the Russians* (1945); *Report on the Germans* (1947); *Lost Boundaries* (1948); *Land of Milk and Honey* (1949); and *Back Down the Ridge* (1953).

WHITE, William Hale (pseudonym Mark Rutherford), English novelist: b. Bedford, England, Dec. 22, 1831; d. Groombridge, Kent, March 14, 1913. He studied theology at New College, a Congregationalist seminary, until 1851, and subsequently preached occasionally in Unitarian chapels. In 1854 he entered the civil service as a clerk at Somerset House. Transferring to the Admiralty in 1858, he became assistant director of contracts there in 1879 and held this post until his retirement in 1891. White is best known for his trilogy: *The Autobiography of Mark Rutherford* (1881); *Mark Rutherford's Deliverance* (1885); and *The Revolution in Tanner's Lane* (1887). In addition to other novels, he wrote *John Bunyan* (1905), and translated (1883) Baruch Spinoza's *Ethica Ordine Geometrico Demonstrata.*

WHITE, Sir William Henry, English naval architect: b. Davenport, England, Feb. 2, 1845; d. London, Feb. 27, 1913. He was educated at the Royal School of Naval Architecture, and from 1867 to 1883 was employed in the construction department of the Admiralty, becoming chief constructor. In addition, he lectured on naval design at the Royal Naval College from 1870 to 1881. Between 1883 and 1885 he organized and directed the warship building department of Armstrong & Co. Returning to government service, he was director of naval construction at the Admiralty from 1885 to 1902. During these years he was responsible for the design of more than 200 British naval vessels. White was knighted in 1895. After his retirement he frequently served as a technical consultant, and helped to design the *Lusitania* and the *Mauretania.* He was the author of *Manual of Naval Architecture* (1877).

WHITE, Sir William Thomas, Canadian statesman: b. Bronte, Ontario, Canada, Nov. 13, 1866. He was graduated from the University of Toronto in 1895, and was admitted to the bar in 1899. After serving for some years on the staff of the Toronto *Telegram,* he became connected with the assessment department of Toronto. From 1900 to 1911 he was general manager of the National Trust Company. White was an opponent of the

Reciprocity Treaty between Canada and the United States, and although a Liberal in politics was instrumental in defeating the Laurier Ministry. He was Minister of Finance in the Conservative Cabinet of Sir Robert L. Borden from October 1911 to 1919. He was knighted in 1916.

WHITE ANTS. See TERMITES.

WHITE BASS. See BASS.

WHITE BOOK, a government publication in Germany and Portugal, corresponding to the British Blue Book and the Yellow Book of France. See BLUE BOOKS.

WHITE BOYS, an illegal association formed in Ireland in 1760, composed of starving day-laborers, evicted farmers and others in a like condition, who used to assemble at nights to destroy the property of landlords or their agents, the Protestant clergy, the tithe collectors or any others that had made themselves obnoxious in the locality. In many cases they did not confine their acts of aggression merely to plunder and destruction, but even went the length of murder.

WHITE BRETHREN, a sect which caused a commotion in Europe about the beginning of the 15th century. A priest whose origin is unknown, his nationality being variously alleged as Spanish, French and Scotch, made his appearance in Lombardy, and said that he was the prophet Elias, and had come back from heaven to give notice of the coming destruction of the world. He had thousands of followers, who were arrayed in white, and carried large crucifixes, as they marched from the Ligurian Alps into central Italy. Pope Boniface IX caused him to be apprehended, and he was burned as an impostor. The White Brethren then dispersed.

WHITE CAMELIA, The Knights of the, formed in May 1867 at New Orleans, was the largest of the revolutionary orders called into existence by the misgovernment of Reconstruction. Its principal strength was in the Gulf States, farther south than the notorious Ku Klux Klan (q.v.). The organization was as follows: A supreme council for the United States; a grand council in each State; a central council in each congressional district and councils in each county. Each council was divided into circles and groups. The officers of the council were known as commander, lieutenant-commander, etc.; the members were called «brothers.» The objects of the order were, to nullify radical legislation, to reduce the influence of Negroes in politics, to prevent amalgamation of the races and to defend the white race against radical encroachment. The White Brotherhood and the White League were closely related orders that existed in the same territory a few years after the White Camelia had disintegrated. Consult Brown, *Lower South American History* (1902); *Constitution and Ritual of the Knights of the White Camelia,* in West Virginia University Documents relating to Reconstruction, Nos. 1 and 2.

WHITE CAPS, in American history, the lawless bands in southern Indiana, who, from 1880, undertook the regulation of the manners and morals of that section. During the Civil War, the Knights of the Golden Circle (q.v.) flourished in the same parts. The White Caps dressed differently in different parts of the country which they terrorized. Where they were regularly organized and did the most mischief they generally had nearly a full uniform or regalia. They wore white paper foolscaps, with paper masks, and coats of coffee sacking. To make the coats they merely cut arm or sleeve holes in the sides of coffee sacks close to the bottoms and holes in the bottoms to put their heads through.

WHITE CATTLE (of Chillingham), certain cattle preserved in a semi-wild state in Chillingham Park, England. They are pure white, except the muzzle, which is black, and the horns which are tipped with black. The white color on the body, however, is artificially produced, the owner causing all spotted calves to be killed. They are now generally believed to be the descendants of the mountain bull or urus (see Ox), which was wild in Gaul at the time of Caesar's invasion, and the stock whence modern breeds of domestic English cattle have been partly derived. Dawkins, however, considers them the last surviving representatives of a still more primitive race, the gigantic ox, known by its remains in caves to have occupied Great Britain in the Pleistocene Period. He considers them much modified in every respect by their small range and their contact with man.

WHITE CLOVER, OAK PINE. See CLOVER; OAKS; PINE.

WHITE COLORS, *in painting,* white pigment or white lead. Baryta yields several commercial varieties of white color, largely used for adulterating white lead. The substances used are heavy spar, the native sulphate, and witherite, the native carbonate, of baryta. An artificial sulphate of baryta is also used in permanent white. Zinc white or Chinese white is a hydrated oxide of zinc and pearl white is yielded by the nitrate of bismuth. A fine chalk yields Spanish white, and whiting is ordinary ground chalk. Quicklime is a sanitary white for external walls, etc.

WHITE CROSS, a self-supporting American organization which had a large membership throughout the Union, having for its motto, «Truth, Charity and Philanthropy,» and for its emblem cross bandages of white on a field of red. It was founded in 1898 by Mrs. Jane Creighton of Portland, Oreg., and its object was the care of wounded and sick American soldiers and sailors, and aid to the widows, and orphans of those who had fallen in battle, or died of disease or accident.

WHITE CROSS SOCIETY, an association founded in England, in 1883, by the bishop of Durham, and introduced in the United States in that year by the Rev. B. F. de Costa, rector of the Protestant Episcopal Church of Saint John the Evangelist, New York, who became a Roman Catholic in 1899. The objects of the society are «to urge upon men the obligation of personal purity; to raise the tone of public opinion upon the subject of morality; to secure proper legislation in connection with morality.» Those who become members of the society promise «by the help of God» to treat all women with respect and endeavor to protect them from wrong and degradation; to endeavor to put down all indecent language and coarse jests; to maintain the law of purity as equally

binding on men and women; to endeavor to spread these principles and try to uplift younger brothers and to use every possible means to fulfil the command, «Keep thyself pure.» The society seeks to forward its objects «by the full presentation of those spiritual truths which form distinguishing characteristics of Christianity and demonstrate its unalterable hostility to every form of impurity.» The Society has been established also in Canada.

WHITE-CROWNED SPARROW. See SPARROW.

WHITE EAGLE, Order of. See ORDERS (ROYAL) AND DECORATIONS.

WHITE ELEPHANT, an elephant affected with albinism. Such animals, always rare, are highly esteemed by some Eastern potentates and are considered sacred in Siam, where the animal has become a national symbol, so that Siam is called «the land of the white elephant,» and one of the highest decorations conferred by its rulers is that of the Order of the White Elephant. A specimen purchased by the late P. T. Barnum from King Theebaw, of Burma, was brought to the United States in 1884. It stood seven feet and a half high and the face, ears, front of trunk, fore feet and part of breast were of a light ash color. Figuratively, a present which does one much more harm than good, or more generally any nominal advantage which has this effect. It is reported that when in old times the ruler of Siam desired to ruin any one, he made him a present of a white elephant. The sacred elephant has an enormous appetite, and, being sacred, it would be a crime to let it die, so that the gift generally entailed ruin on the recipient.

WHITE-EYES, one of the numerous small insectivorous birds of the New Zealand region, called blight-birds locally, because they feed so largely upon the plant-lice which torment garden plants and orchard trees. They belong to the genus *Zosterops,* which is variously classified by ornithologists, but seems most nearly related to the titmice. Other species are scattered elsewhere throughout the Old World tropics. All are neatly but not gaudily dressed have in most cases a conspicuous ring of white feathers around the eye and build pretty nests. The genus is interesting, further, from the fact that many of its species are confined to small islands, apparently affording examples of the effect of isolation (q.v.).

WHITE FEATHER, a symbol of cowardice; a term introduced in the days when cock-fighting was in vogue. As a thoroughbred game cock has no white feathers, a white feather was a proof that the bird was not game.

WHITE FLY, a minute insect of the family *Aleyrodidæ,* closely allied to the aphids and coccids, which infest the leaves of plants, usually on the lower side, and are pests in greenhouses. (See GREENHOUSE INSECTS). They are covered with a whitish mealy secretion, and when young also secrete wax. The group is not a large one and does not do much harm to fruit or forest trees, except that one species (*Aleyrodes citri*) has been prevalent in Florida orange groves since about 1890. The evil they do results not only from their sucking the nutritive juices of the plants, but from the spread of smut-fungus which is promoted by their presence. Consult Howard, 'The Insect-book' (New York 1901).

WHITE FRIARS, a name formerly given to the friars of Our Lady of Mount Carmel, because they wore a white scapular and cloak over their brown habit. See CARMELITES.

WHITE GOAT. See ROCKY MOUNTAIN GOAT.

WHITE HATS, a badge of the Democratic party in Flanders in the 14th century. White hats were used in England to denote radical proclivities, because Orator Hunt (1773–1835), the great demagogue, during the Wellington and Peel administration, used to wear a white hat.

WHITE HELLEBORE, a liliaceous plant of the genus *Veratrum,* a source of insect-poison, the principle of which is the alkaloid veratrin. See also HELLEBORE.

WHITE HOUSE, the official residence of the President of the United States, in Washington, D. C. The name arose from the fact that the building is constructed of freestone and painted white. It is 170 feet long, 86 feet deep and two stories in height. It has an Ionic portico, the main entrance faces north. Reception rooms are on the first floor and the private apartments of the President are on the second floor. Among the reception rooms are the Blue Room used for diplomatic functions, the East Room used for public receptions, and the Red and Green rooms. The original official residence for the President was begun in 1792; it was first occupied by Adams, in 1800. In 1814 it was burned by the British and four years later was rebuilt. In 1903 executive offices connected with the main building were built on the grounds. These were greatly enlarged in 1934 by excavating the basement and extending it to the south, adding a new story in the former attic.

WHITE LADY, an apparition which figures in the legends and traditions of various countries, as presenting herself to give warning of death and other momentous events in royal and titled households. The White Lady is supposed to be an ancestress of the family she visits, and the association of such a legend with a family name is regarded as a guarantee of noble and ancient lineage. The one-time imperial house of Hohenzollern had its White Lady, and Hampton Court, England, is said to be invaded at times by a supernatural visitor, although there seems to be some doubt whether it is a White Lady or the ghost of Henry VIII. The earliest historical instance of the apparition is recorded as having occurred in the 15th century and is celebrated under the name of Bertha of Rosenberg, in Bohemia. Similar appearances are said to have been witnessed in the Schloss at Berlin, one as recent as 1879.

WHITE LEAD, a white pigment very largely used in painting. Many processes have been devised for its manufacture. The old Dutch method was to expose sheet lead in coils, placed in earthenware jars partly filled with vinegar, to the combined action of air, moisture and carbonic acid gas. This was done by immersing the jars with their contents in decomposing horse manure which furnished the heat and carbonic acid gas necessary for the

process. The English process, which is the one by which most of the white lead is made, differs from the Dutch process by the use of fermenting tan bark instead of manure. The pots containing the lead and dilute acetic acid or vinegar are piled in rows in the so-called stacks and surrounded with the fermenting tan bark. After about three months the lead is removed and purified. The process is slow and the methods of purification dangerous to the workmen, but the resulting white lead is of the best quality. In the French method a solution of basic lead acetate is first prepared by the action of an impure acetic acid on litharge or lead oxide. Carbonic acid gas is then passed through this solution and the white lead precipitated. White lead is also produced electrolytically, by employing a solution of sodium-nitrate, preferably in a cell of wood and a porous diaphragm. The anode is of lead and the cathode of copper. When the current is turned on, nitric acid appears at the anode as lead nitrate and from the cathode appears caustic soda. The lead hydroxide obtained is later treated with sodium bicarbonate to secure the carbonate of lead. White lead is subject to frequent adulteration. It may be tested for purity by making a solution of the powder in acetic acid, which should take up all the lead and leave the adulterant. White lead is a basic carbonate of lead of somewhat variable composition. That formed by the Dutch and English processes may be represented by the formula $2PbCO_3,Pb(OH)_2$.

WHITE LEAGUE, The, in American history, a popular name for a semi-military organization, gathered to repress the negroes of the State of Louisiana, who, it was asserted, were meditating insurrection. The organization had its inception in New Orleans in 1874 and on the refusal of the city authorities to allow the landing of a cargo of firearms, which the league had imported from New York, a riot ensued which resulted in more than 100 deaths. The league afterward became a powerful factor in Louisiana politics.

WHITE METAL, a term used for an alloy of lead, antimony and tin used for bearings in machinery. Also applied to many other alloys that have a white color.

WHITE MONKS. See *Bernardines* under ORDERS, RELIGIOUS.

WHITE MOUNTAINS, a group of peaks and hills, or a range of mountains, principally in New Hampshire, in the northern part; but which extend into Maine on the east and on the west are connected with the Green Mountains in Vermont. They belong to the Appalachian system. Mount Katahdin, in Maine, is the highest elevation on the eastern rim, and in New Hampshire there are about 20 peaks, with deep narrow valleys and long lines of rounded foot-hills. The peaks are in two groups; the eastern or White Mountain group proper and the Franconia group, separated by a tableland varying from 10 to 20 miles in width. The principal summits of the eastern group are, beginning at the Notch and passing around to Gorham, Mounts Webster, Clinton, Pleasant, Franklin, Monroe, Washington, Clay, Jefferson, Adams and Madison. Of these Mount Washington is the highest and is indeed the highest mountain summit in New England, being 6,293 feet above the level of the sea. The principal peaks of the Franconia group are Pleasant, Lafayette, Liberty, Cherry and Moosehillock. Near the southern border of the plateau are Whiteface, Chocorua, Red Hill and Ossipee, and in the southeast, Kearsarge. North of the plateau and near the upper waters of the Connecticut, are several elevations, among which are the twin mountains known as Stratford peaks. The plateau is deeply furrowed by several streams. The geological formation of the White Mountains is almost entirely of ancient metamorphic rocks. In many of the peaks the upper portion is composed of huge masses of naked granite or gneiss, and the debris which in the course of ages has clothed the lower portion with a coarse gravelly soil, possesses only enough of the constituents of vegetable life to support those trees and shrubs which will grow in the hardest and poorest soil. Land slides, the result of dislodgment of bowlders and loosely adherent soil after heavy rains, are not infrequent. One of these occurred in the notch of the White Mountain group in August 1826 and destroyed a whole family named Willey. The most noteworthy of many waterfalls among the mountains are the Artist's Fall in North Conway; the Silver Cascade, a beautiful thread of water descending from far up the side of Mount Webster; Ripley's Falls, on a tributary of the Saco, below the Willey house, the lower one, Sylvan Glade cataract, falling at an angle of 45 degrees, 156 feet, in a stream from 50 to 75 feet in width; the falls of the Ammonoosuc, which in a course of 30 miles descends over 5,000 feet; the Berlin Falls on the Androscoggin, descending over 200 feet in the course of a mile, and the Crystal Cascade and Glen Ellis Fall, near the Glen house, on a tributary of the Androscoggin. Of the "notches," or passages (not rent through the solid granite of the mountains by some violent convulsion of nature as has often been supposed, but carved by the slow action of rivers), there are five; the White Mountain Notch, two miles in length and at its narrowest point only 22 feet wide, through which the Saco River passes; the Franconia Notch, which permits the passage of the Pemigewasset; the Pinkham Notch, through which a branch of the Saco and one of the Androscoggin find their way, and the Grafton and Dixville notches, through which flow the Androscoggin and one of its tributaries. The first two of these are those best known. "The Flume" at Franconia Notch is the most noted of those narrow waterways excavated through the rock, though there are others hardly inferior to it in attractiveness. Among the other objects of interest in the Franconia group is the "Old Man of the Mountain," a well-defined profile of the human face formed by three projecting rocks. (See FRANCONIA). At the base of the mountain lies a beautiful lakelet one-fourth of a mile long and one-eighth wide, called "Profile Lake," or the "Old Man's Washbowl." Five miles south of the notch is the "Basin," a circular bowl-like cavity 45 feet in diameter and 28 in depth, produced by the whirling of large stones in a natural hollow in the rock by the current. It is filled with clear sparkling water, which flows down the mountains in a succession of beautifully clear

cascades. The "Pool," in the same vicinity, is a natural well in the solid rock 60 feet in diameter and 190 feet deep, of which 40 feet is water. The White Mountains were first visited by a white man, Darby Field, of Pascataquac, in 1642, when with two Indians he ascended Mount Washington. Later in the same year Thomas Gorges and companions traveled up the Saco and explored the mountains and the plateau and discovered the sources of the Saco, Connecticut, Androscoggin and Kennebec rivers. The White Mountains are a famous summer resort.

WHITE OAK SWAMP, Battle of. See Frayser's Farm, Battle of.

WHITE PLAINS, city, New York; seat of Westchester County; altitude 200 feet. It is situated 25 miles north-northeast of New York City, and is served by the New York Central Railroad. The Bronx and Mamaroneck rivers border the city and there are lakes nearby. White Plains is a residential community, with a considerable retail trade, and manufactures of plumbing and heating equipment, textiles, chemicals, cables, and pipe. The Westchester County civic center is here, with an auditorium; as well as Good Counsel College, founded 1923, for women.

White Plains was settled in 1683, and in early years, up to the American Revolution, was active in iron mining. It was the meeting place of the provincial assembly which ratified the Declaration of Independence in 1776 and in the same year was the scene of the Battle of White Plains. It was incorporated as a village in 1866; as a city in 1916. Government is of the commission form. Pop. (1950) 43,466.

WHITE PLAINS, Battle of, in the American Revolution. On Oct. 21, 1776, following his evacuation of New York City and the repulse of the British in the Battle of Harlem Heights, (September 16), Washington established his headquarters at White Plains, N. Y. On the evening of October 27 Col. John Haslet with about 1,600 American troops had taken possession of Chatterton Hill, a commanding eminence on the west side of the Bronx River, and on the morning of the 28th, reinforced by a small additional force under Gen. Alexander McDougall and two pieces of cannon under command of Alexander Hamilton, he fortified his position as well as time would allow. On the morning of that day Sir William Howe advanced with his forces in two columns (numbering about 13,000 men) on the American army posted along the Bronx. Perceiving the importance of the position on Chatterton Hill and regarding it as the only assailable point of the American army, Howe sent Leslie with a strong detachment to cross the Bronx and attack it in front, while Colonel Rahl with a Hessian regiment was ordered to cross the river a quarter of a mile below and attack Haslet in flank. The hill was carried with great difficulty, the Americans retreating in good order and without being pursued. The British troops rested that night on Chatterton Hill. The next day, October 29, a skirmish took place between the two armies; but Howe, finding the Americans still too strongly posted to be attacked with safety, waited for reinforcements. These arrived on the evening of the 30th; but a storm coming on, the Americans took advantage of it and withdrew to the still stronger position of Newcastle, two miles above, which they had previously fortified. Afraid to attack them in this position, Howe fell back to the junction of the Harlem and Hudson rivers and encamped on Fordham Heights, and Washington withdrew his army leisurely into New Jersey and made his headquarters at Hackensack.

The loss of the Americans in the Battle of White Plains and the skirmish of the succeeding days were nearly 300 in killed, wounded and prisoners, and that of the British about the same. The battlefield was marked and set aside as White Plains Battlefield Site, a historical park, in 1926.

WHITE RIVER, in Arkansas, has its rise in the Ozark Plateau, in the northwestern part of the state, flows northeast into Missouri, being dammed to form Lake Taneycomo, and enters Arkansas again in Marion County, then flows southeast to the Mississippi River. It enters the Mississippi through several channels, some of which pass through the mouth channels of the Arkansas River. Except in the highlands of the Ozark Plateau, the greater part of the course of the river is through marshy forest land. It is navigable to Batesville, about 300 miles. The total length is 690 miles.

WHITE RIVER, in Indiana, the chief branch of the Wabash in the state, is formed by the confluence, in Pike County, of the East and West Fork, which have their rise near the eastern boundary of the state. From the junction of the two forks to the mouth of the White, where it enters the Wabash, is 50 miles; the total length from the source of the West Fork is 350 miles; from the source of the East Fork, 300 miles.

WHITE RIVER, in South Dakota, the chief river of the southwestern portion of the state, rising in Dawes County, northwestern Nebraska, and flowing northeast into South Dakota, through Shannon and Washington counties, thence easterly to the Missouri River, which it joins a little south of Oacoma. The territory drained is locally known as the Bad Lands. Total length about 325 miles.

WHITE RIVER JUNCTION, village, Vermont; in Hartford town in Windsor County; altitude 340 feet. It is situated on the Connecticut River, at the mouth of the White River, nine miles north-northeast of Woodstock, and is served by the Central Vermont, and the Boston and Maine railroads. It is a commercial center for a large agricultural region in Vermont and New Hampshire. There are extensive railroad yards. White River Junction is a traffic center, and has much transient trade. Woodstock, near by, is a summer resort and has winter sports as well. There is a public library, a high school, and a United States veterans hospital established in 1938. The business section is on one side of White River; the residential, on the other. Pop. (1950) 2,365.

WHITE SAGE. See Eurotia; Goosefoot.

WHITE SANDS NATIONAL MONUMENT. A remarkable accumulation of granular gypsum in the Tularosa Desert in Otero and

Dona Ana counties, N. Mex. It consists mostly of dunes five to 50 feet high, of dazzling whiteness, and covers an area of 140,247.04 acres. Most of the material is nearly pure gypsum containing about 95 per cent of that mineral. To the north it grades into quartz sand. Attempts were made to utilize the deposit for manufacture of plaster of Paris, but local demand for this product was small and cost of long distance shipment was too great. The gypsum was carried into the basin in solution from the adjoining mountains and after crystallizing by evaporation of the water has been blown by the wind into dunes. Some of it is brought to the surface by ground water. The national monument was created in 1933. White Sands Proving Ground, a testing ground for rockets, is to the southeast in Dona Ana County.

WHITE SEA, gulf, northern USSR, a large inlet between Kola Peninsula on the west and Kanin Peninsula on the east. Near its mouth, and on the eastern side, is a branch called the Gulf of Mezen, which receives the waters of the river Mezen. The inner part of the sea sends off three large arms, namely Kandalaksha Gulf, between the USSR and Finland; Onega Bay, which receives the river Onega; and Dvina Gulf (Gulf of Archangel), into which flows the Northern Dvina River. Of the islands in the sea, Solovetsk is the largest (180 square miles). The White Sea is comparatively shallow, and is frozen over from October to May. Arkhangelsk (Archangel), at the mouth of the Northern Dvina, is the leading port of northern Russia. Other ports on the shores of the sea are Onega and Kem. Its area is about 36,000 square miles.

WHITE SULPHUR SPRINGS, town, Montana; Meagher County seat; altitude 5,200 feet. It is situated 54 miles east of Helena, on the White Sulphur Springs and Yellowstone Park Railroad. The county was named for Gen. Thomas Francis Meagher. In a cattle and sheep region, the town holds an annual rodeo on Labor Day. The springs from which the town derives its name are used for medicinal purposes. Pop. (1950) 1,025.

WHITE SULPHUR SPRINGS, town, West Virginia; in Greenbrier County; altitude 1,917 feet. It is a residential community and health resort, 83 miles southeast of Charleston and only a few miles from the Virginia border. It is served by the Chesapeake and Ohio Railway. It was settled about 1750 and its mineral springs have been popular since the early 1800's; Presidents Van Buren, Tyler, and Fillmore used it as a summer residence. There is a federal hatchery for bass and trout here. Government is by mayor and council. Pop. (1950) 2,643.

WHITE SWELLING, any severe disease of the joints resulting from chronic inflammation in the bones, cartilages, or membranes. The knee, ankle, wrist and elbow are the joints most subject to this form of disease. It is distinguished from simple inflammation of the synovial membrane (synovitis) by the fact that the synovial membrane passes into pulpy degeneration. Amputation is frequently necessary. The disease may be local or constitutional in origin; in the latter case it may be due to rheumatism, gout, syphilis, or pyemia.

WHITEAVES, Joseph Frederick, Canadian paleontologist: b. Oxford, England, Dec. 26, 1835; d. Aug. 8, 1909. He studied at the University of Oxford in 1858–1861 and made investigations of the land and fresh-water mollusca and fossils of the oolitic rocks in the vicinity of Oxford, adding considerably to the information possessed. He moved to Canada in 1861, was engaged in geological investigations in Montreal and Quebec in 1861–1862, and in 1863–1875 he was curator of the museum and secretary of the Natural History Society of Montreal. He made a special study of the land and fresh-water mollusca of Lower Canada in 1867–1873. He was appointed to the Canada Geological Survey in 1875, became its paleontologist in 1876, and in 1877 was appointed zoologist and assistant director. He was one of the original fellows of the Royal Society of Canada.

WHITEBAIT, a small fish, which is regarded by naturalists as merely the fry of the herring or of similar fish. The whitebait fishery is actively prosecuted on some parts of the British coast, particularly in the estuary of the Thames, where the whitebait is very abundant in spring and summer, beginning to appear in the end of March or early in April. Adult whitebait are caught on the coasts of Kent and Essex during winter, and in this condition are about six inches in length. Whitebait is found also in the Forth. It is much in demand as a delicacy for the table. At the time when ordinarily captured, whitebait are only from one and one half to four inches in length. They are caught by means of bag nets sunk four or five feet below the surface of the water. For several months they continue to ascend the river in shoals with the flood tide and descend with the ebb tide, not being able to live in fresh water.

The whitebait has the body more compressed than the mature herring; belly, serrated; lower jaw, longer than the upper; scales, very soft, small and thin, and very easily rubbed off; color, silvery white, greenish on the back. The food of the whitebait seems to consist of minute crustaceans. It is probable that under the name whitebait the fry of all the British herring family (Clupeidae)—the pilchard, the sprat and the shad—are indiscriminately taken and used like the fry of the herring.

WHITECHAPEL, hwīt'chăp-ĕl, district London, England. It forms three wards of Stepney metropolitan borough, east of the City of London. It is one of the poorest portions of the metropolis, and was formerly notorious for its criminal population. From 1888 to 1891 it was the scene of the atrocities of the mysterious Jack the Ripper. Within its boundaries are the Tower of London and London Hospital, and it is intersected by Whitechapel Road. The name is derived from a former medieval chapel, whence all distances east of London were calculated.

WHITEFIELD, hwīt'fēld, **George,** English evangelist, founder of the Calvinist Methodists: b. Gloucester, Dec. 16, 1714; d. Newburyport, Mass., Sept. 30, 1770. He was sent to the grammar school of St. Mary de Crypt at Gloucester, and at 18 entered as servitor at Pembroke College, Oxford, where he became acquainted with the Wesleys, and

joined the small society which procured them the name of Methodists. Hearing of his devotional tendencies, Dr. Benson, bishop of Gloucester, made him an offer of ordination at 21, which he accepted, and he was ordained a deacon in 1736. Such was his powerful and exciting preaching, that, after his first sermon at Gloucester, a complaint was made to the bishop that he had driven several people mad; on which the prelate observed that he hoped the madness would not be forgotten before the next Sunday. He for some time supplied a curacy at Dummer, in Hampshire, but the next account sent him by the Wesleys of their progress in Georgia excited in him a desire to assist in their labors, and he arrived at Savannah in May 1737. Observing the deplorable want of education in the colony, he projected an orphan-house for which he determined to raise contributions in England, where he arrived in the beginning of 1739. Although discountenanced by many of the clergy, Bishop Benson did not scruple to confer on him priest's orders: and on going to London the churches in which he preached were incapable of holding the crowds assembled. He then adopted the practice of preaching in the open air, which he first carried out at Kingswood, near Bristol, among the colliers, on whom his discourses produced a surprising effect, and whose vicious manners and habits he visibly improved. He afterward preached in the open air in Bristol, and in Moorfields, Kennington, and other places in the neighborhood of London, to vast assemblages of people. In August 1739, he again embarked for America, and made a tour through several of the provinces, where he preached to immense audiences, with an effect vividly portrayed in the autobiography of Benjamin Franklin. He arrived at Savannah in January 1740, where he laid the foundation of the orphan-house, and after making another extensive tour, returned to England, in March 1741. During his absence his cause had been declining at home, and the differences between him and Wesley on the doctrines of election and reprobation deprived him of many followers. After visiting many parts of England, Scotland and Wales, where he married in 1741, he again returned to America (1744), and remained there nearly four years. His preaching met with great opposition in New England at this time and Harvard College put forth a «testimony» against him. Returning to England in July 1748 he was soon after introduced to the Countess of Huntington, who made him one of her chaplains. A visit to Ireland and two more voyages to America followed, and for several years his labors were unremitting. He preached at Exeter, N. H., the day before his death, and also at Newburyport. He is buried beneath the pulpit of the Federal Street Church at Newburyport. His works were published in 1771–72. Consult Gillies, 'Memoirs' (1772); Tyerman, L., 'Life of Whitefield' (1876–77).

WHITEFISHES, a name given in the United States to various species of salmonoid fishes of the genus *Coregonus* and sometimes to those of *Argyrosomus,* more properly designated ciscoes. *Coregonus* has a comparatively small and nearly toothless mouth, the premaxillary bones broad and with the edge nearly vertical, and the lower jaw short. The thin cycloid scales are much larger than in the salmons and trouts, and the caudal fin is deeply forked. Internally, the stomach is horse-shoe shaped and provided with very numerous pyloric caeca, and the swim-bladder is very large. The species, about 15 in number, though some ichthyologists recognize many more, are confined to the clear lakes of the northern portions of the northern hemisphere often extending into the Arctic regions and sometimes there becoming anadromous. Wherever found they are highly valued for food. North America has about eight species. The common whitefish (*C. clupeiformus*) has its centre of distribution in the Great Lakes, but extends into the various lake systems of New York and southern Canada. It reaches a length of two feet and may be distinguished from the related species by its numerous and long gill-rakers, the toothless mouth and the elevated but not compressed back. As generally in the whitefishes, the color is olivaceous above and white below. It receives various local names from the fishermen, such as buffalo-back; and the variety landlocked in Otsego Lake at the head of the Susquehanna River is known as the Otsego bass. During the greater part of the year the whitefish remains in the deeper waters of the lakes, moving about in schools which change their feeding grounds with considerable regularity. Being toothless they feed only upon small animals, such as crustaceans, snails and insect larvæ, the first being by far the most important part of their diet. During the late fall and early winter the schools congregate on the shallows to spawn; in the act of spawning the female rises to the surface and is immediately followed by a male which mingles the sperm with the stream of eggs issuing from her vent. The eggs are about one-eighth of an inch in diameter and sink to the bottom, where most of them are eaten by the small fishes and mud-puppies which swarm on the spawning grounds. They develop slowly and require several weeks to hatch, the exact time depending upon the temperature of the water. Each female produces from 10,000 to 75,000 eggs, depending upon her size.

Besides the enemies affecting the eggs and young the adult whitefish are preyed upon by the large pike and lake-trout which follow the schools, and to a less extent by smaller predaceous fishes. The extensive development of the fisheries, which are prosecuted most vigorously at the very season when the spawning fish are most accessible on the shallows, has so depleted the numbers of the whitefish that the fisheries are now dependent upon artificial propagation for their maintenance. The methods are essentially the same as those employed in the artificial propagation of the shad, though many modifications in detail have been found necessary. Hundreds of millions of eggs are now annually taken and hatched under the auspices of the United States and State commissions of fisheries. Such extensive and even greater operations are required to sustain these fisheries at a point of production equal to satisfying the demand of the market. These figures represent the American catch alone and during the same year the Canadian fisheries prob-

ably yielded about 40,000,000 pounds more. Whitefish are sold fresh or are frozen immediately after capture and placed in cold storage at a temperature several degrees below freezing and in this condition shipped, especially during the winter, to all parts of the country.

Other species of *Coregonus* are found in the Great Lakes as well as in other lakes particularly northward and westward, but at the present time none are so highly valued as the common whitefish. An important one is the shadwaiter or round whitefish (*C. quadrilateralis*). The genus *Argyrosomus,* however, includes two species of great and increasing importance, though inferior in quality to the common whitefish. The genus differs from *Coregonus* chiefly in the projecting lower jaw, larger mouth and horizontal premaxillary bones. The numerous species are similarly distributed in North America, which has eight, Europe and Asia, and except for their great activity and predatory mode of life their habits in general resemble those of the true whitefishes. The cisco whiting or lake herring (*A. artedi*) is about a foot long, bluish or greenish above, with dark, speckled silvery sides. It abounds in shallow waters of the Great Lakes and, as indicated above, is of great commercial value. The moon-eye cisco (*A. hoyi*) has a very large eye and the sides are brilliantly silvery. It is about a foot long and is the object of a considerable fishery in the western part of Lake Michigan. It spawns in November in relatively deep water. A third important species of this genus is the blue-fin whitefish (*A. nigripennis*), distinguished from all of the preceding which have pale fins by the blue-black color of its pectorals, anals and ventral. It attains a length of 18 inches and is plentiful in the deep waters of Lake Michigan and the small lakes of Minnesota and Wisconsin and thence northwestward to Athabasca.

Whitefishes seldom take the hook, but are captured by means of pound, trap and gill nets and to a smaller extent with seines. The pound and trap nets are arranged in lines which sometimes reach to a distance of 10 or 12 miles from shore, while the gill nets are set in deep water and are weighted to the bottom.

WHITEHALL, London, England, a street leading from Parliament Square to Trafalgar Square, containing several public offices, and named after a palace that once stood there. The building, known as the Horse Guards, the office of the commander in chief of the army, is so called in consequence of being the station where that part of the troops usually do duty. The original Whitehall succeeded a palace built by Hubert de Burgh before the middle of the 13th century. It afterward came into the possession of the archbishops of York, was inhabited by Wolsey (under the name of York Place), then passed to Henry VIII and was called Whitehall. Charles I was executed in front of Whitehall and he was led to the scaffold out of one of the windows. Oliver Cromwell died in Whitehall. In 1697 the building was destroyed by fire, except the banqueting hall, which had been added by James I, according to a design of Inigo Jones, in 1619. This portion still remains and chiefly consists of one room, of an oblong form and 40 feet high. The ceiling, representing the apotheosis of James I, was painted by Rubens and was retouched by Cipriani. This building was long a royal chapel, but it now contains the museum of the Royal United Service Institution.

WHITEHALL, village, New York, in Washington County; altitude 123 feet; at the southern end of Lake Champlain and northern terminus of the Barge Canal; midway between New York and Montreal on the Hudson-Champlain Trail; 77 miles north of Albany; on the Delaware and Hudson Railroad. The village stands in a narrow valley, at the foot of Skene's Mountain. It is an industrial community, and a railroad division point, with silk mills and railroad shops. Grist mills and lumber mills, paint factories, boat-building yards, and machine shops have place in its industrial history. It has a public library and a high school. Whitehall was a scene of action in both the French-and-Indian and the Revolutionary wars. It was settled in 1759 by Maj. Philip Skene, a British army officer, and some 30 families; the settlement was at first called Skenesborough, in his honor. In the Revolution, Skene, as a Tory, lost the land holdings on which he held patents. In 1776 an American garrison was stationed at Whitehall; fearing capture by Burgoyne, the soldiers and townsfolk destroyed the fort and the houses, and abandoned the place. At the close of the war nearly all the people returned and claimed their former holdings. In 1806 the place was incorporated as the village of Whitehall. In 1812, when the Lake Champlain towns and villages were again near the center of danger, a fort and blockhouse were built. The Champlain Canal was the predecessor of the present Barge Canal section as a unit in a waterway from the Hudson to Canada. Pop. (1950) 4,457.

WHITEHAVEN, city, England, seaport and important coal-mining center in Cumberland, situated on a bay of the Irish Sea, 40 miles southwest of Carlisle. It is well built, and has a town hall, customhouse, market house, public library, public baths, with swimming pond; a theater, a good harbor and a deepwater floating dock. There is a considerable shipping trade, coals, iron ore, pig iron, and steel rails being exported and American and other produce imported. The manufactures comprise sailcloth, cordage, anchors, nails, cement, alabaster, earthenware, candles, and soap. Iron shipbuilding also is carried on and there are blast-furnaces, iron- and brass-foundries, engineering works, flour- and saw-mills; breweries, and a tannery. There are here extensive coal and iron mines. The coal mines, which have been worked since the 17th century, extend some miles under the sea, and coal is mined beneath the town. Pop. (1951) 24,624.

WHITEHEAD, Alfred North, English mathematician and philosopher: b. Ramsgate, Isle of Thanet, Kent, Feb. 15, 1861; d. Cambridge, Mass., Dec. 30, 1947. Educated at Sherborne School and Trinity College, Cambridge, from which he received his B.A. degree in 1884, he served as lecturer and senior lecturer on mathematics at Trinity College, 1885–1911. He lectured on applied mathematics and mechanics, and later was reader in geometry at University College of the University of London. He was professor of applied mathematics at the Imperial College of

Science and Technology of the University of London, 1914–1924. He then went to the United States as professor of philosophy at Harvard University, a post he held until his retirement in 1936. Like his most distinguished pupil, Bertrand Russell, Whitehead viewed philosophy from the standpoint of mathematics, and together they wrote the monumental *Principia Mathematica* (1910–1913), in which the deduction of mathematics from formal logic was achieved. Whitehead's idealistic philosophy, which he called the philosophy of organism, was concerned with "the becoming, the being, and the relatedness of actual entities."

His writings include *A Treatise on Universal Algebra* (1898); *The Principle of Relativity* (1922); *Religion in the Making* (1926); *The Function of Reason* (1929); *Nature and Life* (1934); and *Essays in Science and Philosophy* (1946).

WHITEHEAD, Charles, English poet: b. London, 1804; d. Melbourne, Australia, July 5 1862. He was engaged in a London mercantile house until 1857 when he went to Australia and entered journalism. He was the author of numerous poems, plays and sketches, among which are *The Solitary* (1831); *The Autobiography of Jack Ketch* (1834); *The Cavalier,* drama (1836); *Richard Savage* (1842), subsequently dramatized; *Smiles and Tears,* or *the Romance of Life* (3 vols. 1847); *Life and Times of Sir Walter Raleigh* (1854) Consult Bell, Mackenzie, *Charles Whitehead, a Forgotten Genius* (1884).

WHITEHEAD, Cortlandt, American Protestant Episcopal bishop: b. New York, Oct. 30, 1842; d. Niagara Falls, Sept. 18, 1922. He was graduated from Yale in 1863 and from the Philadelphia Divinity School in 1867. Ordained to the priesthood in 1868 he was engaged in pastoral work in Colorado for three years and was rector of the Church of the Nativity, South Bethlehem, Pa., 1870–1882. In January 1882 he was consecrated bishop of Pittsburgh.

WHITEHEAD, William, English poet: b. Cambridge, Feb. 12, 1715; d. London, April 14, 1785. He was educated at Winchester and Clare Hall, Cambridge, was appointed secretary and registrar of the order of the Bath in 1755, and in 1757 was appointed poet laureate, in succession to Colley Cibber (q.v.). His identity is frequently confused with that of the satirist Paul Whitehead. He was the author of the tragedies: *The Roman Father* (1750); and *Creusa, Queen of Athens* (1754); the comedy, *The School for Lovers* (1762); a farce, *The Trip to Scotland* (1770); and numerous minor poems. His collected works were edited and published with a memoir by William Mason (1788).

WHITEHILL, Clarence Eugene, opera singer: b. Marengo, Iowa, Nov. 5, 1871; d. New York City, Dec. 1932. He studied under L. A. Phelps and was engaged as a church singer until, following the advice of Madame Melba, he went to Paris to study for the operatic stage. He studied under Giraudet and Sbriglia in Paris and in 1900 made his debut successfully at Brussels. In 1901 he made his first appearance at the Opéra Comique in Paris. He studied the great Wagnerian rôles with Cosima Wagner and was highly successful in them. He appeared at Bayreuth, and at Covent Garden, London; after 1909 with the Chicago Opera Company; after 1920 a member of the Metropolitan Opera Company.

WHITEING, Richard, English novelist: b. London, July 27, 1840; d. London, June 29, 1928. He was educated privately and began his career in journalism in 1866 with a series of satirical sketches on social and political topics afterward republished as *Mr. Sprouts—His Opinions* (1867). He became leader writer on the *Morning Star* and later Paris correspondent for various New York, London and Manchester papers and then joined the editorial staff of the London *Daily News,* a position he resigned in 1899. Among his writings are *The Democracy* (1876); *The Island* (1888); *No. 5 John Street* (1899); *The Life of Paris* (1900); *The Yellow Van* (1903); *All Moonshine* (1907); *My Harvest* (1915); *Both Sides of the Curtain* (with Dame Geneviève Ward 1918); Film *No. 5 John Street* (1921).

WHITELOCKE, hwīt'lŏk, **Bulstrode,** English statesman: b. London, Aug. 2, 1605; d. Chilton Park, Wiltshire, July 28, 1675. Educated at Oxford he studied law at the Middle Temple, was called to the bar in 1626, and entered Parliament as member for Stafford. He was elected to the Long Parliament of 1640 from Great Marlow, was chairman of the committee for drawing up Stafford's charges of impeachment, and one of the commissioners appointed to treat with the king at Oxford. As a member of the Westminster Assembly (1643) he opposed the adoption of Presbyterianism, and as a commissioner of the Great Seal (1649) withheld consent to the king's death. In 1623 he was ambassador to Sweden, where he concluded a treaty with Queen Christina, and on his return was speaker of the House of Commons (1656), and one of Cromwell's lords (1657). From his manuscripts have been published *Memorials of the English Affairs from the Beginning of the Reign of Charles I to the Restoration* (1682; new ed. 1852); *Memorials of English Affairs from Bruce to the End of the Reign of James I* (1709), and other works.

WHITESTONE, N. Y., a community in the Borough of Queens, New York City; on the East River (north shore of Long Island). It is connected with the Borough of The Bronx by the Bronx-Whitestone Bridge, opened 1939 and owned and operated by the Triborough Bridge Authority.

WHITETHROAT, a bird, either of two species of Old World warblers—*Curruca cinerea,* the greater, and *C. sylviella,* the lesser whitethroat; or a hummingbird (*Leucochloris albicollis*) of Brazil; or a whitethroated sparrow (*Zonotrichia albicollis*), commonly known in the eastern United States, where it is a migrant, as Peabody bird.

WHITEWASH, a milky fluid produced by mixing good slaked lime with water: used as a cheap coating for walls, fences, etc. When mixed with a little size and sometimes colored it is used on interior walls under the name of calcimine.

WHITEWATER, Wis., city in Walworth County; altitude 822 feet; on Whitewater Creek;

43 miles southwest of Milwaukee; on the Chicago, Milwaukee, St. Paul and Pacific Railroad. The surrounding region is agricultural, and the city has canning and food processing plants. There are some small establishments producing such articles as clothing and hardware. In the city are a state teachers' college (coeducational: founded 1866). First settlement of the site was made in 1839. Pop. (1940) 3,689; (1950) 5,101.

WHITFIELD, hwĭt'fēld, or **WHITFELD, Henry,** English clergyman: b. 1597; d. Winchester, England, 1657?. Of the date of his birth and his early life nothing is definitely known. He appears to have been appointed to the living of Ockley, Surrey, in 1616, but having protected several Puritan clergymen during the Laudian persecution incurred the displeasure of Archbishop William Laud, which was further increased by his refusal to read to his parishioners from the *Book of Sports.* He, therefore, emigrated to New England in 1637 with many followers and was one of the founders of Guilford, Conn. In 1650 he returned to England and was minister at Winchester.

His writings include *Some Helpes to Stirre up to Christian Duties* (3d ed., 1636); *The Light Appearing More and More Toward the Perfect Day* (1641); and *Strength out of Weakness* (1652).

WHITFIELD, Robert Parr, American geologist: b. New Hartford, N. Y., May 27, 1828; d. 1910. He studied natural history and geology almost unaided, was assistant on the New York State geological survey in 1856–1876, and in 1872 was attached to the United States Geological Survey. He was instructor in geology at the Rensselaer Polytechnic Institute in 1872–1875, professor in 1875–1878 and for many years after 1887 was curator of the American Museum of Natural History in New York.

WHITGIFT, hwĭt'gĭft, **John,** English prelate: b. Great Grimsby, Lincolnshire, 1530?; d. Lambeth, Feb. 29, 1604. He was educated at Pembroke Hall, Cambridge, and after the accession of Elizabeth took holy orders (1560) and was made chaplain to Cox, bishop of Ely. In 1563 he was appointed Lady Margaret professor of divinity at Cambridge, in which office he gained a high reputation by his lectures on the book of Revelations and the Epistle to the Hebrews, and in 1567 was elected master of Pembroke Hall. Soon after, the queen made him her chaplain and master of Trinity College, Cambridge, and the same year he also became regius professor of divinity. He was made dean of Lincoln in 1571, and in 1576 bishop of Worcester, and, being also vice president of the marches of Wales, made constant use of both the temporal and spiritual powers to put down Roman Catholicism and Puritanism within the limits of his jurisdiction. In 1583 he became archbishop of Canterbury, and soon exacted from every clergyman in the church a subscription to the three points of the queen's supremacy, the lawfulness of the common prayer and ordination service, and the truth of the whole 39 articles. Making use of the court of high commission he removed from positions in the church all nonconformists. In 1585 the star chamber, at his instigation, passed ordinances for the regulation of the press, by which no one was allowed to print except in London, Oxford, and Cambridge; the number of printers was to be determined by the ecclesiastical commissioners; and none but a few special printers were to be suffered to print any book, matter or thing whatsoever until it should be perused and allowed by the archbishop of Canterbury and the bishop of London; and every one selling books contrary to the intent of the ordinance was to be imprisoned for three months. In 1586 he was sworn of the Privy Council and framed the statutes of cathedral churches. The hospital and grammar school at Croydon were founded by Whitgift.

WHITING, hwī'tĭng, **Arthur,** American musician: b. Cambridge, Mass., June 20, 1861; d. Beverly, Mass., July 20, 1936. He studied music in Munich at the Royal Music School with Josef Rheinberger. He was a pianist and composed orchestral and chamber music, as well as numerous songs, pianoforte pieces, concertos and sacred music. His series "University Concerts" were well received at Harvard, Yale and Princeton and other colleges.

WHITING, George Elbridge, American musician and composer: b. Holliston, Mass., Sept. 14, 1842; d. Cambridge, Mass., Oct. 14, 1923. He early displayed musical talent and was engaged as an organist successively at Hartford, Conn., Boston, and at Albany. He studied in Europe in 1863 and in 1872, was organist at the church of the Immaculate Conception, Boston, in 1876–1878 and occupied that position after 1883. In 1878–1883 he was organist at the Cincinnati Music Hall and professor of organ and composition at the Cincinnati College of Music. He was engaged as a teacher in the New England Conservatory of Music for several years but resigned in 1897. His compositions include *Grand Sonata; Tale of the Viking; Dream Pictures,* cantata; *Midnight,* cantata; a one-act opera in Italian, *Lenora* (1893); and numerous preludes and symphonies.

WHITING, Lilian, American author: b. Niagara Falls, N. Y., Oct. 3, 1859; d. April 30, 1942. She engaged in journalism in St. Louis, Mo., in 1876, in 1880–1890 was literary editor of the Boston *Traveler* and was editor of the Boston *Budget* in 1890–1893. Her published books are characterized by familiarity with occult subjects and a disposition to lead her readers unconsciously to recognize the genuineness of mysticism and spiritualistic teaching. They include *From Dreamland Sent,* verse; *The World Beautiful,* 3 vols. (1894, 1896, 1898); *Kate Field: a Record* (1899); *The World Beautiful in Books* (1901); *Boston Days* (1902); *The Outlook Beautiful* (1905); *Life Transfigured* (1910); *The Brownings—Their Life and Art* (1911); *Athens the Violet Crowned* (1913); *The Lure of London* (1914); *The Adventure Beautiful* (1917); *Canada the Spellbinder* (1917); *The Golden Road* (1918); *They Who Understand* (1919).

WHITING, William Henry Chase, American soldier: b. Mississippi about 1825; d. Governor's Island, New York Harbor, March 10, 1865. He was graduated first in his class at the United States Military Academy in 1845. He entered

the engineering corps and was engaged in military construction work, reaching the rank of captain in 1858. He resigned from the army Feb. 20, 1861 and entered the service of the Southern Confederacy. He was chief engineer of the Army of the Shenandoah under Gen. J. E. Johnston in June and July 1862, holding the rank of major; and was promoted brigadier general Aug. 27, 1861. He saw service at the first battle of Bull Run and at the Battle of West Point, Va. He was promoted major general in 1863, built Fort Fisher, N. C., and in 1864 was placed in command there. He was wounded and taken prisoner when Fort Fisher fell, Jan. 15, 1865, later dying from his wounds.

WHITING, city, Indiana, in Lake County; altitude 587 feet; on Lake Michigan; 17 miles southeast of Chicago; on the Pennsylvania, and the New York Central railroads, with freight service via several other lines. Its environment is industrial; its own products include oils, chemicals, roofing, steel, and soap. It has a public library, public and parochial schools, a community center, and a National Guard armory. Settled in 1852, it was incorporated as a town in 1895; as a city in 1903. It has mayor and council. Pop. (1950) 9,669.

WHITING, a name applied to several quite unrelated fishes probably in allusion to the noteworthy whiteness of their flesh, or, in some cases, of the skin of the lower parts. In the United States, and more especially in the South, several species of *Menticirrhus,* a genus of Sciaenidae, are known as whiting, but more commonly as kingfish (q.v.). The common whiting (*M. americanus*) reaches a length of about a foot; the body is elongated and slender with a high spinous dorsal and a long low soft dorsal fin, an undulate caudal fin, and is completely covered with ctenoid scales; the outer row of teeth of the upper jaw are enlarged and strong and the color silvery gray with faint oblique dusky bars. It is very common along sandy shores of the entire Gulf coast and on the Atlantic coast northward to about the mouth of Chesapeake Bay and southward to Brazil. Though remaining on these coasts throughout the year they are most plentiful in summer when they frequent the bays and estuaries, but prefer strong currents and the deeper waters. They feed upon crabs, shrimps and other crustaceans, and being vigorous biters and gamy fighters afford splendid angling. Great numbers are caught on lines for the market and the flesh is unusually firm, delicate and well-flavored. Spawning is said to occur in May. The surf whiting (*M. littoralis*) is so called because, unlike the last, it frequents shallow waters along sandy shores and is captured in large quantities by means of seines. The outer teeth of the upper jaw are not enlarged; the gill-rakers are better developed than in the common whiting; and the black tip of the caudal fin is another mark of distinction. The common northern kingfish (*M. saxatilis*) also extends into southern waters and is there confused with the above species under the name of whiting. It may be recognized by its dusky color and the distinct, dark bands which cross the sides obliquely. Other species occur on the Pacific Coast.

By the New England fisherman the name of whiting or silver hake is given to a common species of the cod family (Gadidae), the *Merluccius bilinearis* of American ichthyologists, though many European authorities fail to distinguish it from the Old World *M. vulgaris.* From the great majority of the cods the whiting is distinguished by the total absence of a chin barbel and by the peculiar excavated area of the top of the skull; the second dorsal and the anal fin are long and each divided nearly in two by a deep notch. The body is elongated and covered with small scales; the color grayish silvery white below. This whiting is common in waters of moderate depth along the shores of New England and somewhat northward, and extends southward in deep water to Virginia and even to the Bahamas. Unlike most of the Gadidae, which are essentially bottom feeders, it is an active, roving species, which comes to the surface to pursue and feed upon herring and other fishes. Sometimes large schools appear on our coasts and many are captured in purse seines and pound nets. Spawning takes place at the bottom on the edge of the continental slope. Owing to its comparatively small size and the softness of its flesh it is one of the least important economically of the family.

The European whiting (*M. vulgaris*) is scarcely distinguishable from the American, but has much smaller scales, fewer spines in the first dorsal fin and larger teeth. It frequents shallower water and is very abundant along the northern coasts of Europe. It makes its appearance in vast shoals, keeping at a short distance from the shore, and is taken by the line in great numbers. It is considered the most delicate and most wholesome of all the species of cod; but it does not attain a large size, usually not exceeding a foot in length and under two pounds in weight. The food of the adults consists chiefly of fishes and of the young of shrimps and other crustaceans. Spawning occurs in, and the young frequent, the shore waters. As long as the young feed chiefly on the bottom they retain a chin barbel, but as their habits change this degenerates and finally disappears. Other fishes sometimes called whiting are the hogfish, harvest fish and a whitefish.

WHITING, a preparation of white chalk from which the grosser impurities have been removed. It is extensively used in the arts, also for cleaning silver and making putty.

WHITINSVILLE, village, Massachusetts, in Worcester County, town of Northbridge (q.v.); 17 miles southeast of Worcester; altitude 302 feet. Products include mill machinery, textiles and paper. Pop. (1950) 5,662.

WHITLOCK, Brand, American diplomat: b. Urbana, Ohio, March 4, 1869; d. Cannes, France, May 24, 1934. He first engaged in journalism, then served as a clerk in the office of the Illinois secretary of state, after which he studied law and was admitted to the bar of Illinois in 1894 and to that of Ohio in 1897, then establishing himself in law practice at Toledo. He was elected mayor of Toledo in 1905 and served four successive terms, declining a fifth nomination. He succeeded in securing a new city charter providing for the initiative, referendum, recall and direct nominations. He was by this time a well-established magazine writer, producing both verse and prose, the latter dealing in the

main with politics and economics in an uncompromising fashion. He was appointed Minister to Belgium by President Wilson in 1913 and was in office at the outbreak of the European War. He was entrusted with the representation of seven of the warring nations, remaining at his post after the German invasion. His skill in dealing with the difficulties of the situation under the German occupation earned for him a worldwide reputation; and he won scarcely less praise for his handling of the Belgian relief work. The necessity for his leaving invaded Belgium when the United States declared war upon Germany in April 1917 was viewed with deep regret in Belgium. He refused to leave Brussels unless accompanied by the other Americans there, and crossed into Switzerland 4 April 1917. He later visited King Albert of Belgium at the battle front, and after the signing of the armistice in November 1918 he resumed his duties at Brussels. He returned to the United States for a visit in 1919, and while at home the country's representation in Belgium was raised to rank of an embassy. He was ambassador from 1919–22. He is author of 'The Thirteenth District' (1902); 'Her Infinite Variety' (1904); 'The Turn of the Balance' (1907); 'Abraham Lincoln' (1908); 'The Gold Brick' (1910); 'On the Enforcement of Law in Cities' (1910–13); 'Forty Years of It: An Autobiography' (1914); 'Memoirs of Belgium Under the German Occupation' (1918); 'Belgium: A Personal Narrative' (1919); 'J. Hardin and Son' (1923); 'La Fayette' (1929).

WHITLOCK, hwĭt'lŏk, Elizabeth Kemble, English actress, fifth child of Roger Kemble (q.v.): b. Warrington, Lancashire, 2 April 1761; d. 27 Feb. 1836. She first appeared at Drury Lane theatre in February 1783, as Portia. In 1785 she was married to Charles Edward Whitlock, a provincial manager and actor, and seven years later accompanied her husband to this country, where they performed for many years in the principal cities. Mrs. Whitlock became the most popular actress of the day in America, and in Philadelphia frequently performed before President Washington and other distinguished persons. She returned to England in 1807 with a competency and thenceforth retired from the stage. In personal appearance and voice she was said to have strongly resembled her sister, Mrs. Siddons.

WHITMAN, Charles Otis, American zoologist: b. Woodstock, Me., 14 Dec. 1842; d. 6 Dec. 1910. He was graduated from Bowdoin in 1868, studied at Leipzig, and in 1880–81 was professor of zoology at the Imperial University, Tokio, Japan. He was engaged in further studies at the Naples Zoological Station in 1882, and in 1883–85 was assistant in zoology at Harvard. He was director of the Allis Lake Laboratory, Milwaukee, in 1886–89, and in 1889–92 professor of zoology at Clark University, Worcester, Mass. He became director of the Marine Biological Laboratory at Woods Hole, Mass., upon its foundation in 1888, and from 1892 until his death was at the head of the department of zoology at the University of Chicago. He was elected to the National Academy of Sciences in 1895. He founded the *Journal of Morphology* in 1887, and after 1883 was editor of the microscopical department of the *American Naturalist*. He has made a specialty of the development of the vertebrates and of the structure and development of worms. His writings include 'Methods of Research in Microscopical Anatomy and Embryology' (1885); 'Biological Lectures' (1890–95); 'The Inadequacy of the Cell Theory of Development' (1893); 'Animal Behavior' (1898), etc.

WHITMAN, Charles Seymour, American lawyer: b. Hanover, Conn., 28 Aug. 1868. He studied at Amherst College and then studied law at New York University, and was admitted to the bar in 1894. In 1901 he was appointed assistant corporation counsel of New York City where his effective work won for him the post of city magistrate. In this capacity he founded the Night Court in that city for the immediate trial of all offenders arrested at night. In 1907 Governor Hughes appointed him a judge of the Court of Sessions, and in the following year deputy attorney-general in the investigation of election frauds in the northern part of the State. In 1909 he was elected district-attorney of New York City on a Fusion ticket. In this capacity he secured representation of the district-attorney's staff in the city magistrate's office, and was active in suppressing arson offenders. The noted Becker trial came up during his tenancy of office, and Whitman's mastery of the case was most effective in unearthing and reforming the relations between certain members of the New York City police and professional criminals. The handling of the Schmidt murder case, the prosecution of the poultry trust and of election frauds won for Mr. Whitman the highest commendation. He was renominated in 1913 and elected almost unanimously. In 1914 Whitman was elected to the governorship of New York State. His principal plank was the reformation of the State finances, which he proceeded to institute vigorously by a reorganization of State departments and a thorough investigation of the salaries of Civil Service employees. In 1916 he was elected chairman of the Republican National Convention, where he urged the nomination of Charles E. Hughes for President. In September of the same year he was re-elected to the governorship and established a precedent by sending to every enrolled voter a report of his first term as governor, containing also reports of the heads of other State departments. In connection with the European War, the governor ably supported the Federal administration in war policies and effectively mobilized the State's resources. He also inaugurated a State Constabulary, and a new State Guard to replace the National Guard on service in France. In 1918 he was defeated for re-election to the State Governorship by Alfred E. Smith, the Democratic candidate. He resumed the practice of law in New York in 1919.

WHITMAN, Frank Perkins, American physicist: b. Troy, N. Y., 29 July 1853; d. 15 June 1919. He was graduated at Brown University in 1874 and took his A.M. there in 1877, later studying at Johns Hopkins University. He was professor of physics at Rensselaer Polytechnic Institute, Troy, in 1880–86; and thereafter occupied that chair at Western Reserve University.

WHITMAN, Marcus, American missionary and pioneer: b. Rushville, N. Y., Sept. 4, 1802; d. near Walla Walla, Ore. (now Wash.), Nov. 29, 1847. He studied medicine, took his degree in New York State in 1832, and practised first in Canada and then in western New York. In 1834 he offered his services to the American Board of Commissioners for Foreign Missions, and in 1835 went with Samuel Parker to explore the region of the Oregon, but did not go beyond Green River. In 1836, having married, with his wife and three fellow missionaries he set out to work among the Indians of the upper Columbia. The party crossed the plains by wagon, being the first persons to reach the Pacific Coast by this means. On May 1st they reached the Columbia River, and located themselves near the site of the present Walla Walla, Wash. They were soon followed by a large number of emigrants, who settled in what was then known as Oregon, and now forms the States of Oregon, Washington and Idaho. At this time the Hudson Bay Company was using every possible means to secure this territory to the English. When this plan became evident to Whitman he decided to take every precaution to forestall it. The Ashburton Treaty was then before Congress, and was expected to settle the Oregon question. In 1842–43 Whitman traveled over 3,000 miles to the East on horseback, enduring all the hardships of a Western winter in the mountains, and according to the statement of H. H. Spalding, one of his missionary companions, he reached Washington (March 3, 1843) only to find that the treaty had been signed, but that the Oregon question had not been included. Whitman, as Spalding's version represents, at once went to work to show the government the value of the land it had deemed worthless, demonstrated to the people the fertility of the soil of Oregon, and the fact that it could be reached by wagon, and then returned at the head of a large body of emigrants. By his daring ride and earnest endeavors Whitman, in this view of the matter, won this great section for the United States and the results of his work were secured by the treaty of 1846. This claim has been a subject of controversy, some history students favoring that of Jason Lee (q.v.). Whatever the verdict on the political phase, there is no doubt that Whitman's ride (he reached Boston March 30, 1843) resulted in the reversal of the missionary board's purpose to discontinue the southern branch of the mission in which he was engaged; and his work and that of his companions has a historical relation to the American settlement of the Oregon country. Whitman, his wife, and 12 of their companions were massacred by the Cayuse Indians. Consult Nixon, 'Life of Marcus Whitman' (1895); Mowry, 'Marcus Whitman' (1901); and Bourne, 'Essays in Historical Criticism' (1901); Hulbert, A. B., and D. P., eds., 'Marcus Whitman, Crusader' (1936–38); and Marshall, W. J., 'The Acquisition of Oregon and the Long Suppressed Evidence about Marcus Whitman' (Seattle 1911). See Oregon; Oregon Question, The.

WHITMAN, Sarah Helen Power, American poet: b. Providence, R. I., 1803; d. there, June 27, 1878. She was married to John W. Whitman, a Boston lawyer, was once engaged to Edgar Allan Poe, afterward writing a defense of him entitled 'Edgar A. Poe and His Critics' (1860); contributed numerous critical articles and poems to periodicals, and was noted for her conversational powers. Her verse was in part collected in the volume 'Hours of Life, and Other Poems' (1853), and fully in the posthumous 'Poems' (1879). 'Fairy Ballads' and some other works were written with her sister, Anna M. Power. Her finest poem, 'A Still Day in Autumn,' has much melody and beauty of expression and retains an honored place in anthologies.

WHITMAN, Walt (originally Walter), American poet: b. West Hills, Long Island, N. Y., May 31, 1819; d. Camden, N. J., March 26, 1892. He was educated in the public schools of Brooklyn, and learned the printer's trade, after which he taught in country schools in Long Island. For a brief period he did editorial and reportorial work on newspapers, and in 1847–48 he made an extensive pedestrian tour as a workman through the United States and Canada, subsequently employing himself as a carpenter and builder. His first and chief work, 'Leaves of Grass,' was published by himself in New York in 1855. This thin volume of 94 pages was received, for the most part, with abuse, mainly because of its unconventional metrical style and the freedom with which the poet dealt with moral and social subjects. During the American Civil War, Whitman's brother was wounded on the battlefield, and the poet, who hastened to his aid, remained afterward as a volunteer army nurse at Washington and in Virginia for the years 1862–65. One result of this experience was the small volume 'Drum Taps' (1865), subsequently included with 'Leaves of Grass.' After the war he held a government clerkship in Washington, but the fatigue and mental strain of his labors in the hospitals brought about a severe attack of paralysis in 1873. He was recovering from this when the sudden death of his mother in his presence caused a serious relapse. From this time he resided at Camden, N. J., never securing robust health. During all these years Whitman wrote with the old vigor and freedom of rhythm, but with less of the early crudeness of expression. Though Whitman, like Carlyle and Browning, may be a dangerous and dangerously easy model for imitation, he undoubtedly worked out for himself a style of distinction as notable as theirs. This in itself is a title of fame, or at least a charm against oblivion, even though his literary style ran to extremes and vices. His evolved style was a rhythmic recitative or irregular chant, precursors of which may be found in the English translation of the Psalms and other Biblical poems, in Macpherson's 'Ossian,' and in the later poems of William Blake. These chants vary in movement and seem governed by laws rhythmic rather than metric, which (like the grammar of an unwritten tongue) have never been formulated even by the inventors themselves. They have a peculiar, wild, stirring charm, which is apt, for a time, to make regular verses seem tame and insipid. As to subject, Whitman set himself the Atlantean task of uplifting into the sphere or dominion of poetry the whole of modern life and man, omitting nothing, con-

cealing nothing. His thesis is that of St. Peter's vision: "There is nothing common or unclean." Hence the logical necessity with Whitman to include the treatment of subjects which in modern society are tabooed as obscene and unmentionable; hence, too, the accusations of indecency, so evident and pertinent from the accuser's point of view, but so futile and irrelevant from that of the accused. Whitman was an idealist who bound himself by a solemn vow to be a thorough-going realist; and his resolute and often successful endeavor to secure this union gave his work its exceptional artistic quality. He was a prince of impressionists in literature. But so hard and high was the task that he set himself, that it is no matter of surprise that he sometimes, if not often, fails, and from heights where he was approaching the sublime falls perilously near the ridiculous. This is the fate of all artists who strive for the highest things, that their failures—often only apparent—are more easily detected than their solid achievements; hence the contumely and ridicule that a Turner or a Wordsworth, Keats or Shelley suffers at the hands of a clever but uninitiated critic. So it was largely with Whitman; but it is better to approach him in the same spirit that he has shown toward man and nature, that of forever seeking for what was great and good, while outfacing steadily and bravely every stern and refractory reality. As the years roll on, Whitman's work is more highly esteemed. He had the true poetic fire, and was one of those who "talked with angels," and had glimpses of the life beyond. Several writers have contended that he was "illuminated" like Moses and Swedenborg.

Besides the two books already mentioned, he published *Drum-Taps* (1865); *Democratic Vistas* (1871); *Passage to India* (1871); *After All, Not to Create Only* (1871); *As Strong as a Bird on Pinions Free* (1872); *Memoranda During the War* (1875); *Two Rivulets* (1876); *Specimen Days and Collect* (1883); *November Boughs* (1888); *Sands at Seventy* (1888); and *Goodbye, My Fancy* (1891).

The *Conservator*, of Philadelphia, Penn., is the organ of Whitman study. Consult Burroughs, J., *Notes on Walt Whitman as Poet and Person* (New York 1867); Bucke, R. M., *Walt Whitman* (New York 1883); *The Complete Writings of Walt Whitman*, ed. by R. M. Bucke, T. B. Harned, and H. L. Traubel, 10 vols. (1902); Harned, Thomas B., ed., *Letters of Anne Gilchrist and Walt Whitman* (New York 1918); Phelps, W. L., *The Poetry of Walt Whitman* (New York 1924); Bailey, John C., *Walt Whitman* (New York 1926); Holloway, E., *Whitman, An Interpretation in Narrative* (New York 1926); Arvin, N., *Whitman* (New York 1938); Fausset, H. l'Anson, *Walt Whitman, Poet of Democracy* (New Haven 1942); Canby, H. S., *Walt Whitman, an American* (New York 1943).

WHITMAN, town, Massachusetts, in Plymouth County; altitude 76 feet; about 4 miles east east of Brockton, and 21 miles southeast of Boston; on the New York, New Haven and Hartford Railroad. The chief manufacturing establishments are concerned with shoes and findings, tacks and nails, steel shanks, electric appliances, braid, burial vaults, and shoe machinery.

Whitman has several churches, public schools, and a public library. It is the birthplace of Francis Cardinal Spellman. The town was originally a part of Abington, was settled about 1670, and was known as Little Comfort or South Abington. It was set off in 1875 and incorporated as South Abington. In 1886 the present name was adopted in honor of Augustus Whitman. The government is administered by annual town meetings. Pop. (1940) 7,759; (1950) 8,413.

WHITMAN COLLEGE, located at Walla Walla, Washington, was founded by Cushing Eells as a memorial to Marcus Whitman (q.v.); it was chartered in 1859 as Whitman Seminary, but was not open to students until 1866; in 1882 the courses were extended and the standard raised. A new charter was obtained in 1883 by which the name was changed to Whitman College.

The college is coeducational. In 1951–1952 there were 49 on its teaching staff, 699 students; the value of grounds, buildings, and equipment was $2,055,000; total endowment was $2,462,913.

The curriculum is administered in three divisions: social sciences, letters and arts, and basic sciences. The college confers the degree of bachelor of arts, and the degree of master of arts. The Conservatory of Music has its own fully equipped three-story building and offers extensive courses in theoretical and applied music. Whitman is a residence college and maintains dormitories in which all women and all freshman men whose homes are not in Walla Walla are required to live.

WHITMAN NATIONAL MONUMENT, Washington, located 6 miles west of Walla Walla. Established in 1940, it contains 45.8 acres. It was named in honor of Marcus Whitman to commemorate his devotion to the welfare and needs of the Indians.

WHITMER, hwĭt'mẽr, **David**, American Mormon leader: b. near Harrisburg, Pa., Jan. 7, 1805; d. Richmond, Mo., Jan. 25, 1888. He brought Joseph Smith (q.v.) to his father's farmhouse near Palmyra, N. Y., where the "Golden Plates" were translated in June 1829. After being baptized by Smith he was one of three men privileged to examine the "Golden Plates" to testify to their supernatural source yet material character. In 1834 he was president of the "High Council of Zion," organized by Smith to manage Mormon interests in Missouri, and was one of the leading men of the denomination. However, Smith excommunicated him in 1838. In 1867 Whitmer and his family revived the "Church of Christ," but had made only 150 proselytes at his death.

WHITMER, hwĭt'mẽr, **Thomas Carl**, American composer: b. Altoona, Pa., June 24, 1873. He was educated at Franklin and Marshall College, and studied music in Philadelphia, Pa., and New York, N. Y. From 1916 to 1932 he was organist of the Sixth Presbyterian Church, Pittsburgh, Pa. He was composer in residence at Pennsylvania College for Women, 1948–1949. He composed a series of six music-dramas, works for piano and stringed instruments, choral works and many organ pieces. He is the author of *The Way of My Mind* (1917); *The Way of My Heart and Mind* (1920); *Song for Free Men* (chorus for massed groups, 1940); *I Am the Resurrection* (anthem, 1942); *The Arm of God* (a church cantata, 1945); *I Walk by the Three Rivers* (1946).

WHITMIRE, town, South Carolina, in Newberry County, on the Enoree River, 22 miles east of Laurens. It has cotton mills, and is in an agricultural community. Pop. (1950) 3,006.

WHITNEY, hwĭt'nĭ, **Adeline Dutton Train**, American author: b. Boston, Mass., Sept. 15, 1824; d. Milton, Mass., March 21, 1906.

She was married to Seth D. Whitney of Milton, Mass., in 1843. Although a frequent contributor to different periodicals during her earlier years, her real literary career did not begin until 1859, and her best work was done in the two following decades. Her writings, which are chiefly for young people, are wholesome in tone and entertaining in style, and include, among many others, *Hitherto: A Story of Yesterdays* (1869); *Real Folks* (1871); *Sights and Insights* (1876); *Bonnyborough* (1885); *A Golden Gossip* (1890).

WHITNEY, Alexander Fell, American labor leader: b. Cedar Falls, Iowa, April 12, 1873; d. Cleveland, Ohio, July 16, 1949. As president of the Brotherhood of Railroad Trainmen, he was recognized as one of the most powerful union spokesmen in the United States. Militant and outspoken, he was one of the key figures in the railroad wage controversy of May 1946, precipitating a nationwide rail strike which paralyzed transportation from May 23 to May 26, 1946.

Leaving high school in Cherokee, Iowa at 15 years of age, Mr. Whitney began his career by selling newspapers and candy aboard trains of the Illinois Central Railroad running between Dubuque and Sioux City, Iowa. His self-assurance won the favor of a railroad superintendent who hired him as a brakeman, and from 1890 to 1901 he worked in this capacity for the Illinois Central and other railroads throughout the Midwestern states.

In 1896 he joined the G. E. Boynton Lodge 138 of the Brotherhood of Railroad Trainmen at Eagle Grove, Iowa. The almost religious fervor with which he advocated the principles of unionism caused his fellow workers to elect him chairman of the local lodge, a post which led him into a lifetime of service with the brotherhood, of which he became president in 1928. As chairman of the Railway Labor Executive Association, 1932–1934, he served as spokesman for 21 railway labor organizations. It was largely through his efforts that the Railway Retirement Act of 1935 and the Omnibus Transportation Act of 1940 became law.

WHITNEY, Anne, American sculptor: b. Watertown, Mass., Sept. 2, 1821; d. Boston, Jan. 23, 1915. For several years before beginning work as a sculptor she contributed verse of high quality to magazines and newspapers. Her poems were collected and published in one volume in 1859. She opened her first studio as a professional sculptor in Watertown in 1860. In 1872, after four years of study abroad, she established her studio in Boston. Among her works are the statue of Samuel Adams for the Capitol at Washington, a bronze replica of which stands in Adams Square, Boston; one of Lief Erikson in Boston (replica in Milwaukee, Wis.); the statue of Charles Sumner in Cambridge, Mass., and portrait busts of many notables.

WHITNEY, Asa, American inventor: b. Townsend, Mass., Dec. 1, 1791; d. Philadelphia, Pa., June 4, 1874. As a boy he worked in his father's blacksmith shop, then became a machinist, and later manufactured machinery in Vermont and at Brownsville, N. Y. In 1830 he was appointed master machinist of the Mohawk and Hudson railroad shops, and three years later became superintendent of the road. In 1839–1841 he was state canal commissioner of New York. He settled in Philadelphia in 1842 after forming a partnership with Matthias W. Baldwin for the building of locomotives. In May 1847 he obtained a patent for a cast iron car wheel with a corrugated center web, and a patent for his method of manufacturing it; and in April 1848 he obtained a patent for an improved process of annealing and cooling cast iron wheels. With these three patents he developed his own firm into the largest car wheel works in the country. He left $50,000 to the University of Pennsylvania for a chair of dynamic engineering.

WHITNEY, Asa, American merchant: b. North Groton, Conn., March 14, 1797; d. Washington, D.C., Sept. 17, 1872. He began his business career about 1817 as buyer for a New York drygoods merchant and traveled abroad extensively. In 1836 he formed his own firm, but failed in the panic of 1837. He went to China where he made another fortune in a little over a year, and upon his return to America worked tirelessly to get Congress to authorize the building of a transcontinental railroad in order to expand trade with the Orient. Before his death one railroad to the Pacific coast had been completed and three others were begun.

WHITNEY, Caspar, American editor: b. Boston, Mass., Sept. 2, 1864; d. Irvington-on-Hudson, N. Y., Jan. 18, 1929. After graduation from St. Matthew's College, Calif., he spent several years in hunting and exploration. In 1888 he became sports writer for *Harper's Weekly,* and in 1898 went to Cuba as war correspondent for *Harper's.* He was editor of *Outing Magazine,* 1900–1909; *Outdoor America,* 1909; *Recreation,* 1913. He was a war correspondent in Mexico in 1914, and was correspondent in Europe for the New York *Tribune* in 1917–1919. He was editor of the *American Sportsman's Library,* and was author of several books, including *Hawaiian America* (1899); *Jungle Trails and Jungle People* (1911); *What's the Matter with Mexico?* (1916); *The Critical Year* (1918).

WHITNEY, Eli, American inventor: b. Westboro, Mass., Dec. 8, 1765; d. New Haven, Conn., Jan. 8, 1825. He worked his way through Yale, and in 1792 went to Georgia as a teacher. Finding a patron in the widow of Gen. Nathanael Greene, of the Revolutionary army, he resided on her estate and studied law. Cotton culture in the South at this period was hampered by the slow and difficult work of separating the cotton from the seed by hand. Whitney set to work to remedy this by inventing a machine, and by April 1793 he had succeeded in building one that could turn out 50 pounds of cleaned cotton in a day. He formed a partnership with Phineas Miller in 1793 to patent and make cotton gins, and returned to New Haven to begin manufacturing them; but before he could obtain his patents a number of imitations of his gin had been put into operation. Lawsuits in defense of his rights carried off his profits and $50,000 voted him by the state of South Carolina. Not until 1807 did he receive a clear title to his patent, and in 1812 Congress refused its renewal. In 1798, however, he obtained a government contract for the manufacture of firearms, and was probably the first to introduce the system of interchangeable parts.

He established his factory at Whitneyville near New Haven, and made a fortune by this manufacture. See also COTTON GIN.

WHITNEY, Gertrude Vanderbilt, American sculptor: b. New York City, April 19, 1877; d. there, April 18, 1942. She was the daughter of Cornelius Vanderbilt (1843–1899), and in 1896 was married to Harry Payne Whitney, son of William C. Whitney (q.v.). She studied sculpture in New York and Paris, and executed many notable commissions such as the *Aztec Fountain* in the Pan American building, and the *Titanic Memorial,* both in Washington, D.C.; the *St. Nazaire War Memorial,* France; the *Columbus Memorial,* Palos, Spain. In 1931 she established the Whitney Museum of American Art in New York, which was consolidated with the Metropolitan Museum of Art in January 1943.

WHITNEY, Henry Howard, American soldier: b. Glen Hope, Pa., Dec. 25, 1866; d. Madison, N. J., April 3, 1949. He graduated from West Point in 1892. In 1898, under orders from the secretary of war, and disguised as an English sailor, he made a military reconnaissance of the island of Porto Rico and obtained information which enabled Gen. Nelson Miles to take the island. He served throughout the Spanish-American war as captain and assistant adjutant general on the staff of General Miles, and accompanied him on his world tour in 1902–1903. He served as chief of staff, District of Paris, 1918–1919, and was retired by his own request in 1920.

WHITNEY, SIR James Pliny, Canadian statesman: b. Williamsburg, Ontario, Can., Oct. 2, 1843; d. Toronto, Sept. 25, 1914. He was called to the bar of Ontario in 1876, and practiced law at Morrisburg. He was elected to the Ontario legislature in 1888, where he became the leader of the Conservative Opposition. From 1905 until his death he was prime minister of Ontario. He was knighted in 1908.

WHITNEY, Josiah Dwight, American geologist: b. Northampton, Mass., Nov. 23, 1819; d. Lake Sunapee, N. H., Aug. 19, 1896. He was the brother of William D. Whitney (q.v.) After graduating from Yale in 1839, he spent the years 1842–1847 in study in Europe, then, with J. W. Foster, explored the Lake Superior region. They published a synopsis of the explorations in 1849, and a report on the geology in 1850–1851. Whitney was appointed state chemist and professor at Iowa State University in 1855, and was made state geologist of California in 1860. He labored on the survey of that state until 1874, publishing his *Geological Survey of California,* 1864–1870. Mount Whitney, the highest peak of the Sierra Nevada, was named in his honor. In 1875 he was appointed to the chair of geology at Harvard. He was the author of *The Metallic Wealth of the United States* (1854); *Yosemite Guidebook* (1869); and other works on geology.

WHITNEY, William Collins, American public official: b. Conway, Mass., July 5, 1841; d. New York City, Feb. 2, 1904. He graduated from Yale in 1863, attended Harvard Law School in 1863–1864, and was admitted to the New York bar in 1865. He took an active part in the proceedings against the Tweed ring, and as corporation counsel of the city, 1875–1882, thoroughly reorganized the law department. As secretary of the navy in the Cabinet of Grover Cleveland from 1885 to 1889, he accomplished much in the development of plans for strengthening the naval service. He did effective work for the election of Cleveland as governor of New York in 1882, and as president in 1884, and again in 1892, when he was manager of the Democratic campaign.

Whitney declined to enter the Cabinet again, however, preferring to pursue his business career. One of his largest enterprises was the consolidation of the various street railway lines in New York City The Metropolitan Street Railway system was mainly organized by him, and he was a director in many corporations and societies. He was especially interested in the breeding and training of horses, and as the leader of the American turf he worked for its elevation to higher levels of sportsmanship. At the time of his death he was one of the largest landowners in the East, with holdings in several states, including a game preserve of 16,000 acres in the Adirondacks. While his main residence was in New York, he maintained others in his various estates, as well as a house in London. He left two sons, Harry Payne Whitney and Payne Whitney.

WHITNEY, William Dwight, American philologist: b. Northampton, Mass., Feb. 9, 1827; d. New Haven, Conn., June 9, 1894. He was the brother of Josiah D. Whitney (q.v.). After graduating from Williams College in 1845 he studied at Yale, 1849–1850, and then went to Germany, where he continued his philological and Sanskrit studies under Franz Bopp at Berlin and Rudolf von Roth at Tübingen. He was appointed professor of Sanskrit at Yale in 1854, and in 1870 professor of comparative philology, retaining both posts until his death. In 1856 he published, with Roth, an edition of the *Atharva-Veda Sanhita,* and in 1862 issued at New Haven an edition, with translation and notes, of the *Atharva-Veda Prâtiçâkhya.* His *Language and the Study of Language* (1867) was an admirable exposition of the main principles of comparative philology. His other published works include a number of language text books; an edition of the *Taittiriya-Prâtiçâkhya* (1872), for which he was awarded the Bopp medal of the Berlin Academy; *Oriental and Linguistic Studies* (1872); *The Life and Growth of Language* (1875); *A Sanskrit Grammar* (1879); *The Roots, Verb Forms, and Primary Derivatives of the Sanskrit Language* (1885), a supplement to the grammar. He was a contributor to Otto von Böhtlingk's and Roth's great Sanskrit Dictionary (1853–1875), and was editor in chief of *The Century Dictionary of the English Language* (1889–1891). He was elected a member of the American Oriental Society in 1850 and wrote more than half of the contents of volumes 6-12 of the *Journal* of that society. He was one of the founders and was first president (1869) of the American Philological Association. The 19th volume of the *Journal* of the American Oriental Society (1897) contains a complete bibliography of his works.

WHITNEY, Willis Rodney, American chemical engineer: b. Jamestown, N. Y., Aug. 22, 1868. He graduated from the Massachusetts Institute of Technology in 1890, and took his Ph.D. at the University of Leipzig in 1894. In 1904 he was appointed nonresident assistant professor of theoretical chemistry at the Massachusetts Institute of Technology and nonresident professor in

1908. He was director 1900–1928 of the research laboratory of the General Electric Company, Schenectady, N. Y., and after 1928 vice president in charge of research. The perfecting of metallic electric lamp filaments and the development of wrought tungsten are among the results of his research. He was president of the American Chemical Society in 1910, and received its Willard Gibbs Medal in 1916. He was appointed to the Naval Consulting Board in 1915 and to the advisory committee of the United States Bureau of Standards, 1925–1930. He translated M. Le Blanc's *Electrochemistry* in 1896, and has been the recipient of many academic and scientific honors.

WHITNEY, Mount, a peak of the Sierra Nevada, California, Tulare and Inyo Counties, in the southeastern part of the state; altitude 14,495 feet, the highest elevation in the United States outside of Alaska. The slope is precipitous on the east, rising abruptly for about 11,000 feet from Owens Valley. The peak was named for Josiah D. Whitney (q.v.), who first measured its height in 1864.

WHITNEYITE, a metallic mineral, containing 88.4 per cent of copper and 11.6 per cent of arsenic and having the formula Cu_9As. It is known only massive, its structure being very fine-granular. It is malleable, has a hardness of 3.5 and specific gravity of about 8.5. Its color is pale reddish-white, tarnishing quickly to a bronze or nearly black. It was regarded as a rare mineral until discovery of large quantities in the Mohawk mine, Michigan, where it proved a valuable ore of copper.

WHITON, James Morris, American clergyman: b. Boston, Mass., April 11, 1833; d. New York, N. Y., Jan. 25, 1920. He was educated at Yale, and was rector of the Hopkins Grammar School in New Haven, Conn. (1854–1864). Ordained to the Congregational ministry in 1865, he held pastorates at Lynn, Mass. (1865–1875); Newark, N. J. (1879–1885); New York City (1886–1891); Haworth, N. J. (1898–1901). After 1896 he was on the editorial staff of the *Outlook*. Among his published works are several school textbooks in Greek and Latin, several volumes of sermons preached in Great Britain (1887–1889), and a number of books on religious subjects.

WHITRIDGE, Frederick Wallingford, American lawyer: b. New Bedford, Mass., Aug. 8, 1852; d. New York City, Dec. 30, 1916. He graduated from Amherst College in 1874, from Columbia University Law School in 1878, and was admitted to the New York bar in 1879. He became president of several electric railway lines in New York and its suburbs. In 1888 he was lecturer on administrative law at Columbia University, and in 1888–1894 on constitutional and political history. In 1906 he was special United States ambassador to Spain to attend the coronation of King Alphonso XIII.

WHITSIDE, hwĭt'sīd, **Samuel Marmaduke,** American soldier: b. Toronto, Can., Jan. 9, 1839; d. Bethesda, Md., 1904. He entered the United States Army in 1858, served through the Civil War, was brevetted major in 1865, and made captain in 1866. For more than 25 years he fought in the Indian wars on the Western frontier, where he captured Big Foot and his 400 Sioux warriors in December 1890, and on the following day commanded his regiment in the Battle of Wounded Knee. He was promoted lieutenant colonel in 1895; was in command of the 5th United States Cavalry during the Spanish-American War; and was in command of the Department of Santiago and Puerto Principe, Cuba, 1900–1902. He retired from active service in 1902.

WHITSITT, hwĭt'sĭt, **William Heth,** American clergyman: b. Nashville, Tenn., Nov. 25, 1841; d. Richmond, Va., Jan. 20, 1911. He graduated from Union University, Murfreesboro, Tenn., in 1861, was ordained to the Baptist ministry in 1862, served in the Confederate Army, 1862–1865, and was pastor of Mill Creek Church, Nashville, 1865–1866. After further study in America and abroad he became professor of church history at Southern Baptist Theological Seminary, 1872–1895, and president of that institution, 1895–1899. From 1901 until his death he was professor of philosophy at Richmond College, Va. He published *Origin of the Disciples of Christ* (1888), *Genealogy of Jefferson Davis* (1908), and other works.

WHITSON, hwĭt's'n, **John Harvey,** American novelist: b. Seymour, Ind., Dec. 28, 1854; d. Rowley, Mass., May 2, 1936. He was ordained to the Baptist ministry in 1898, taught Bible history and literature at Ward-Belmont College, Nashville, Tenn. (1920–1923), and was head of the department of religious education at Hardin College in Missouri, after 1923. Among his novels were *Barbara, a Woman of the West* (1903); *The Rainbow Chasers* (1904); *Justin Wingate, Ranchman* (1905); *Filibusters* (1910); *Edgewood Enigma* (1912); *Wings of Mars* (1914); *Mystery of Greenacres* (1916).

WHITSTABLE, hwĭt'stà-b'l, urban district, England, Kent County, is located 6 miles north of Canterbury, on the south shore of Thames estuary, near the mouth of the Swale. It has noted oyster fisheries. As early as 1830 it was the terminus of a railway from Canterbury. Pop. (1951) 17,467.

WHITSUNDAY, the seventh Sunday after Easter; a religious festival in commemoration of the descent of the Holy Spirit on the day of Pentecost. The name was derived from the white garments worn on that day by candidates for ordination and children presented for baptism. The older name was Pentecost. See also Pentecost.

WHITTEMORE, hwĭt'ê-mōr, **Amos,** American inventor: b. Cambridge, Mass., April 19, 1759; d. West Cambridge (now Arlington), March 27, 1828. He worked for some years as a gunsmith, and about 1795 formed a copartnership with one of his brothers and several other persons for the manufacture of brushes for carding cotton and wool. He had not been long in this business before he invented a machine for puncturing the leather and setting the wires of the cards, a work previously performed by hand. The invention was patented in the United States in 1797. In 1799 Whittemore went to England to secure his rights there, but was unsuccessful. In the United States the patent was sold for $150,000; but afterward his brother Samuel Whittemore repurchased it, and carried on the business. Amos Whitte-

more devoted his last years to the invention of an orrery, in which every planet was to describe its own orbit, but did not live to complete it.

WHITTEMORE, Thomas, American clergyman: b. Boston, Mass., Jan. 1, 1800; d. Cambridge, March 21, 1861. He studied for the Universalist ministry under the Rev. Hosea Ballou, and in June 1821 became minister of a church at Milford, Mass. The next year he became minister of a church in Cambridgeport until 1833. In 1828, with Russell Streeter, he bought the semimonthly *Universalist Magazine* and published it as a weekly under the title *Trumpet and Universalist Magazine.* Streeter shortly sold his interest to Whittemore, who remained as editor for 33 years. He was also president of the Cambridge bank and of the Vermont and Massachusetts Railroad, and represented Cambridge repeatedly in the state legislature. He published *A History of Universalism* (1830; enlarged 1860), *Songs of Zion* (1836), *Life of Hosea Ballou* (1854–1855), and other works.

WHITTIER, hwĭt'ĭ-ẽr, **John Greenleaf,** American poet: b. Haverhill, Mass., Dec. 17, 1807; d. Hampton Falls, N. H., Sept. 7, 1892. He was a Quaker, and was called "the Quaker poet." In his boyhood he worked on the farm he later described in his poem, *Snowbound.* He received but little formal education, though he contrived by working at shoemaking and teaching to pay for two periods of six months at Haverhill Academy in 1827–1828. When the Newburyport *Free Press* accepted a poem from him in 1826, it led to a lifelong friendship with the editor, William Lloyd Garrison (q.v.).

Whittier's fame has become so firmly established as a poet that most people forget his long career as an editor and reformer. He edited the *American Manufacturer,* a weekly concerned chiefly with mechanics, the industries and agriculture, in Boston in 1829, and in the following year the Haverhill *Gazette.* During 1830–1832 he conducted the *New England Review,* which George Dennison Prentice had brought into some prominence, at Hartford, Conn. To this time belong his first independent publications, *Legends of New England* (1831), and *Moll Pitcher* (1832). In 1833 he issued *Justice and Expediency,* an antislavery pamphlet, and acted as a secretary of the antislavery convention at Philadelphia, and was a member of the committee which drafted the declaration of principles. He sat in the Massachusetts legislature in 1835, and in the following year sold his farm and removed to Amesbury, some eight miles northeast of Haverhill, where he chiefly resided for the rest of his life. In 1836 he became secretary of the Anti-Slavery Society, and in 1837 published *Poems Written During the Progress of the Abolition Cause in the United States.* With that cause he was now thoroughly identified. At Concord, N. H., he, with George Thompson (q.v.), was mobbed during the latter's lecturing tour.

Whittier edited the *Pennsylvania Freeman* in Philadelphia during 1838–1840, and in the first of these years his office was sacked and burned by a mob. In 1844–1845 he edited the *Middlesex Standard* in Lowell, Mass., and during 1847–1860 was corresponding editor of the *National Era,* a Washington paper, sometimes writing half a dozen columns weekly of general articles and reviews. He also contributed to the *Atlantic Monthly* from its foundation in 1857. His poem, *A Word for the Hour* (January 1861), shows that he shrank from the Civil War and was prepared to let the Southern states secede. He hailed the end of the war and of slavery with delight, and did his utmost to induce the North to welcome back the South in the most generous spirit.

Besides those mentioned above, Whittier's publications include the following: *Mogg Megone* (1836); *Poems* (1838); *Lays of My Home and Other Poems* (1843); *The Stranger in Lowell* (1845); *Supernaturalism in New England* (1847); *Leaves from Margaret Smith's Journal* (1849), an imaginative description of early New England, and *Old Portraits and Modern Sketches* (1850), all four collected from the *Era; Voices of Freedom* (1846); *Songs of Labor, and Other Poems* (1850); *The Chapel of the Hermits, and Other Poems* (1853); *Literary Recreations and Miscellanies,* also gathered from the *Era* (1854); *The Panorama, and Other Poems* (1856); *Home Ballads and Poems* (1860); *In War Time, and Other Poems* (1864); *National Lyrics* (1865); *Snowbound: a Winter Idyl* (1866); *The Tent on the Beach, and Other Poems* (1867); *Among the Hills, and Other Poems* (1869); *Miriam, and Other Poems* (1871); *The Pennsylvania Pilgrim, and Other Poems* (1872); *Hazel Blossoms* (1875); *Mabel Martin: a Harvest Idyl* (1875); *The Vision of Echard, and Other Poems* (1878); *The King's Missive, and Other Poems* (1881); *The Bay of Seven Islands, and Other Poems* (1883); *Saint Gregory's Guest, and Recent Poems* (1886), and *At Sundown* (1892), a posthumous volume. The Riverside edition of his works, both in prose and in verse, carefully revised and annotated by himself, appeared at Boston in 1888–1889. The most complete edition of the poems is the one-volume Cambridge edition (1895).

Whittier was long interested in politics, though his active participation largely ceased with the development of antislavery opinion in the North. His services to the cause of antislavery were important. He wrote numerous occasional poems celebrating or denouncing incidents and events of the conflict, the best known being the *Ichabod* verses, "the most powerful that he ever wrote," rebuking the defection of Daniel Webster from antislavery principles in the *Seventh of March* speech. Opposed to the Civil War, Whittier insisted, when it was begun, that slavery was the vital question, and during its progress contributed largely to the small quantity of valuable poetry that it evoked. Subsequently he devoted himself to presenting in narrative and ballad poem the legends, traditions and history of colonial America, particularly New England; to describing, as he did notably in *Snowbound,* rural scenes and conditions, many of which have passed into history, and to writing several hymns which appear in the collections of many denominations. His work has been criticized for its inequality and faulty rhymes, and also somewhat for its moralizing tendency. Much of his verse does reveal a certain want of compression and verbal selections, due principally to the fact that it was written with a readiness approaching improvisation. To object to his moralizing tendency is simply to object to the point of view of one who was originally and strongly, a reformer. His leading characteristics are a fine simplicity, a convincing quality and what Lowell styled as his "genial piety."

He was less cosmopolitan than Longfellow, but by many critics has been ranked as not greatly inferior to that poet.

Consult Pickard, S. T., *Life and Letters of John Greenleaf Whittier,* 2 vols. (1894); Pickard, S. T., *Whittier as Politician; illustrated by his Letters to Professor Elizur Wright, Jr.* (1900); and Pickard, S. T., *Whittier-Land* (1904); Albree, J., *Whittier Correspondence from the Oak Knoll Collections* (1911); Denervaud, M. V., *Whittier's Unknown Romance; Letters to Elizabeth Lloyd* (1922); Sparhawk, F. C., *Whittier at Close Range* (1925); Mordell, A., *Quaker Militant, John Greenleaf Whittier* (1933); Currier, T. F., *Elizabeth Lloyd and the Whittiers* (1939); Bennett, W., *Whittier, Bard of Freedom* (Chapel Hill, N. C., 1941); Rowntree, A., *Whittier: Crusader and Prophet* (London 1946).

WHITTIER, city, California, in Los Angeles County; altitude 246 feet; 14 miles southeast of Los Angeles; on the Southern Pacific, and the Union Pacific railroads. The surrounding country is predominantly agricultural, producing fruits, especially avocados, walnuts, oranges, and lemons. A residential suburb, Whittier has little mechanical industry, but there are some foundries and oil well supplies. The city is the seat of Whittier College, a non-sectarian, coeducational institution founded by the Society of Friends in 1901; it possesses the world's largest Quaker church. A colony of Friends established the city in 1887, naming it in honor of the poet John Greenleaf Whittier; it was incorporated in 1898. Pop. (1940) 16,115; (1950) 23,820.

WHITTINGHAM, hwĭt'ĭng-ăm, **Charles,** English printer: b. Caludon, Warwickshire, June 16, 1767; d. Chiswick, near London, Jan. 15, 1840. He served his printing apprenticeship at Coventry, and in 1789 he established his own printery in London. In 1809 he removed to Chiswick, at that period still outside London, and there, in 1811, he founded the Chiswick Press, which became distinguished for excellence and beauty of workmanship. He was one of the first to issue cheap reprints of the classics, and he pioneered in bringing out India-paper editions.

Soon after Whittingham took his nephew, Charles Whittingham (1795–1876), into partnership, in 1824, the Chiswick Press issued Washington Irving's *Knickerbocker's History of New York* (1824) and Pierce Egan's *Life of an Actor* (1825). The younger Whittingham began block-color printing in 1840, and in 1844 reintroduced William Caslon's old-style type. In 1852 the Chiswick Press was moved back to London, where it continued to print many fine books for the publisher William Pickering (1796–1854), including the "Aldine" edition of the English poets.

WHITTINGHAM, William Rollinson, American Protestant bishop: b. New York, N. Y., Dec. 2, 1805; d. Boston, Mass., Oct. 17, 1879. He was graduated at the General Theological Seminary, New York, in 1825, ordained deacon in 1827, and priest 1829, and was in charge of Saint Mark's Church, Orange, N. J., until 1831. He then became rector of Saint Luke's, New York, and in 1835 was professor of ecclesiastical history in the General Seminary, which position he held until his consecration as bishop of Maryland in 1840. The written evidence of his learning is preserved in the pages of various periodical publications, such as *The Churchman,* of which one time he was editor. During the Civil War, in opposition to many of the people in Maryland, he was unflinching in his advocacy of loyalty to the Federal government.

WHITTINGTON, hwĭt'ĭng-tŭn, **Richard,** English merchant and mayor of London: b. Pauntley, Gloucestershire, England, 1358?; d. London, England, March 1423. He became a mercer in London, a member of the common council in 1385 and 1387, subsequently alderman and sheriff, and mayor in 1397–1398, 1406–1407 and 1419–1420. He was very liberal in charitable gifts. The legend which represents him as making his fortune by sending a cat in an outgoing ship to Barbary, where it was sold for a large sum, and as returning to London, which he had just quitted on hearing Bow bells sounding what seemed to be

"Turn again, Whittington,
Lord Mayor of London."

is without foundation.

WHITTREDGE, hwĭt'rĭj, **Worthington,** American artist: b. Springfield, Ohio, May 22, 1820; d. Feb. 25, 1910. He studied art in Cincinnati, worked there as a portrait painter 1842–1849, later went to Europe and studied under Andreas Achenbach at Düsseldorf, also in Paris, Belgium, Holland and Rome, returning to the United States in 1859, to become noted as a landscape painter of the Hudson River school. Accompanying Gen. John Pope on his western tour of inspection in 1874, he sketched many Rocky Mountain views. He was elected a National Academician in 1861, and he was president of the Academy in 1875–1876.

His chief works include *House on the Hudson River* (1863, in the New York Public Library); *Old Hunting Ground* (1864); *View of the Rocky Mountains from the River Platte* (1868); *Trout Brook* (1875); *Camp Meeting* (1906, in the Metropolitan Museum). The best known of his early paintings is *The Poachers,* which is often reproduced as a lithograph.

WHITWORTH, hwĭt'wûrth, Sir **Joseph,** English mechanical engineer: b. Stockport, Dec. 21, 1803; d. Monte Carlo, Jan. 22, 1887. He worked as a mechanic in Manchester and London, discovered the method of making a truly plane surface, and in 1833 established himself as a tool-maker at Manchester. Between 1840 and 1850 he developed his measuring-machine, by means of which he elaborated his standard system of uniform measures and gauges which was found by engineers to be of great usefulness. One of his devices which proved to be of much immediate service was that of a uniform system of screw-threads. He made many experiments in connection with rifles, and, in 1857, perfected a hexagonal-barreled rifle of great range, accuracy and penetrative power, highly excelling the Enfield, then largely in use. It was not accepted at the time by the War Department, as being of a caliber too small for a military weapon; though in 1869 the War Office declared that a weapon of such caliber would appear to be the most suitable. He was equally successful in the building of cannon, but his rifled gun with a 250-pound shell and a six-mile range was rejected by the ordnance board in 1865, greatly to the detriment of British ordnance. His invention of compressed cast steel for ordnance was an important one, and came into general use. His works at Manchester were converted into a limited liability company in 1874, and in 1897 united with the Elswick works, established by Sir William Armstrong (q.v.). His fortune was devoted

to the endowment of 30 scholarships in mechanics and to the furthering of charitable and educational work. He was made a baronet in 1869.

WHITWORTH GUN. See ORDNANCE.

WHOLE FAMILY PROTECTION. See INSURANCE, FRATERNAL.

WHOOPER, the whooping swan. See SWAN.

WHOOPING COUGH, an infectious disease which most commonly attacks children, generally but once in their lives. It is characterized by a series of coughs ending in a long-drawn breath, during which a shrill whistling sound—the whoop—is produced. Several fits of coughing succeed one another until some phlegm or mucus is expelled. Vomiting not infrequently follows a fit of coughing. The first symptoms, usually five or six days after exposture to infection, are those of a common cold or sore throat; a difficulty of breathing and other slight febrile affections are succeeded by horseness, cough and difficulty of expectoration. After 10 to 14 days the cough becomes convulsive and is attended by the whoop, which is caused by the inspiration of air through the contracted cleft of the glottis. These spasms occur at uncertain intervals, but usually about every two hours, and between them the child returns to play, takes food with good appetite, and exhibits little sign of illness. In four or five weeks the disease reaches its height, after which the expectoration becomes loose and the fits of coughing gradually diminish in frequency and duration. This second stage may last from two to eight weeks and is succeeded by convalescence, the duration of which is variable. Whooping cough is seldom fatal to adults, but is most fatal in the first year of childhood. Bronchitis and pneumonia are the most serious complications. Patients should not come in contact with other children. Vaccines are said to have prophylactic as well as curative properties.

WHOOPING CRANE. See CRANE.

WHORTLE-BERRY. See VACCINIACEAE.

WHYDAH, whĭd'ŭ, a French West African seaport, known also as Ouidah (q.v.).

WHYDAH-BIRD, WHIDAH-BIRD, or **WIDOW-BIRD,** a weaver-bird (q.v.) of the West African subfamily *Viduinae;* in which the tail-feathers are greatly prolonged and modified. The paradise whydah-bird is brownish-black, the head, chin and throat being black and the neck encircled by a brown collar. The under parts are pale brown. The tail is long and the two central feathers are elongated and possess broad webs at the tip and a slender shaft, while the two next feathers are about 11 inches long and are broadly webbed. The other tail feathers are set vertically. This species attains a length of five or six inches, exclusive of the tail feathers. The nest is said to be ingeniously made of cotton fibres and to be divided into two compartments, in one of which the female sits on the eggs, but the other being occupied by the male bird. The shaft-tailed whydah-bird (*V. regia*) is colored a rusty red on the head and neck, the back of the head and crown being black. The average length of this species is eight or nine inches, and the four central feathers are elongated, but consist each of the bare shaft or quill only, a slight web existing at their tips.

WHYMPER, hwĭm'pĕr, **Edward,** English mountain climber, artist and author: b. London, April 27, 1840; d. Chamonix, France, Sept. 16, 1911. He was trained as a wood-engraver, and in 1860 he was sent by a London firm to make sketches of Alpine peaks. He ascended Mount Pelvoux, in the French Alps, in 1861, and three years later the Pointe des Écrins, his party being the first to accomplish the latter feat. In 1865, at his seventh attempt, he reached the summit of the Matterhorn, hitherto unscaled, but four of his party of seven lost their lives during the descent. In 1867 and 1872 he visited northern Greenland, where he discovered magnolia cones which gave evidence of a previous abundant vegetation there; his valuable collection of rare fossils, trees and shrubs was acquired by the British Museum. In 1879–80 he explored the Andes in Ecuador with the prime objectives of studying mountain-sickness and the effects of diminished pressure on the human body. During this journey he discovered the Andean glaciers, collected specimens of fossils, plants and animals, and, in 1880, was the first to reach the summit of Chimborazo, a feat which Friedrich Heinrich Alexander Humboldt (q.v.) attempted and failed to accomplish; he also ascended Cotopaxi, and was the first man to climb six other lofty peaks. In 1901–05 he made exploring tours of Canada, ascending mountains and making investigations in the Great Divide region of the Rockies. His books include: *Scrambles amongst the Alps in the Years 1860–69* (1871); *Travels amongst the Great Andes of the Equator* (1892); *Chamonix and Mont Blanc* (1896; 15th ed., 1910); *Zermatt and the Matterhorn* (1897; 14th ed., 1910).

WHYTE, Alexander, clergyman of the Free Church of Scotland: b. Kirriemuir, Forfarshire, Scotland, Jan. 13, 1837; d. London, Jan. 6, 1921. He was educated at the University of Aberdeen and at the New College, Edinburgh. He was assistant minister of Free Saint John's, Glasgow, 1866–70; assistant minister, 1870–73 and minister, 1873–1909 of Free Saint George's, Edinburgh. He was professor of New Testament Literature and also principal of New College, Edinburgh, from 1909 to 1918. He published *A Commentary on the Shorter Catechism* (1882); *Bunyan Characters* (4 series, 1893–1908); *Samuel Rutherford and some of his Correspondents* (1894); *Jacob Behmen; An Appreciation* (1894); *Lancelot Andrewes and His Private Devotions* (1895); *Four Temperaments* (1895; later ed. 1910); *Bible Characters,* 6 vols. (1896–1902); *Saint Teresa: an Appreciation* (1897, 1910); *Father John of the Greek Church* (1898); *Sir Thomas Browne: an Appreciation* (1898); *Characters and Characteristics of William Law* (1898); *Newman: an Appreciation* (1901); *Bishop Butler: an Appreciation* (1903); *The Apostle Paul* (1903); *Walk, Conversation, Character of Jesus Christ Our Lord* (1905); *Thomas Shepherd, Pilgrim Father and Founder of Harvard* (1909); *Thirteen Appreciations of Old Time Divines, Mystics, and Churchmen* (1914).

WHYTE-MELVILLE, hwĭt'mĕl'vĭl, **George John,** British novelist: b. Fifeshire, Scotland, June 19, 1821; d. Vale of Aylesbury

Berkshire, Dec. 5, 1878. He was educated at Eton, and at 18 joined the 93rd Highlanders, from which he transferred in 1846 into the Coldstream Guards. In 1849 he retired, but with outbreak of the Crimean War in 1854 he volunteered for service and was appointed major of Turkish irregular cavalry. The rest of his life was chiefly devoted to fox-hunting and the writing of novels of sporting and country-house life. Although an excellent horseman, he was killed by the fall of his horse while hunting. His sporting novels included *Captain Digby Grand* (1853), *Kate Coventry* (1856), *Tilbury Nogo* (1861), and *Black but Comely* (1879). *The Gladiators* (1863) was the best of several historical novels. His *Songs and Verses* (1869) contained some lyrics of considerable charm. Valuable notes on horsemanship are found in his *Riding Recollections* (1875).

WIARTON, lake port, Ontario, Canada, in Bruce County, on an inlet of Georgian Bay, 125 miles northwest of Toronto, served by the Canadian National Railway. Pop. (1951) 1,955.

WIBERT. See GUIBERT.

WIBORG, alternate name for the Russian seaport of Viipuri (q.v.) and for the Danish town of Viborg (q.v.).

WICHERN, vĭk'ĕrn, **Johann Hinrich,** German evangelical theologian: b. Hamburg, April 21, 1808; d. there, April 7, 1881. He studied theology at Göttingen and Berlin, and then, returning to his native town, gave himself up to endeavors to improve the condition of the poor and suffering. In the Rauhes Haus (founded Nov. 1, 1833) he established an institution for neglected children, with a training seminary for teachers connected with it, and similar institutions were shortly afterward formed throughout Germany. In 1856, he was appointed councilor of the Prussian Ministry of the Interior, and, in 1858, superintendent of all penal and reformatory institutions in the kingdom. His writings include *Die Innere Mission der Deutschen Evangelischen Kirche* (1849); *Die Behandlung der Verbrecher und Entlassenen Sträflinge* (1853); *Der Dienst der Frauen in der Kirche* (1858).

WICHITA, wĭch'ĭ-tô, **city,** Kansas, seat of Sedgwick County, situated at an elevation of 1,400 feet above sea level, on a broad plain in the south central part of the state at the junction of the Arkansas and Little Arkansas rivers; it lies 146 miles southwest of Topeka and 230 miles southwest of Kansas City, and is served by the Santa Fe, Rock Island, St. Louis-San Francisco, Midland Valley, and Missouri Pacific railroads. The city is the commercial and industrial center of a rich agricultural and oil and gas producing district. Leading agricultural products of the vicinity are wheat, cattle, and other livestock, dairy products, and poultry. Wichita is an important grain and livestock market and shipping center. It has an extensive wholesale and retail trade, railroad shops, and large-scale flour milling, meat packing, and oil refining concerns; manufactures include aircraft, stoves, furnaces, and household appliances, machinery, oil field equipment, refrigerator cars, building supplies, and dairy, food, and other products.

Besides a modern school system, educational facilities include the Municipal University of Wichita (q.v.), Friends University, Sacred Heart Junior College (Catholic) for women, a city library, an art museum, the Public Museum, the Wichita Art Association, daily newspapers, and the Pioneer Society of Sedgwick County, which maintains local history exhibits. The city has a number of parks, playgrounds, and recreation centers. In Riverside Park is the city zoo. Lawrence Stadium, built in 1934, provides seating accommodations for 6,000, while the Municipal Forum seats 4,800. Wichita is the scene of the annual Kansas National Livestock Show. The United States government maintains here a federal district court, a veterans' hospital, and other agencies.

History.—In 1864, a trading post was established at the juncture of the Arkansas and the Little Arkansas rivers by James R. Mead, with the assistance of Jesse Chisholm (q.v.). In the vicinity was a temporary Wichita Indian village. With the removal of the Wichita tribe to Oklahoma Territory (see OKLAHOMA) following the treaties of the United States with the Indians there in 1867, a white settlement soon grew up at the trading post. The trail followed by Chisholm on a trading expedition in 1865, later known as the Chisholm Trail, quickly became an important overland cattle route, and the settlement at Wichita, whose name is derived from the Wichita village, a stopping point for cattle drivers. Wichita was laid out in 1869, incorporated as a town in 1870, as a city of the third class in 1871, second class 1872, and first class 1886. In 1872, the Santa Fe Railway arrived, a United States land office was opened here, and the Wichita *Eagle* and Wichita *Beacon* were founded. Development of the rich agricultural lands and other natural resources of the vicinity, and of city commerce and industries brought prosperity to Wichita, whose population rose from 4,911 in 1880 to 23,853 by 1890. Since the turn of the century, the city has continued to make notable progress along many lines. It has the commission-manager type of government. Pop. (1940) 114,966; (1950) 168,279.

WICHITA, Municipal University of, a coeducational institution at Wichita, Kans. With assistance from the Boston Education Society, it was established in 1892 under the auspices of the Congregational Church. A collegiate department was formed in 1895, and the following year the name of the institution became Fairmount College. In 1926, the name was changed to Municipal University of Wichita. It offers courses in liberal arts, business administration, home economics, and public school music; and also offers pre-law, pre-medicine, pre-theology, and pre-engineering courses. In 1951–1952, it employed a teaching staff of 140 members and had a student enrollment of 3,700; the value of the plant was $2,600,861, and endowments totaled $91,812.

WICHITA FALLS, city, Texas, seat of Wichita County, at an altitude of 946 above sea level, on the Big Wichita River 120 miles west-northwest of Fort Worth. It is 12 miles from the Oklahoma state line, and is served by the Fort Worth and Denver City, the Missouri, Kansas and Texas, the Wichita Valley, and the Wichita Falls and Southern railroads. The city, which has an area of 10.83 square miles, is in a rich farming and stock-raising country, intensively de-

veloped by irrigation. Cotton, sorghums, wheat, oats, barley, alfalfa, vegetables, fruits (peaches, plums, prunes, grapes), melons, poultry, beef and dairy cattle, and sheep are produced here. Even more important for the city is its nearness to the principal developed oil fields of north central Texas: only 15 miles from the Burkburnett field, 11 miles from Iowa Park, and 26 miles from Electra. The Wichita Falls oil district includes ten north Texas counties. Much of the development here has been by independents, and the city is the headquarters of most of the operators. There are three refineries in the city, and five more within a 50-mile radius, with six pipe lines. Wichita Falls has oil-field supply houses, and is the jobbing and wholesale center for this rich north Texas and south Oklahoma district; manufactures include oil-field equipment and tanks. Other factory products include flour, glass fruit jars, gas engines, air-conditioning equipment, brick and tile, dried egg products, cheese and creamery products, cottonseed oil, ginned and compressed cotton, work clothing, boots and shoes, foundry and machine-shop products.

Among the city's outstanding features are the federal building, a county courthouse, a memorial auditorium (built in 1928), the Kemp Public Library (opened in 1918), the Coyote Stadium, Hardin Junior College, and the Academy of Mary Immaculata. Lake Wichita, five miles to the southwest, Diversion Reservoir, 34 miles distant, and Lake Kemp, 45 miles to the southwest, are fine for fishing, boating, and duck shooting. Twenty-one city parks have a total area of 436 acres; Weeks Park, 260 acres in extent, is the largest.

A favorite camping site in the 1850's was this land near the falls of the Big Wichita. A townsite in 1876, it was reached by the first railroad (the Fort Worth and Denver City) in 1882, becoming the county seat in 1883, was incorporated as a city in 1889. In 1886 the five-foot-high falls in the river were wrecked when a dam washed out. Irrigation began in 1900. The first oil well came in, in 1901. The Burkburnett boom began in 1919, and a second boom in oil came in 1937. By the charter of 1924 a city manager is chosen by a board of six aldermen. Pop. (1920) 40,079; (1930) 43,690; (1940) 45,112; (1950) 68,042.

WICHITA INDIANS, one of the southern tribes of the Caddoan linguistic stock of North American Indians; their traditional home was the Wichita Mountains of Oklahoma, near which their reservation now lies. In the first half of the 19th century their principal village was on the north fork of Red River, a short distance below the mouth of Elm Creek, in Oklahoma, but four centuries ago (in 1541) Coronado found them in Kansas, between the Arkansas and Kansas rivers, in what the Spaniards designated the province of Quivira (q.v.). The typical house of the Wichitas is the grass lodge; they were always agriculturists, and formerly practised tattooing, from which custom and from their resemblance to their congeners, the Pawnees, they are called by the French *Pani Piqués.* They are now under the Kiowa agency in Oklahoma, with their subtribes, the Tawakoni and Waco.

WICK, Frances Gertrude, American physicist: b. Butler, Pa., Oct. 2, 1875; d. Poughkeepsie, N. Y., June 15, 1941. After graduating at Wilson College, Chambersburg, Pa., she taught for six years at Butler High School. Following four years of study at Cornell University she spent two years teaching physics at Simmons College. In 1910, she joined the faculty of the department of physics at Vassar College, and she occupied several posts there before becoming professor in 1922; she was elected chairman of the department of physics in 1939. During several leaves of absence from Vassar, she did research work in the laboratories of Cornell and Harvard universities, the laboratory of the General Electric Company, Cambridge University, in England, and the Institute for Radium Research, at Vienna. She achieved an international reputation for her work in the field of luminescence or cold light. Many articles by her in this field were published in the *Physical Review,* the *Journal* of the Optical Society of America, and the *Proceedings* of the National Academy of Arts and Sciences.

WICK, seaport and county town, Scotland, in Caithness, at the mouth of Wick River, which empties into Wick Bay, an inlet of the North Sea; it is situated 327 miles north of Edinburgh. Wick is the center of the Scottish herring fishery and kindred industries. An extensive breakwater gives protection to the two harbors. Pop. (1951) 7,161.

WICKARD, wĭk'ĕrd, **Claude Raymond,** American administrator: b. near Camden, Carroll County, Ind., Feb. 28, 1893. He graduated at Purdue University with a B.S. degree in agriculture in 1915, and for several years thereafter farmed his own large acreage in the vicinity of Camden. In 1933, he resigned his seat in the Indiana state senate and relinquished many local activities in order to go to Washington, D.C., to join the staff of the United States Department of Agriculture. At first assistant chief of the corn and hogs section of the Agricultural Adjustment Administration, in February 1940 he became undersecretary of agriculture. In August 1940, he succeeded Henry Agard Wallace (q.v.) as President Franklin D. Roosevelt's secretary of agriculture; in addition to the duties of this post, during World War II he was also administrator of food production and distribution. When President Harry S. Truman reorganized his Cabinet in May 1945, Wickard resigned the secretaryship of agriculture, and the following July he was appointed head of the Rural Electrification Administration.

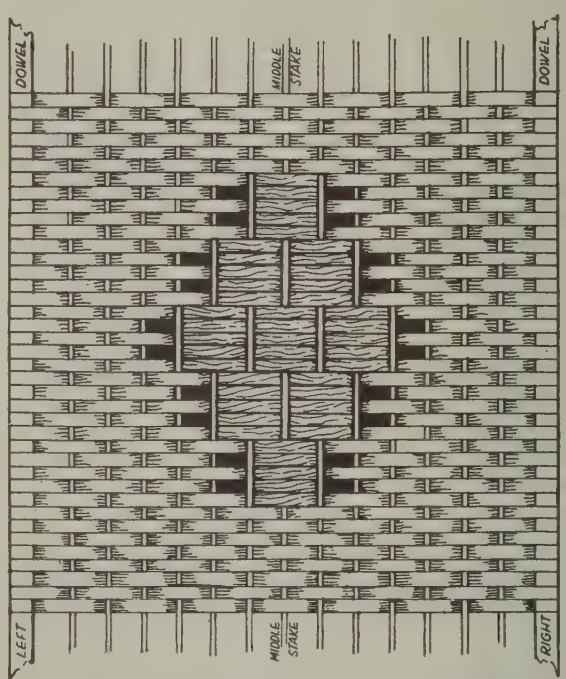
WICKER WEAVING AND PRODUCTS. The predecessor of all arts, the most universal art and the least changing art in the realms of history is wicker weaving. True, there have been changes in the commodities used for weaving and changes in the articles made by weaving, but the actual method of weaving wicker strands has passed down from the very earliest days of mankind with marked uniformity. Weaving in its general sense—including that of textiles as well as wicker—is considered by historians and Biblical students as the oldest of arts. Just when it was born and by whom created is impossible to say. Some Biblical students contend that Eve, following her great sin, wove a skirt of twigs and leaves through an endowed art. Other equally studious students assert that

Eve and her fellow Bib'ical personages learned the art of weaving by viewing the interlacing growths of tree limbs and noting the protection resulting therefrom. Still more assert that the art became known by persons through watching and adopting methods used by birds in weaving their nests, or spiders and other insects in weaving their webs. Whatever caused human intelligence to grasp the art of weaving may never be known, but that it is the earliest art is taken as an established or accepted fact. Actual Biblical evidences showing an early knowledge of weaving are found in Exodus 28:32, where it relates that bindings were made of woven work. The same book, 39:22, says that robes were made by weaving. Exodus 2:2 tells of an ark (basket) being woven of papyrus reed and Moses set adrift in it on the river Nile. Biblical commentaries also add that boats, sails, mats and ropes were made by weaving. There are other Bible references to weaving, thus indicating that the art, so far as wickerwork is concerned, was well known in those days. Historians, here and there, speak further of wicker weaving although they do not specifically use the word "wicker." The word has long been understood, however, as perfectly proper in classifying all materials used in the weaving of furniture, baskets and baby carriages. Modern dictionaries define "wicker" as (1) "a pliant young shoot or rod; twig; osier; withe; as, a willow wicker; (2) ware made of wickerwork; (3) a wike; mark." "Wickerwork" is defined as "a fabric or texture, as a basket, of woven or platted osiers, withes or twigs; basket work, as a chair of wickerwork." Since the accepted meaning is so broad it is quite easy to trace wicker weaving down through the many ages to the present day although there is a surprising lack of written information on the entire subject. It is known that practically every race of human beings has been familiar with the art of wicker weaving, for in the history of all races there are references to woven bags, baskets, roofs, floors, and furniture. And yet with all this great age and universal use we find that wicker weaving (not textile weaving) has remained as it began—a slow hand vocation in which the strands have been woven about a frame. That is, the development remained unchanged until 1916, when Marshall B. Lloyd of Menominee, Mich., invented and put into practical use a new method for weaving wicker and a loom which weaves the strands into shapes desired.

Commodities.—Biblical data shows that the first wicker weaving was done by using natural leaves and twigs, interlacing them at right angles in just the same manner as modern hand weavers work with their more modern commodities. Then came heavier pieces of wood as is indicated in II Kings 23:7, which says, "women weave hangings from the grove." Whether this means limbs of trees, or vines hanging from trees, is unknown although the latter is the accepted version. Exodus 2:2 specifically states the ark (basket) of Moses was woven of papyrus reed just as were boats, sails and other articles. Medieval days find the willow branch popular for wicker weaving. It has remained so to the present day although the scarcity of it and the growing demand for woven work in general has made it necessary, as well as wise, for manufacturers to turn to other forms of wicker. Rattan has been most generally used in making wicker articles during recent years. It is a vine growing in India, China, South Africa and elsewhere in the Orient. It was first used as ballast for vessels returning from the Orient. When the rattan reached America it was burned as firewood or waste. It was discovered, during the days of the hoopskirt, that rattan would lend itself to the manufacture of hoops. This led to its becoming prominent in the manufacture of woven furniture and bodies for baby carriages. Rattan is usually known as reed when used for these purposes. The rattan vine is harvested by natives, then cured and classified as to size and texture. The bark is removed and treated, thus becoming "cane" and used most extensively as seats for chairs, davenports and the like. The wood part of the rattan vine inside the bark is also treated, and the finished product is known as "reed." While being woven, reed is kept in water so as to make it pliable. If it is not soaked the reed will not bend without breaking, and despite its extensive use the article gives only limited satisfaction owing to its brittleness. The most recent form of wicker is a fiber made from paper. Just whether it should be classified as a textile or wicker has not been established. It is manufactured much like a textile (see TEXTILE INDUSTRY) and is used very extensively as a wicker and a textile. It, however, quite naturally fits in under the wicker classification. The lack of willow and the dissatisfaction over reed has long caused baby carriage, furniture and basket makers to seek a new article. World War I, perhaps, had most to do with the discovery of paper and its adaptability to textile and wickerwork. During the war there arose an amazing lack of clothing, bags, cordage, and other articles of this nature. The strength of paper, which has long been used in railway car wheels, its pliability and other abilities to be treated chemically, so that when completed it can resist weather conditions without injury, evidently turned the human mind to paper. Tests have proven that a piece of twisted paper gauging $\frac{1}{1000}$ of an inch is stronger than any known steel of the same weight. Experiments have proven that certain hard or tightly-twisted paper $\frac{80}{1000}$ of an inch in diameter will not break unless the tension is more than 50 pounds, while the same thickness of reed will not stand a strain of 13 pounds. G. L. Brownell made the first real paper-twine machinery Dec. 17, 1895. Gradually the use of twisted paper as a textile became general in the manufacture of clothing, bags, cordage, belts, caps, hats, braces and leather substitutes. Then it spread to wickerwork, where it finds its most adaptable place. In recent years we have made tremendous strides in the paper trade. Special machinery for making textile and wicker fiber from reels of paper are now manufactured. The Scandinavian countries are producing large amounts of paper fibers, while the British government has for some time been interested and busy in the manufacture of paper fiber articles. The evenness of strength, freedom from odor, absence of loose ends, flexibility, elasticity, strength, as well as weather and water-proofing qualities make paper fiber today the most important strand in the manufacture of wicker woven articles. In addition to the above advantages it is much cheaper and more abundant than any other form of wicker. The ability of paper to permit itself to be manufactured into wicker fiber, either alone or with cotton, wool and even wire centers, and its ability to accept modern chemical and other treatments for purposes of strength and elasticity, adds to its importance and

growing popularity. All other forms of wicker are used in a more or less natural state and do not require or lend themselves to chemical or other advanced treatments of mankind. Wicker fiber, however, overcomes these objections. Since all other wickers except wicker fiber are used practically in their natural state it is necessary to weave the strands in large sizes. This does not make possible for them the beautiful finishes of the wicker-fiber articles. Owing to the smallness of the best hard wicker fibers, the article manufactured usually has from two to four times as many feet of fabric as the natural wicker woven articles, therefore making the wicker fiber article stronger. The shortness of natural wickers, like willow and reed, make it necessary for ends to occur frequently in furniture, baskets or baby carriage bodies. Wicker fiber can be made in endless strands, thus doing away with unsightly ends. Wicker fiber originates, like paper, from the forest with fir and pine proving the most satisfactory wood, although almost any kind can be used. After the trees have been cut and the logs sent to the paper mills a pulp is formed. (See PAPER.) This pulp becomes paper and is cut into ribbons of various widths. These reels of paper ribbon are run through baths of resin glue for purposes of preservation and toughening. Then the ribbons enter twisting devices running 5,000 to 20,000 revolutions per minute. Sometimes wire centers are used but usually pure paper fiber is manufactured. The twisted paper ribbon is dried and is then ready for weaving. After being woven the shaped article is dried and painted from two to four times with enamel or shellac. These various treatments make the fiber absolutely impervious to water, sunshine and other weather conditions.

Methods of Weaving.—Hand weaving must have been the only method used in Biblical days, so far as wicker weaving is concerned, for there is no mention of any machine being used. The Biblical method consisted of weaving two strands at right angles to each other, considerably or exactly like textile weaving. (See TEXTILE INDUSTRY.) When wicker was to be woven a frame was made and the upright strands or weft attached to it. Then the warp was interlaced through the weft. This method has been handed down through all ages and through all peoples until today. Many men have tried to change the method of the biblical days but failed. More tried to use the same method and weave wicker on machines like textiles are woven. But all of these inventors, save one, were doomed to failure. Marshall B. Lloyd of Menominee, Mich., spanned the gap of centuries by changing the method of weaving before trying to make a machine loom which would do the weaving. Instead of attaching either the weft or warp to the frame of the article desired, he found a way of weaving the wicker independent of the frame and then attaching the wickerwork to the frame. Any of the modern wickers lend themselves to his method. Later he produced a machine known as the Lloyd Loom, which weaves the wicker 30 times faster than the most expert hand weaver can, and with far greater superiority. The loom also lends itself to weaving any kind of wicker strand. The Lloyd Loom requires that the weft be attached to a drum. The warp is fed through a stationary shuttle after being made more or less continuous by connecting the ends of various pieces of wicker or by making continuous wicker fiber. The average baby carriage body of years ago of endless wicker fiber was usually woven on the loom in 18 minutes, while a hand weaver required an entire day of nine working hours to accomplish the same results. And even then the work would not be nearly as smooth and beautiful. This is due to mechanical exactness in weaving as compared with human lack of exactness, as is very evident when the old homespun textiles are compared with modern machine-woven products. The weaving of cane for chair seats, etc., has been in vogue for many years. This kind of weaving is called flat weaving and requires no shaping as does furniture, baby carriages and baskets. Hence, the early solution of its mechanical weaving problems.



From *Fiber Furniture Weaving* by Emil Gandre; Bruce Publishing Co.

A diamond weave.

Wicker-Woven Baby Carriages.—The development of the baby carriage has been slow. The first baby carriages were merely baskets like that in which Moses was found. The American Indian mother with her papoose strapped on her back, either in skins or in woven articles, according to weather conditions, originated another form of the baby carriage. While there is no authentic data to show the development of the baby carriage, it is taken for granted that when man put wheels under a sledge, thus making a wagon, he conceived the idea which led to the modern wagon, baby carriage, train, and even the automobile. The first form of a baby carriage was a basket with a wheel on either side. Then came the elaborate chariotlike carriage, but still with only two wheels. The latter came into prominence in the 18th century. Early in the 19th century the baby carriage took the shape of the average toy express wagon with four solid wood wheels. Then came the collapsible carts which could be folded up into a small article. Wicker-woven carriages regained prominence in the 20th century, and were popular until 1935. Most of them were made of beautifully woven bodies or baskets. The finer the strand, the more even the weaving, and the greater the

cost to the ultimate purchaser. The bodies were set on steel springs which were either air or oil tempered, the latter producing more resiliency and solidity. Four wheels, two on either side, made of wood or wire and with rubber tires, a woven hood or top, a storm shield, smooth and soft upholstering, and wheel brakes complete the carriage.

Wicker-Woven Baskets. — These articles have been made ever since Biblical days, as shown in the above Bible references. There has been little advancement in the art. The usual wickers described above have been and are being used.

Wicker-Woven Furniture.—The Bible gives very little information on what sort of furniture was used at that time. It is said that the early Egyptians wove bedsteads of wickerwork, but what the make-up of the wicker was is not known. In 1650 a few chairs were made of wicker, while in 1711 wicker and cane chairs seem to have secured considerable general usage. In the 16th century the Hollanders made heavy wooden chairs and used woven cane or rush seats. The 19th century found chairs made of wicker willow and wicker reed. Tables, davenports, desks and bedroom furniture later were made of various kinds of wicker. The high cost of weaving, great waste of material, numerous short unsightly ends, combined with the lack of wearing and weather-proofing qualities kept the quantity of wicker-woven furniture to a very low ebb when compared with the vast volume of furniture made and used in the world.

GEORGE W. ROWELL, JR.

WICKERSHAM, George Woodward, American Cabinet officer and lawyer: b. Pittsburgh, Pa., Sept. 19, 1858; d. Jan. 25, 1936. He studied at Lehigh University and took his degree in law at the University of Pennsylvania in 1881. He first engaged in practice in Philadelphia, but after 1882 he practiced in New York. He was for many years a member of the law firm of Strong and Cadwalader; was counsel for the companies reorganizing the Chicago traction lines; for the Interborough Rapid Transit Company in the construction of the New York subway; and for the builders of the Pennsylvania tunnels in New York. He was connected with the reorganization of the Mexican railway system; and had a wide experience in railway litigation in the United States. He was attorney general of the United States during the Taft administration and handled successfully the anti-trust litigation, especially the cases against the Standard Oil Company and the Tobacco Trust. He was in 1924 American member of the Committee on Progressive Codification of International Law under the League of Nations; in 1929 President Hoover appointed him chairman of the National Commission on Law Observance and Law Enforcement, popularly known as the Wickersham Commission.

During a two-year period the commission delved deeply into the twin problems of observance and enforcement. One of its major conclusions was that the machinery for criminal law enforcement in the United States was entirely inadequate, and that the annual cost of crime amounted to the staggering total of $1,000,000,000. It was, however, the 80,000-word report on prohibition, released Jan. 13, 1930, that attracted widest attention. A majority of the commission disapproved the "noble experiment"; but the chairman and three colleagues favored further trial of the provisions of the Eighteenth Amendment and the national prohibition act. Less than two years later Mr. Wickersham conceded that prohibition had been a failure and urged that it be replaced by regulation of the sale of alcoholic beverages.

After 1932 he was president of the International Arbitral Tribunal until his death. He published a volume of essays and addresses, *Changing Order* (1914), and *Spring in Morocco* (1923).

WICKFORD, village, Rhode Island, in the township of North Kingston, Washington County; on Narragansett Bay, about eight miles northeast of Kingston. Founded in 1709 when Lodowick Updike, a real estate developer, began selling lots, its first house was probably erected in 1711. Wickford prides itself on possessing more 18th century houses than any other village of its size in New England; no less than 20, built between 1728 and 1804, are on its short Main Street. They include the gambrel-roofed Stephen Cooper House (1728), Immanual Case House (1786), and Ye Old Narragansett Bank House (1768), once used as a bakery, then as a bank, but residential since 1853. Rhode Island's first academy, Washington Academy, was established here in 1800. The South County Barn Museum has a fine collection of ancient implements used by farmers, mechanics, and housewives. Pop. (1950) 2,437.

WICKHAM, Edward Charles, English educator and dean of Lincoln: b. Hammersmith, London, Dec. 7, 1834; d. Sierre, Switzerland, Aug. 18, 1910. He received his early education at a private school in Hammersmith kept by his father, and at 13 entered Winchester College. Succeeding to a fellowship at New College, Oxford (William of Wykeham's other foundation), he began his undergraduate career at 17, won the chancellor's prize for Latin verse in 1856, and the Latin essay in 1857. Graduating B.A. the latter year, he was ordained deacon. Ordained priest in 1858, he taught at Winchester two years, then, having accepted a tutorship, returned to Oxford. He was one of the leaders in the reforms of New College which opened it to scholars and commoners who had not been educated at Winchester. He also helped to amend the statutes so that tutors and other college officials could retain fellowships after marriage. With a Balliol friend he initiated the system of intercollegiate lectures. In September 1873, he succeeded Edward White Benson as headmaster of Wellington College, and two months later was married to Agnes, eldest daughter of William Ewart Gladstone, the prime minister. Resigning his post in 1893, he was appointed dean of Lincoln Cathedral in January 1894. Devoted to the liberal principles of his famous father-in-law, he worked to improve the system of primary and secondary education in his diocese. His works include *Horace* (vol. 1, 1874; vol. 2, 1893); *Notes and Questions on the Church Catechism* (1892); *The Prayer-Book* (1895).

WICKHAM, William of. See WILLIAM OF WYKEHAM.

WICKING, *in curling,* an ingenious master stroke by which a stone is sent in an oblique

direction so as to hit the winner's stone and drive it from the tee, the former often replacing the latter and so becoming the winner in turn; also called "inringing."

WICKLOW, Irish Free State, a maritime county of Leinster Province, on the Irish Sea, with an area of 782 square miles. Chief town, Wicklow. The county generally is mountainous, but has fertile lowlands where oats and potatoes are cultivated, and much pasture land devoted to stock-raising. Iron and lead are mined, and a little copper. Pop. about 57,600.

WICLIF, wĭk'lĭf, **WYCLIFFE, WYCLIF, WICLIFFE,** or **WICKLIFFE, John,** English reformer: b. Spreswell, Yorkshire, probably about 1330; d. Lutterworth, 31 Dec. 1384. He studied at Balliol College, Oxford, of which he became master between 1356 and 1361, in which later year he was appointed by his college to the living of Fillingham, in Lincolnshire. About the same time the Pope bestowed upon him a prebend in the collegiate church of Westbury-on-Trym, near Bristol, in which he was confirmed by the king. In 1368 he gave up Fillingham and accepted the living of Ludgershall, in Buckinghamshire, and four years later qualified as doctor of theology. He was presented by the Crown in 1374 to the benefice of Lutterworth, in the south of Leicestershire, which he held till his death. A Latin tract 'Determinatio quædam Magistri Johnannis Wyclyff de Dominio contra unum Monachum,' has been regarded as belonging to the controversy raised by the refusal of the Parliament of 1366 to pay a tribute demanded by the Pope Urban V, in virtue of the homage paid by King John to Innocent III, but some authorities refer it to a date about 10 years later, when similar circumstances arose. At the time of writing the tract, Wiclif was regarded as royal chaplain, for he calls himself *peculiaris regis clericus,* and in 1374 was named second on a commission which went to Bruges to try to settle disputes concerning ecclesiastical jurisdiction with the representatives of the Pope Gregory XI. He had shortly before been appointed a canon of Lincoln, but never actually obtained a prebend in that cathedral. The development of his views on the relation between the ecclesiastical hierarchy and the secular authorities brought him into close association with John of Gaunt, duke of Lancaster, and his party, and in 1377 the anti-Lancastrians sought to strike at their political opponents through Wiclif. He was summoned in that year before Archbishop Sudbury and his suffragans at Saint Paul's, and attended, accompanied by Lancaster, Lord Percy, and other powerful Lancastrians. A violent altercation between the duke and William Courtenay, bishop of London, caused the break-up of the meeting, and the infuriated populace plundered Gaunt's palace and attacked Percy's house. Soon afterward Pope Gregory sent several bulls to the University of Oxford, the archbishop of Canterbury, and the bishop of London, in which he accused Wiclif of teaching the condemned doctrines of Marsilius of Padua and John of Jandun, and ordered him to be arrested and examined. The parties were reluctant to move in view of Wiclif's great popularity and influence, and even after the bulls had arrived he was consulted by the government as to whether they might legally prevent money from going abroad to absentee holders of benefices. He eventually appeared before the prelates at Lambeth in 1378, but the king's mother sent a message forbidding them to interfere with him, and a popular demonstration in his favor put an end to the proceedings. In the Gloucester Parliament of 1378 he made a defense of John of Gaunt, who had grossly violated the Westminster right of sanctuary.

This year, 1378, was an important date in Wiclif's religious career. While continuing to inveigh against certain abuses, he began to question the whole basis of sacerdotalism and its authority, and by 1381 had attained to a substantially Lutheran position in regard to transsubstantiation and the mass. About this time also he commenced his appeal to the common people and presented religion as a popular force rather than a dogmatic system or an organized institution. This appeal assumed two forms, the sending out of his "poor preachers" and the translation of the Bible from the Vulgate into the English of his day. His itinerant evangelists spread his doctrines throughout the land and soon made the Lollard movement one of great strength and importance. In his translation of the Bible he had the assistance of Nicholas Hereford, who was responsible for most of the Old Testament, and the whole work was revised by his assistant, John Purvey, who finished it soon after Wiclif's death. Wiclif's views on the eucharist were promptly condemned at Oxford and forbidden to be taught there, and in 1382 Courtenay, archbishop of Canterbury, summoned a council in the Blackfriars' convent hall, at which Wiclif's teaching was condemned and some of his followers excommunicated. This council known as the "earthquake council" because a violent earthquake occurred during the meeting, ordered the Carmelite, Dr. Stokes, to publish the condemnation at Oxford. The chancellor of Oxford University at that time, Robert Rygge, was a supporter of Wiclif and evaded the duty of carrying out the council's mandate until absolutely compelled to do so. Wiclif himself remained untouched, but he retired to Lutterworth, where he occupied himself in preaching and writing. It is said that Urban VI summoned him to Rome in 1384, but this is doubtful. He had a paralytic stroke in 1382 or 1383, and again in 1384, from which he died. He was buried at Lutterworth, but in 1428, in accordance with a decree of the council of Constance in 1415, his body was exhumed and burned, and his ashes thrown into the river Swift.

Of the 24 Wiclifite propositions condemned by the earthquake council, 10 were described as heretical and 14 as erroneous. The most important of the 10 were: that transsubstantiation is philosophically false, since the substance cannot be changed while the accidents remain; that transsubstantiation is not taught in the Gospels; that confession is not necessary to salvation; that no one after Urban VI should be recognized as Pope; and that it is unscriptural for ecclesiastics to hold temporal possessions. Of the erroneous doctrines, several seriously limited the right of excommunication in a distinctly

Protestant sense, one asserted the right of unlicensed preaching, another declared that dominion, whether civil or ecclesiastical, could not belong to one in mortal sin, and another distinctly asserted the authority of the temporal power over the ecclesiastical in temporal affairs. Wiclif unmistakably made his appeal to Scripture as of higher authority than Church tradition or decrees, and had a strong sense of the individualistic basis of religion. He never reached the Lutheran doctrine of justification by faith, but from denunciation of abuses in the Church rapidly advanced to his three main positions: that all dominion was of divine origin and was forfeited by anyone in mortal sin; that transsubstantiation was a doctrine both unphilosophical and unscriptural; and that monasticism in every form was a corrupt institution.

At first he attacked only the luxurious and corrupt orders of monks and was on friendly terms with the friars, but from about 1379 the friars were also included in his condemnation. He was one of the last of the realists in philosophy, and he tried to reconcile predestination with the freedom of the human will. Not only was Wiclif one of the chief forerunners of the Reformation, but he was also a pioneer in English prose literature. He wrote many learned works in Latin, but the nature of his message and the necessities of his position led him to appeal to the people in works in their own tongue. His chief Latin works are 'De Dominio Divino'; 'De Dominio Civili'; 'De Officio Pastorali,' and 'Trialogus.' All, except the 'Trialogus' and the 'De Officio Pastorali,' and also volumes of Latin sermons and a volume of Polemical Works, have been edited by English and foreign scholars for the Wiclif Society. The excepted words were edited by Lechler (1869 and 1863 respectively). His translation of the Bible was edited by Forshall and Madden (1850); and his English works are to be found in the three collections 'Three Treatises of John Wycliffe' (1851), by Todd; 'Select English Works of Wyclif' (1869–71), by T. Arnold; and 'The English Works of Wyclif' hitherto unprinted (1880, Early English Text Society), by F. D. Matthew.

Bibliography.—Lechler, 'Johann von Wiclif und die Vorgeschichte der Reformation' (1873); Poole, 'Wycliffe and Movements for Reform' (1889), and 'History of Mediæval Thought' (1884); Buddensieg, 'Johann Wiclif und seine Zeit' (1885); Stevenson, Jos., 'The Truth About John Wiclif'; Gasquet, F. A., 'The Eve of the Reformation'; and Cadman's article on Wycliffe in 'Three Religious Leaders of Oxford' (New York 1916); Workman, H. B., 'John Wyclif, a Study of the English Mediæval Church' (2 vols. Oxford 1926); and 'Summa de ente,' etc., ed. by S. Harrison Thomson (1930).

WIDDIN, vĭd'ĭn, or **VIDIN,** Bulgaria, a town on the right bank of the Danube, near the Serbian frontier, consisting of three parts, the town on the Danube, the walled city and the citadel. The principal buildings are the palace, several mosques with lofty minarets and a range of bazaars lining the main street. Ships can reach the town at high-water. There is a considerable trade, chiefly in corn, wine and salt, and the chief manufactures are gold and silver filigree work and jewelry. Widdin was formerly strongly fortified and during Russo-Turkish wars was important strategically, but the Treaty of Berlin (1878), which erected Bulgaria into a hereditary principality tributary to the Porte, decreed that its fortifications should be dismantled. Pop. (1926) 18,611.

WIDE AWAKES, in American political history, a name adopted by numerous Republican campaign clubs organized for the purpose of aiding in the election of Abraham Lincoln during the Presidential campaign of 1860. The first club was organized in Hartford, Conn. It is stated that in New York City there were on one occasion 20,000 Wide Awakes marching in procession.

WIDE, WIDE WORLD, The, a tale by Susan Warner, published in 1851 under the pen name of "Elizabeth Wetherell." It reached a sale of over 300,000 copies. The life of the heroine, Ellen Montgomery, is followed from early childhood to her marriage with a fullness of particulars which leaves nothing to the reader's imagination. The scenes and episodes are those of a homely, every-day existence, described with close fidelity to detail. Ellen's spiritual experience is minutely unfolded, and the book was long regarded as one of those which are "good for the young." The criticism of a later generation pronounces it mawkish in sentiment and unreal in conduct. It stands among the fading fancies of an earlier and less exacting literary taste.

WIDENER, Peter A. Brown, American capitalist: b. Philadelphia, Pa., 13 Nov. 1834; d. 6 Nov. 1915. He acquired a large fortune in the meat business, entered politics, was appointed city treasurer of Philadelphia in 1873 and in 1874 was re-elected to that office. He became largely interested in street railway corporations, and was associated with both the tobacco and Standard oil groups of capitalists. In 1897 he presented to the city of Philadelphia his private residence, valued at $600,000, for a branch of the Free Lending Library, and in the following year gave to the library a collection of 500 rare books valued at $28,000. In 1899 he endowed at Philadelphia the Widener Memorial Training School for Crippled Children, a combined home, hospital and school. The school site consists of a tract of 36 acres at Logan, a Philadelphia suburb.

WIDGEON, or **WIGEON,** a river-duck of the genus *Mareca.* Widgeons have a short bill, rounded at the tip, with a strong, broad nail, and the upper lamellæ prominent; wings long and pointed; tail, moderate and wedge-shaped. There are about 10 species in various parts of the world. They are found on the seashore and on the margins of lakes and rivers, feeding chiefly on vegetable substances, and performing periodical migrations at night in vast flocks. The American widgeon or baldpate (*M. americana*) is about 18 inches long; the bill is blue, black at the base and tip; upper parts finely waved transversely with dark lines; lower parts mostly white; top of head nearly white, with a broad green patch around and behind the eyes; the rest of the head and neck grayish, spotted and banded with black; the wing-covers are white, the greater part tipped

with black; the speculum is green, encircled by black. The baldpate is found throughout North America, breeding chiefly north of the United States and wintering in Central America. It is an active bird, with a swift and well sustained flight, in ranks of various and irregular forms, and it associates during the winter with teals and other ducks. The flesh is highly esteemed, especially when they have fed in the rice fields of the South, or along with the canvas-back on the water-celery of the Chesapeake. They do not dive, but feed with the head and neck immersed, swimming very near together. Their food consists of aquatic seeds, roots, insects, worms, small fry, leeches, nuts and grain, especially rice in the rainy season; being very fond of the tender aquatic plants on which the canvas-back feeds, and no diver itself, it watches the latter and snatches the morsels as it emerges and before it has had time to open its eyes. They are among the most difficult ducks to shoot, owing to their shyness and swift, irregular flight. The nest is built on the ground, often far from water and usually of leaves lined with down. The eggs number eight or 10, are pure ivory white and about two inches long by nearly one and one-half in diameter. The European widgeon (*M. penelope*) is rather smaller, and not uncommon all along the Atlantic Coast of the United States, as well as on the Pacific. It differs chiefly in having the head and neck reddish brown or cinnamon, the top of the head cream-colored. Consult Phillips, J. C., 'Natural History of the Ducks' (4 vols. 1922–26).

WIDNES, England, a manufacturing town in Lancashire, on the Mersey, opposite Runcorn, 13 miles east-southeast of Liverpool. There are extensive chemical, alkali and soda works; soap, candle, grease and manure works; copper-smelting works and rolling-mills, and iron-foundries. The town has a considerable carrying trade, which has been further developed by the construction of large docks in 1866, extended in 1884. Pop. 38,879.

WIDNMANN, vĭd'n-män, **Max,** German sculptor: b. Eichstätt, Bavaria, 13 Oct. 1812; d. Munich, Bavaria, 3 March 1895. He was educated at Munich and at Rome, executing while at the latter city his "Shield of Hercules," considered one of his masterpieces, and in 1849 became professor of sculpture at the Academy of Art at Munich. Several of the public monuments in that city are by him, but his best work is considered to be shown in his busts and statuettes, which, however, are fewer in number. His statues include those of Orlando de Lasso (1848); Schiller (1863); Goethe (1868); Castor and Pollux (1877). Specimens of his workmanship are to be found at Bamberg, Ratisbon, Würzburg and other cities.

WIDOW, one who has lost her husband by death and remains unmarried. A "grass-widow" is a divorced woman. Among the ancients was practised a form of funeral sacrifice, in which the widow was slain or induced to commit suicide so that she might be buried with her husband and accompany him to the world of spirits. This practice is mentioned as existing among the Greeks by Euripides and Pausanias, and from Cæsar it may be inferred that it existed also in Gaul. Widow sacrifice is still the custom in some African tribes; traces of it may be found in China; it lingered till late in the first half of the 19th century in Fiji, and though abolished by law in British India in 1829, was not wholly stamped out until late in the 19th century.

WIDOW BEDOTT (bĕ-dŏt') **PAPERS, The,** a collection of broadly humorous sketches by Frances Miriam Whitcher, which appeared first in Neal's *Saturday Gazette* of Philadelphia, about 1847, and in book form in 1855. They were extremely popular in their day and are still read and quoted from, though they have been followed by many works in a similar vein.

WIDOW-BIRD. See WHYDAH-BIRD.

WIELAND, vē'länt, **Christoph Martin,** German author: b. in the Swabian village of Oberholzheim, near Biberach, 5 Sept. 1733; d. Weimar, 20 Jan. 1813. The son of a country clergyman, after thorough preparation, he went in 1750 to the University of Tübingen to study law, but most of his time was devoted to *belles-lettres.* In 1751 appeared his 'Zwölf Moralische Briefe,' which met with very favorable reception. He also wrote at this time the didactic poem, 'Anti Ovid.' In 1752 he went to Zurich as a literary companion to J. J. Bodmer (q.v.). Inspired by the deeds of Frederick the Great to write a poem exhibiting the ideal of a hero, he chose the story of Cyrus. The first five cantos appeared in 1759, but the poem remained unfinished. About this time he published 'Araspes and Panthea,' an episode from the 'Cyropædia' of Xenophon. After a brief residence he left Bodmer's house, became a tutor, and in 1760 returned to Biberach. In 1762 he went to live with Count Stadion, an accomplished scholar, but a thorough man of the world, averse to all religious enthusiasm. Wieland had been prone to religious mysticism; but the gay pleasure-seeking life of the society with which he now came in contact, and the sceptical and cynical kind of literature now most at his command, produced an entire change of sentiment. The first indication of this new philosophy of life appears in the tale of 'Nadine,' which he styles a composition in Prior's manner. This was followed in 1764 by 'Die Abenteuer des Don Sylvio de Rosalva' ('The Adventures of Don Sylvio de Rosalva'), a work for which Don Quixote serves as model. In 1766–67 appeared his 'Agathon,' which established his reputation. The 'Musarion' (1768), a production distinguished for grace, ease and harmony, advocates a rational unity of the sensual and spiritual. In 1770 he wrote 'Die Grazien' ('The Graces'); and the 'New Amadis' in 1771, a poem which celebrates the triumph of intellectual over mere physical beauty. In 1769 he was appointed *professor primarius* of philosophy at the University of Erfurt. In his 'Verklagter Amor' ('Cupid Accused') he defended amatory poetry; and in the 'Dialogen des Diogenes von Sinope' (1770) gave a general vindication of his philosophical views. In 1772 he was invited to Weimar by the Duchess Anna Amalia as tutor to her two sons. Turning his attention to dramatic poetry, he wrote the 'Wahl des Hercules' ('Choice of Hercules'), and the 'Al-

ceste.' He also edited the 'Deutscher Mercur,' a monthly, which he conducted till near the close of his life. His views, as exhibited therein, however, showed so much of the narrow conventional spirit of French criticism, that he was attacked by Goethe in the satire 'Götter, Helden und Wieland' ('Gods, Heroes and Wieland'). This Wieland answered with great good nature, recommending it to all who were fond of wit and sarcasm. Goethe and Herder were soon drawn to Weimar, where the Duchess Anna Amalia formed a circle of talent and genius, later also joined by Schiller. In 1774 appeared the 'Geschichte der Abderiten,' in which Wieland sought with an engaging wit to correct the provincialism of his time. 'Oberon' (1780), a romantic epic, is the most finished of his works. Wieland also prepared translations of Horace, Lucian and the 'Letters' of Cicero. His translations of Shakespeare (1762–66), made the English poet «an open book for Germans.» He superintended (1794–1802) an edition of his 'Works' in 45 volumes. These were also edited by Gruber (1818–28 and 1867–75), and there are many editions of selections, some of which have been translated into English. Wieland's place in literature in a sense falls within the group headed by Goethe, Schiller and Lessing, not so stellar as these, he was yet singularly attuned to his time. A veritable German Voltaire, his influence, exerted especially through the 'Deutscher Mercur,' was immense. Of facile and incessant wit, no other writer had more to do with shaping the German language to elegant expression. This explains the delight with which the work of Wieland was met in his day. Consult Loebell, 'Entwickelung der Deutschen Poesie' (1858); Ranke, 'Zur Beurtheilung Wielands' (1885); Hirzel, 'Wieland's Beziehungen zu den deutscher Romantikern'; Lenz, W., 'Wieland's Verhältniss zu Spenser, Pope, und Swift'; and Gruber's biography, with his editions.

WIENER, vē'nèr, **Leo,** Jewish-American author: b. Russia, 26 July 1862; d. Belmont, Mass., 13 Dec. 1939. He was educated at Minsk, at the University of Warsaw and the Polytechnic of Berlin. From the latter city he went to New Orleans, worked in a cotton factory, and later sold fruit in Kansas City, Mo. He then obtained a position as teacher in Odessa, Mo., and afterward a professorship in the University of Missouri. He was appointed assistant professor of Slavonic languages at Harvard in 1901; professor in 1911. He contributed many etymologies to Webster's New International Dictionary, but his greatest editorial production is the 24-volume compilation of Count Tolstoy's works. Among his other publications are 'History of Yiddish Literature in the 19th Century'; 'Contributions Toward a History of Arabico-Gothic Culture' (4 vols. 1917); 'Africa and the Discovery of America' (3 vols. 1919); 'Mayan and Mexican Origins' (1926).

WIENER-NEUSTADT, vē'nĕr-noi'stät, Austria. See NEUSTADT.

WIERTZ, vērts, **Anton Joseph,** Belgian painter: b. Dinant, 22 Feb. 1806; d. Brussels, 18 June 1865. He studied art in the Antwerp Academy, where he gained, in 1832, a prize which enabled him to continue his studies in Rome. On his return to Belgium he lived at Liège for a time, and from 1848 at Brussels, where the Belgian government erected a large studio for him in 1850. Wiertz was a painter of great, though eccentric, genius, with a strange predilection for horrible and fantastic subjects, and invented a method of painting, called by himself *peinture mate,* in which the characteristics of fresco and oil painting are combined. His principal pictures are 'Greeks and Trojans contending for the Body of Patroclus'; 'The Flight into Egypt'; 'Death of Dionysius'; 'The Triumph of Christ' (1848), his masterpiece; 'The Things of To-day in the Eyes of the Men of the Future'; 'The Beacon of Golgotha'; 'The Last Cannon'; 'Napoleon in Hell'; 'A Second after Death.' He did not sell any of his chief paintings, which he bequeathed to the state, but supported himself by painting portraits. His Brussels studio, fitted up after his death as the Musée Wiertz, contains his large pictures. He wrote 'Eloge de Rubens' (1840); and 'Caractères Constitutifs de la Peinture Flamande' (1863). Consult Labarre, 'Antoine Wiertz' (1866).

WIESBADEN, vēs'bä-dĕn, Prussia. A town in the province of Hesse-Nassau, formerly capital of the government of Wiesbaden, and capital of the Duchy of Nassau, beautifully situated among vineyards and orchards on the southern slopes of the Taunus range, about three miles north of the Rhine and 20 miles west of Frankfort. For many years it attracted about 80,000 visitors from all parts of Europe by its baths. Among notable buildings are the royal palace, the ducal palace, the town-house, the government buildings, the courthouse, the museum and picture-gallery, the library (100,000 vols.), the royal court theatre, the Trinkhalle, and the Kurhaus, consisting chiefly of a large and splendid saloon, forming the east side of a square, while the north and south sides are lined by colonnades, filled with gay shops, and uniting a promenade and a bazaar. The springs, all of which except one are alkaline and among the most powerful of their class, are very numerous, and have temperatures varying from 100° to 153° F. The springs of Wiesbaden are spoken of by Pliny as the «Fontes Mattiaci,» and on the Heidenberg, north of the town, traces of a Roman fortress were discovered in 1838, which seems to have been connected with the town by a wall, the Heidenmauer («heathen's wall»), in the ruins of which votive tablets and inscriptions have been discovered. Wiesbaden thrives principally on its popularity as a winter and summer watering-place, but also does a large business in wine and has manufacturing establishments for chocolate, surgical instruments, etc. The population is 151,961.

WIFE. See HUSBAND AND WIFE.

WIG, an artificial hair covering for the head to conceal baldness, or to alter the appearance. They are usually made of human hair woven into a cap that fits the head tightly. Those worn for baldness are politely termed toupees. The use of wigs is traced back to the ancients. They were used especially by the women. The fashion is said to have been copied by the Greek

ladies from those of Egypt. Under the Roman emperors it became common even for men to wear wigs, and several of the emperors themselves used this ornament. In the latter half of the 16th century the fashion became much in vogue in France, Italy and England. In 1560 no lady appeared at the French court without a blonde wig. Louis XIII set the fashion, wearing a wig of long curls, being himself bald. The courtiers naturally followed. Louis XIV was at first averse to wigs; but in the latter part of his reign, when he began to lose his own hair, he reintroduced the fashion, which went to a greater extreme than ever. About 1660 they began to be worn by the clergy, who had at first shown themselves hostile to the practice. The practice of powdering these wigs was adopted about the year 1700. About 1720 the great wig began to give place to the queue, which remained the fashion till early in the 19th century. Modern refinement has abolished the wig as an ornament except in Great Britain for the lord-chancellor, judges and barristers. They are still worn by actors and actresses as a part of the make-up or dress suitable to a particular character.

WIGAN, England, a town of Lancashire, on the Douglas, 21 miles northeast of Liverpool. Wigan stands in the centre of an extensive coal field, and its manufactures, which are important, consist chiefly of calicoes, fustians and other cotton goods, linens, checks, cotton twist, etc., besides iron foundries, iron forges, railway car works, iron rolling mills, large breweries, chemical works and corn and paper mills. It has a Mining and Technical College. Pop. 84,000.

WIGGIN, Kate Douglas Smith, American author: b. Philadelphia, Pa., 28 Sept. 1859; d. London, England, 24 Aug. 1923. She was educated at Abbott Academy, Andover, Mass., and in 1876 went to Los Angeles, studying the kindergarten system there, and later at San Francisco organized the first free kindergarten in the West. In 1880 she married S. B. Wiggin, a lawyer (d. 1889), and removed to New York. In 1895 Mrs. Wiggin was married to George C. Riggs. In 1906 Bowdoin College gave her the Litt.D. degree. She published, with her sister, Nora A. Smith, 'Froebel's Gifts' (1895); 'Kindergarten Principles and Practice' (1896), etc. Her other works, several of which have attained great favor in this country and England, include 'The Bird's Christmas Carol' (1888); 'The Story of Patsy' (1889); 'A Cathedral Courtship' (1893); 'Mann Lisa' (1896); 'Penelope's Progress' (1898); 'Penelope's Experience in Ireland' (1901); 'Diary of a Goose-girl' (1902); 'Rebecca of Sunnybrook Farm' (1903); 'New Chronicles of Rebecca' (1907); 'Susanna and Sue' (1909); 'Mother Carey's Chickens' (1911; dramatized 1915), etc.

WIGGINS, Benjamin Lawton, educator: b. Sand Ridge, S. C., 11 Sept. 1861; d. Sewanee, Tenn., 1909. His education was received at the University of the South from which he was graduated in 1880. He afterward (1883–84) pursued graduate work at Johns Hopkins University. In 1882 he returned to the University of the South as professor of Greek, which position he held until his death, with the added duties (after 1893) of vice-chancellor or president. Under his supervision the University of the South became one of the leading institutions in the Southern States.

WIGGINS, (John) Carleton, American artist: b. Turners, N. Y., 4 March 1848. He studied at the National Academy of Design in New York and under George Inness and H. Carmiencke and later in Paris. He first exhibited at the National Academy in 1870, and at the Paris Salon in 1881. He painted landscapes, and was especially successful in his paintings of cows. He was elected to the National Academy in 1906. His works are well represented in both public and private collections. Among them are 'A Holstein Bull' (Metropolitan Museum of Art, New York); 'Morning on the Hills' (Brooklyn Museum); 'October' (Corcoran Art Gallery, Washington); 'Lake and Mountains' (Chicago Art Institute); 'Evening after a Shower' (National Gallery, Washington); 'The Wanderers' (Hamilton Club, Brooklyn); 'Ploughing in France'; 'Plough Horse' (Lotus Club, New York). D. 12 June 1932.

WIGGINS, Guy Carleton, American artist, son of (J.) C. Wiggins (q.v.): b. Brooklyn, N. Y., 23 Feb. 1883. He studied under his father and at the Polytechnic Institute, Brooklyn, and the National Academy of Design, New York. He is notably successful in his portrayal of scenes in New York, and is also known for his landscapes. Among his works are 'Metropolitan Tower' (Metropolitan Museum, New York); 'Columbus Circle, Winter' (National Gallery, Washington); 'Berkshire Hills, June' (Brooklyn Museum), etc. He was made full member of the National Academy in 1935.

WIGGINS, Joseph, English sea captain and explorer: b. Norwich, 3 Sept. 1832; d. Harrogate, 13 Sept. 1905. He was apprenticed to his uncle, a shipowner, at the age of 14 and at 21 rose to be master of a ship. He afterward became owner of several cargo vessels and developed a keen interest in the project of developing a trade route between the countries of northern Europe and Siberia by means of the Northeast Passage through the Arctic seas. His first voyages, in 1874, 1875, 1876 and 1886–87 were less successful for the actual cargo delivery than for their awakening of interest in the matter and for his brilliant achievements as a navigator, demonstrating the possibility of taking ships far beyond any point hitherto reached. In 1887 he sailed up the Yenisei River to Yeniseisk. His first notable achievement in the delivery of a cargo was that of a shipment of rails for the Trans-Siberian Railway, in 1893, for which feat he was honored by the tsar. He made another successful visit to Yeniseisk in 1895. He was selected to take charge of a relief expedition into Siberia at the time of the famine in 1905 but died while preparations were under way. He received in 1894 the Murchison Medal of the Royal Geographical Society. Consult Johnson, H., 'Life and Voyages of Joseph Wiggins' (London 1907).

WIGGLESWORTH, wĭg'lz-wĕrth, **Michael,** American Puritan clergyman: b. Yorkshire, England, 1631; d. Malden, Mass., 10 June

1705. In 1638 he was brought to Charlestown, Mass., by his father and accompanied him in the same year to New Haven, Conn. He was graduated from Harvard in 1651, subsequently becoming a tutor there. He then studied theology and was settled as pastor of the Church of Malden in 1656. He was accounted skilful in medicine, and was offered the presidency of Harvard in 1684, but on account of ill health declined the honor. His best-known work, 'The Day of Doom' (1662), was a popular poem in New England for a long period. Two editions were printed in England and the sixth edition in New England appeared in 1715. The savage Calvinism of the poem is unsurpassed in literature save perhaps in Jonathan Edwards' sermon, 'Sinners in the Hands of an Angry God,' but the work contains not a little dramatic force and here and there passages of dignity and beauty. He also wrote 'God's Controversy with New England' and 'Meat out of the Eater,' in verse; and 'A Discourse on Eternity.' Consult Tyler's 'History of American Literature' (1878); and Dean, 'Memoir of Michael Wigglesworth' (1863; new ed., 1871).

WIGHT, wīt, **Orlando Williams,** American physician and translator: b. Centreville, N. Y., 19 Feb. 1824; d. Detroit, Mich., 19 Oct. 1888. He was educated at the Rochester Collegiate Institute, removed to New York in 1847, studied theology and was ordained to the Universalist ministry. He subsequently studied medicine, being graduated from the Long Island College Hospital in 1865. He engaged as a medical practitioner in Wisconsin, and was appointed State geologist and surgeon-general in 1874. He was health commissioner of Milwaukee in 1878–80, and health officer of Detroit in 1882–88. He was a noted translator and throughout his life devoted a large share of his time to literary work. He wrote 'Maxims of Public Health' (1884); 'Peoples and Countries Visited' (1888), etc. His translations include 'History of Modern Philosophy,' with F. W. Ricord (1852); 'Lives and Letters of Abélard and Héloïse' (new ed., 1861); Martin's 'History of France,' with Mary L. Booth (1863), etc. He also edited 'Standard French Classics' (14 vols., 1858–60); 'The Household Library' (18 vols., 1859, et seq.), etc.

WIGHT, William Ward, American lawyer: b. Troy, N. Y., 14 Jan. 1849. He was graduated at Williams College in 1869, and the Albany Law School in 1873. He began law practice in Milwaukee in 1875. Among his services were Fire and Police Commissioner, president of the board of Milwaukee-Downer College (1907–24), and president of the State Historical Society of Wisconsin. He wrote 'Life of Henry Clay Payne,' etc. Died 2 Jan. 1931.

WIGHT, Isle of, England, off the south coast, in the county and opposite to the mainland portion of Hants, is separated from the mainland by the roadstead or channel of Spithead on the east, and by the Solent or continuation of this on the west. It is about 23 miles in length from east to west, by 15 miles broad; circuit about 70 miles; area, 146 square miles. The land is rolling, affording agreeable scenery; the air is remarkably healthful. Only a small portion of the surface is waste. The downs, which cross the island from east to west and form excellent sheep-walks, separate it into two districts, which in their general character contrast with each other, the soil on the north side being generally a stiff, cold clay, and on the south side a fertile sandy loam. On the promontory that forms the western extremity of the island are three notable chalk cliffs locally called the "Needles." Celtic tumuli occur on a number of the chalk downs, and there are monoliths of geologic interest. Excellent cement is manufactured at the works on the west side of the Medina, and largely exported. The chief imports are cattle, coal, timber and building material. The island is well defended, being protected on the east side by Sandown Fort, Bembridge Fort and Battery, and by other forts which lie between the island and the mainland. The western approach is guarded by Hurst Castle and other forts. The chief towns are Newport (the capital), Ryde, Cowes, Ventnor, Brading, Yarmouth and the fashionable health resorts of Sandown and Shanklin on the southeast coast. Osborne, near Cowes, was a residence of Queen Victoria, and with its beautiful grounds is now a national memorial, the gift of Edward VII. Its most recent use is as a college for naval cadets. Among the antiquities of the Isle of Wight the most interesting is Carisbrooke Castle, which stands a little southwest of Newport, and consists of extensive and well-preserved picturesque ruins. It has many historical associations: it is supposed to have originally been a fortress of the Britons, was afterward repaired and enlarged by the Romans, was considerably strengthened under Cerdic, who founded the kingdom of Wessex, and rebuilt in the reign of Henry I. During the Parliamentary War it became the asylum of King Charles I on his escape from Hampton Court, and afterward his prison. Another interesting remain is Quarr Abbey, about two and one-half miles from Ryde, which was built in 1132, and is now a farmhouse. Pop. 88,454. Consult Thomas's 'Isle of Wight' (Boston 1912).

WIGMORE, John Henry, American lawyer and university dean: b. San Francisco, 4 March 1863; d. Chicago, Ill., 20 April 1943. One of America's great authorities on the law of evidence, he was graduated from Harvard; practiced law at Boston, 1887–89; thereafter was professor of Anglo-American law at Keio University, Tokyo, Japan, for three years, and from 1893 was professor of law at Northwestern University (dean of the law faculty, 1901–29). He published 'Digest of the Decisions of the Massachusetts Railroad Commission' (1888); 'The Australian Ballot System' (1889); 'Notes on Land Tenure and Local Institutions in Old Japan' (1890); 'Materials for the Study of Private Law in Old Japan' (1892); 'Treatise on Evidence' (4 vols., 1904–05; 5 vols., 1923); 'Pocket Code of Evidence' (1909); 'Principles of Judicial Proof' (1913). He edited the 16th edition of 'Greenleaf on Evidence' (1899); Compiled 'Examinations in Law' (1900); 'Cases on Torts' (2 vols. 1911); 'Cases on Evidence' (1913), and coeditor of 'Select Essays in Anglo-American Legal History' (1907); 'Evolution of Law Series' (1915); 'Panorama of the World's Legal Systems' (1929). Mr. Wigmore was president of the American Institute of Criminal Law and Crim-

inology 1909–1910, and 1916–1919, served on the staff of the judge advocate general of the United States. In February 1917 he was appointed a member of the United States High Commission.

WIGNER, Eugene Paul, mathematical physicist: b. Budapest, Hungary, November 17, 1902. Educated as a chemical engineer at the Technische Hochschule, Berlin, he taught there until 1930. Coming to the United States he became professor of mathematical physics at Princeton University, held the same position at the University of Wisconsin during 1937–1938, returning to Princeton in the latter year. Associated at an early date with the preliminary organization of nuclear research in the United States, he was one of a group of foreign-born scientists who helped to secure government sponsorship for it. During the period of the Manhattan Project he did research at the University of Chicago Metallurgical Laboratory and other atomic bomb installations. After the war, on leave of absence from Princeton, he became director of research at the Clinton Laboratories, Oak Ridge, Tenn. He returned to his university duties in 1947. In addition to many papers on nuclear theory, he has applied the mathematical methods of group theory to quantum mechanics, and molecular structure, has been interested in theories of reaction rates and has developed theories of the solid state. His book *Gruppentheorie und ihre Anwendung auf die Quantenmechanik der Atomspektren,* written in 1931 is widely used as an advanced text in quantum mechanics.

WIGTOWN, or **WIGTON,** county forming the southwest corner of Scotland; bounded west by the North Channel, north by Ayrshire, east by the Stewartry of Kirkcudbright and the Solway Firth, and south by the Irish Sea. The extent from east to west is about 33 miles, from north to south about 26 miles; area, 487 square miles, of which about 46 per cent is arable. This county which constitutes West Galloway was formed about 1341. It lies between latitude 54° 38′ and 55° 4′ N., and longitude 4° 16′ and 5° 6′ W. Wigtown is somewhat irregular in form, being deeply intersected by two arms of the sea. The western part of Wigtown, known as the "Rhins of Galloway," forms a peninsula; its northern extremity is Corsewall Point, and its southern the Mull of Galloway. The southeastern half of Wigtown extends south in a blunt triangular form, terminating in Burrow Head. The soil is varied, and except a portion along the seashore, especially in the southeastern part which consists of a rich loam—the quality is inferior. The climate is mild but moist, the rainfall being comparatively great. There are many dairy establishments. Wigtown contains three rivers of considerable size, the Cree, the Bladnoch, and the Luce—the Cree and Bladnoch being navigable for a few miles. Small freshwater lochs are numerous. There were at an early period many religious houses in the county and the church, believed to be the oldest in Scotland, founded by Saint Ninian, was built near the site of the present village of Whithorn. The principal towns are Wigtown, Newton-Stewart, Stranraer, and Whithorn. Pop. (1931) 29,299; (1951) 31,625.

WIGWAGGING, a system of visual signaling by means of hand flags. See SIGNALS AND SIGNALING.

WIGWAM, wĭg′wŏm, among the American Indians a lodge, cabin, hut or tent, generally of a conical shape, formed of bark or mats laid over stakes planted in the ground, and converging toward the top, where there is an opening for the escape of the smoke. The most common form is the tepee, which is portable, being usually a framework of roughly trimmed poles, lashed together with split wood, or thongs, and covered with hides, bark, or matting. Those designed to be more permanent, approached the log house or bark shack in construction. The word has also been applied to a large temporary structure for public gatherings.

WILBER, wĭl′bĕr, city, Nebraska, and Saline County seat; altitude 1,325 feet; on the Blue River; 31 miles southwest of Lincoln; on the Burlington Railroad. It is in a region growing wheat and corn abundantly. Settled in 1873, it was named for C. D. Wilber of the University of Nebraska, who platted it. It has a library, and municipal water, power, and light systems. A city of the second class, its government is administered by mayor and council. Pop. (1940) 1,355; (1950) 1,358.

WILBERFORCE, Henry William, English journalist and author: b. Clapham, England, Sept. 22, 1807; d. Stroud, Gloucestershire, April 23, 1873. He was the youngest son of William Wilberforce (q.v.). Educated at Oriel College, Oxford, during his holidays he read with John Henry (later Cardinal) Newman. He entered Lincoln's Inn but abandoned law for theology, and was ordained in the Church of England in 1834. He held several vicarages between 1841 and 1850 at which time he entered the Catholic Church. He wrote *The Parochial System* (1838); *Proselytism in Ireland* (1852); *The Church and the Empires: Historical Periods* (1874). He was the proprietor and editor of the *Catholic Standard,* a London newspaper, from 1854 to 1863.

WILBERFORCE, wĭl′bĕr-fôrs, **Robert Isaac,** English clergyman, 2d son of William Wilberforce (q.v.): b. Clapham, Surrey, England, Dec. 19, 1802; d. Albano, Italy, Feb. 4, 1857. He was graduated from Oriel College, Oxford, in 1823, and was subsequently chosen fellow of his college, associating in that capacity with Edward Bouverie Pusey and John Henry Newman, Hurrell Froude and other leaders of the High Church party. In 1830 he left Oxford to take charge of a parish, and became vicar in 1840 of Burton Agnes, Yorkshire.

WILBERFORCE, Samuel, English prelate, 3d son of William Wilberforce (q.v.): b. Clapham, Surrey, England, Sept. 7, 1805; d. near Dorking, Surrey, July 19, 1873. He was graduated from Oriel College, Oxford, in 1826, ordained deacon in 1828, and appointed curate of Checkendon, Oxfordshire, the same year. He was rector of Brightstone, in the Isle of Wight, 1830–1840, in 1839 became archdeacon of Surrey, and in 1840 a canon of Westminster. In the last-named year also he became rector of Alverstoke, Hampshire. He received the deanery of Westminster in March 1845, but before the close of that year was promoted to the bishopric of Winchester. He was the leader of the High Church party, though much opposed to ritualism, and was both witty and eloquent as well as a skillful debater in the

House of Lords. His readiness in argument and his versatile qualities gained him the title of "Soapy Sam." He published *Notebook of a Country Clergyman* (1833); *Eucharistica* (1839); *A History of the Protestant Episcopal Church in America* (1844); *University Sermons.*

Consult the *Life* by his son, R. G. Wilberforce (1888); Daniell, G. W., *Bishop Wilberforce* (1891).

WILBERFORCE, William, English philanthropist: b. Hull, Yorkshire, England, Aug. 24, 1759; d. London, July 29, 1833. Educated at Cambridge, he was in 1780 elected member of Parliament for his native town; and in 1784 was returned both by his former constituency and by the County of York. He chose to represent the latter. In 1786 he made the acquaintance of T. Clarkson, who gained his sympathies on behalf of the agitation against the slave trade, to which he henceforth devoted all his energies in Parliament until the agitation proved successful. He first called the attention of the house to the subject in 1787, and in 1791 moved for leave to bring in a bill to prevent further importation of African Negroes into the British colonies. Year after year he pressed this measure, but was defeated until 1807, when it was passed during the short administration of H. Fox. Having secured the abolition of the slave trade in the British colonies, he addressed himself to the task of obtaining emancipation for those already reduced to or born in slavery. In 1812, after having sat for Yorkshire in six Parliaments, he withdrew from the representation, and until 1825, when he retired from Parliament, sat for the borough of Bramber. He died shortly after the government plan for the total abolition of slavery in the British colonies had passed in the House of Commons. His remains were interred in Westminster Abbey, and his funeral was attended by distinguished men of all parties. Wilberforce was the author of a treatise entitled *A Practical View of the Prevailing Religious Systems of Professed Christians in the Higher and Middle Classes contrasted with Real Christianity* (1797).

Consult *Life of William Wilberforce* by his sons (1838); his *Correspondence* (edited 1840); and *Private Papers of William Wilberforce* (edited 1897).

WILBERFORCE UNIVERSITY, an institution of higher learning, is located at Wilberforce, Ohio. It was founded in 1856 by the Methodist Episcopal Church, and in 1863 was purchased by the African Methodist Episcopal Church under whose auspices it has since operated. It includes a college of liberal arts, a college of education, a theological seminary, and a school of vocations. The liberal arts college offers courses leading to the A.B. and B.S. degrees with majors in social administration, journalism, and music, in addition to the regular classical and scientific courses. It also offers preprofessional training for law, medicine, dentistry, and engineering. The college of education offers the degree B.S. in education and trains teachers for the elementary and high school grades as well as teachers for agriculture, commerce, industrial arts, health and physical education, home economics, and public school music. The theological seminary offers a three-year course leading to the degree B.D. The school of vocations offers courses in automotive service, electricity, building construction, printing, and food administration. The grounds and buildings are valued at $2,200,000 and there is a yearly income of $400,000. The approximate annual enrollment is 406.

WILBOUR, Charlotte Beebe, American woman-suffrage worker: b. East Hartford, Conn., March 2, 1833; d. New York, Dec. 25, 1914. She was educated at the Wilbraham (Mass.) Academy, and was married to Charles E. Wilbour, an Egyptologist, in 1858. She was associated with Susan B. Anthony and Elizabeth Cady Stanton as a worker for suffrage for women, and became known as a public speaker of much force and eloquence. She was one of the founders of the Sorosis Club in New York in 1868, which in 1869 became the first incorporated women's club in the United States.

WILBUR, wĭl'bẽr, **Curtis Dwight,** American public official: b. Boonesboro (now Boone), Iowa, May 10, 1867; d. Palo Alto, Calif., Sept. 8, 1954. A graduate of the United States Naval Academy (1888), he practiced law in Los Angeles, was elected judge of the superior court (1903–1918), and then associate justice of the state supreme court, serving as chief justice from 1922. He was secretary of the navy (1924–1929) and judge of the 9th United States Circuit Court of Appeals (1929–1945).

WILBUR, John, American preacher of the Society of Friends: b. Hopkinton, R. I., July 17, 1774; d. there, May 1, 1856. He was a teacher and surveyor, who was a strongly conservative member of the Society of Friends. For his alleged statements reflecting on J. J. Gurney (q.v.), the English Quaker, he was denounced by several members of the Rhode Island yearly meeting of 1838. Wilbur's adherents later withdrew from the orthodox society and formed an independent conservative yearly meeting whose members were styled Wilburites (q.v.). Among Wilbur's writings, largely polemical, was *A Narrative and Exposition* (1845).

WILBUR, Ray Lyman, American educator and statesman: b. Boonesboro, Iowa, April 13, 1875; d. Palo Alto, Calif., June 26, 1949. He was educated at Leland Stanford (now Stanford) University, Cooper Medical College, and in Germany and England. He was appointed to the chair of medicine at Stanford in 1909, became dean of the Medical School in 1911, president of the university in 1916, and chancellor for life in 1943. On leave of absence from the university, he was secretary of the interior in the Hoover cabinet (1929–1933). Dr. Wilbur was a member of many local and national organizations interested in public affairs, the advancement of education, health and welfare. From 1923 to 1940, he was a trustee of the Rockefeller Foundation; in 1925, chairman of the Institute of Pacific Relations in Honolulu, and from 1943 until his death, he was chairman of the advisory committee of the Army Specialized Training Program.

WILBURITES, a branch of the Society of Friends or Quakers, who adopted the principles of the Rev. John Wilbur (q.v.) in 1827, and maintained an independent yearly meeting. Having become a preacher of the Society of Friends, Wilbur took a strongly conservative stand against what he regarded as innovations antagonistic to the original doctrines of the society. Wilbur's followers, the Conservative Friends, in 1949 had 12

churches, and about 4,000 communicants. See FRIENDS, THE RELIGIOUS SOCIETY OF.

WILCOX, wĭl'kŏks, **Cadmus Marcellus,** American army officer: b. Wayne County, North Carolina, May 29, 1824; d. Washington, D.C., Dec. 2, 1890. He was graduated from the United States Military Academy in 1846, served in the Mexican War, and in 1860 was commissioned captain. In 1861 he resigned from the army and entered the service of the Confederacy. He participated in the first Battle of Bull Run, was promoted brigadier general in October, and in 1864 became major general. He was engaged in the second Battle of Bull Run, at Fredericksburg, Chancellorsville, Salem Heights, Gettysburg, and other important battles, and was present at the surrender at Appomattox Court House. He was offered a commission as brigadier general in the Egyptian Army after the close of the Civil War, but declined it. In 1886–1890 he was chief of the division of railroads at the General Land Office in Washington. He wrote *Rifles and Rifle Practice* (1859); translated from the French a work, *Austrian Infantry Evolutions of the Line* (1860); and an excellent *History of the Mexican War*, edited by his niece, Mary Rachel Wilcox (1892).

WILCOX, Delos Franklin, American public utility expert: b. near Ida, Michigan, April 2, 1873; d. New York, N.Y., April 4, 1928. He was graduated at the University of Michigan in 1894 and received his Ph.D. at Columbia University in 1896. He edited the Detroit *Civic News* in 1905–1907; was chief of the bureau of franchises of the public service commission in the first district of New York, 1907–1913; deputy commissioner of the New York City department of water supply, gas and electricity 1913–1917; adviser to the Federal Electric Railway Commission 1919–1920; and consultant on utility rates and problems for New York City from 1917.

He was author of *The Study of City Government* (1897); *City Problems* (1899); *The American City* (1904); *Municipal Franchises* (2 vols., 1910–11); *Great Cities in America* (1910); *Analysis of the Electric Railway Problem* (1921); *Depreciation in Public Utilities* (1925); *The Indeterminate Permit in Relation to Home Rule and Public Ownership* (1926).

WILCOX, Ella Wheeler, American journalist and poet: b. Johnstown Center, Wisconsin, Nov. 5, 1850; d. Sound Beach, Conn., Oct. 30, 1919. She was educated at the University of Wisconsin and in 1884 began her literary career by contributing to the periodical press. *Poems of Passion* (1883) gave her a national reputation. Her verse was widely published in daily newspapers. In later life she dealt more and more with subjects pertaining to the higher life, the brotherhood of man, faith in a future life, and reincarnation. Among her other publications, in verse, are *Drops of Water* (1872); *Shells* (1873); *Maurine* (1876); *Sweet Danger* (1902); and *The Art of Being Alive* (1914). She also wrote the novels *Mal Moulée* (1885); *A Double Life* (1890); *An Erring Woman's Love* (1892); *A Woman of the World* (1904); *The Story of a Literary Career* (1905); *Poems of Sentiment* (1906); *Historical Mother Goose* (1914); *Poems of Problems* (1914); *Lest We Forget* (1915); *The Worlds and I*, an autobiography (1918).

WILCOX, Marrion, American author: b. Augusta, Georgia, April 3, 1858; d. New York, N.Y., Dec. 26, 1926. A graduate of Yale (1878), two years later he was admitted to the New York bar, having studied law at Hamilton College. He made special studies at Oxford, Heidelberg, Jena, and Berlin universities from 1881 to 1883. From 1884 to 1886 he served as an instructor at Yale and was associate editor of the *New Englander and Yale Review*, and from 1893 was engaged in editorial and other literary work in New York. In 1902 he became noted as an advocate of fair play to Cuba, defending the principle of reciprocity in the United States and urging concessions from the political leaders and economic associations of Cuba. His principles were approximately those embodied in the treaty submitted to Congress and accepted in 1903. In 1906–1907 he visited South America and Mexico, and on his 1907 visit, at the request of Yale University, he suggested the interchange of professors between the United States and Latin American countries, stressing particularly the need for such interchange with Mexico, Brazil, and Argentina. He published *A Short History of the War with Spain* (1898); *Harper's History of the War in the Philippines* (1900); *Sketches in Spain, England and Italy*, and a novel, *For Labour*. He contributed many articles on Central and South American topics to the *Encyclopedia Americana*, and edited, in collaboration with George E. Rines, *The Encyclopedia of Latin-America* (1917).

WILCZYNSKI, wĭl-zĭn'skĭ, **Ernest Julius,** American mathematician and educator: b. Hamburg, Germany, Nov. 13, 1876; d. Denver, Colorado, Sept. 14, 1932. After attending elementary and high schools in Chicago, he returned to Germany and entered the University of Berlin where he received his doctorate in 1897. He returned to the United States and in 1898 was appointed instructor in mathematics at the University of California. Here he remained until 1907 as assistant and associate professor, except for two years (1903–1905) which he spent in Europe as research associate for the Carnegie Institution at Washington, D.C. He became known as an authority on projective differential geometry and as a leader of a new school of geometers. Many scientific honors were bestowed upon him.

WILD, vĭlt, **Heinrich von,** Swiss meteorologist: b. Uster, Switzerland, Dec. 17, 1833; d. Zurich, Sept. 5, 1902. His education was obtained at Zurich, Königsberg, and Heidelberg, and from 1863 to 1865 he was director of the central meteorological bureau at Bern. He was called to St. Petersburg (now Leningrad) and was director of the Russian meteorological service 1865–1895, when he retired. He invented the polaristrobometer, a polarization plutometer, a magnetic theodolite, and other optical instruments, edited the Russian *Neues Repertorium für Meteorologie*, and published *Temperatur-Verhaltnisse des russischen Reichs* (1876), and many technical papers.

WILD, Jonathan, English robber and informer: b. Wolverhampton, England, about 1682; d. London, May 24, 1725. He was a Birmingham buckle maker who in 1706 went to London intending to engage in his trade, but becoming involved in debt was imprisoned for

four years, after which he became a receiver of stolen goods and an informer against such criminals as were not in his employ. He was hanged at Tyburn. He was the subject of Fielding's satire, *History of the Life of the Late Mr. Jonathan Wild the Great* (1743), and also appears in Ainsworth's novel, *Jack Shepherd,* as well as in various other tales and pretended biographies.

WILD DUCK, The. Henrik Ibsen, in his ironic play *The Wild Duck* (*Vildanden*), published in 1884 and performed the year following, sought to exhibit the folly of obedience to any mere formula of conduct, a doctrine already propounded in his early poetic drama, *Brand.* Incidentally, he made clear the dangers of a shallow idealism, and challenged his admirers to decide each case of conduct on its own merits, rather than according to some nicely worded law discovered in his plays. In *The Pillars of Society* and *An Enemy of the People* Ibsen had insisted that truth and freedom are essential to social welfare; and in *A Doll's House* he had declared for perfect confidence between husband and wife. Yet in *The Wild Duck,* he lets us understand that there are instances when "the truth, the whole truth, and nothing but the truth," may work more harm than good.

A busy-body reformer, sincere though short-sighted, finds that his former classmate in college has been wedded to a woman with a past. He discovers that it is his own father who has disgraced her, and feels in duty bound to enlighten Hjalmar Ekdal and convince him of the necessity of beginning life afresh with Gina on a basis of mutual understanding. But no sooner does Hjalmar learn from the idealist reformer that his Gina has once been the mistress of another than he rebuffs her and the innocent child he had thought his own, and proposes to forsake them both. The little girl, having been taught by the meddling idealist the doctrine of self-abnegation, accepts it literally, and, instead of sacrificing only her pet duck to win back Hjalmar's love, sacrifices her dearest possession, life itself. Thus the idealist—Gregers Werle—with the best of intentions, has wrought havoc in a family hitherto happy, though in part deluded.

Quite aside from its central meaning, the play is of interest as depicting with minute fidelity a curious group of characters. Of especial note are the Ekdals, all victims of old Werle. There is the lieutenant, once his partner in a dishonest business, serving in prison as his scapegoat, and emerging to find his only pleasure in hunting pretended game in a pretended forest in an attic. There is the lieutenant's son Hjalmar, ostensibly a photographer, but in fact an idle dreamer assuming poses to deceive himself and others, mouthing conventionally when informed that old Werle has married him to Gina to conceal her fault and his. There is little Hedvig, cursed by her inheritance from old Werle with weak eyes, straining them unduly in touching up negatives for the lazy Hjalmar, for whose sake she mistakenly lays down her life. And there is Gina, loyal and industrious, the embodiment of common sense, little troubled by remorse for her past, yet unconsciously atoning for it by devotion to her husband and her child. Not the least enigmatic characters are the minor folk Molvik and Relling, the latter proclaiming the need of every creature for some life-lie, some delusion to make him happy.

Technically, the piece is noteworthy for its decorative and incidental symbolism, an insinuated parallel being drawn between the bird that was shot by old Werle and sunk in the marsh until retrieved and further lamed by his dog; and the Ekdal family, injured by Werle and hurt even more by the efforts of Gregers to redeem it. English versions of *The Wild Duck* have been made by Mrs. E. Marx-Aveling, Mrs. F. E. Archer and R. F. Sharp.

FRANK W. CHANDLER.

WILD FLOWERS are showy flowering plants growing in nature. The number of different kinds on any continent is reckoned in the thousands. Among them are the ancestors of all our garden ornamental plants, as well as countless other forms which have never been cultivated by man.

National Flowers.—Though the variety of wild flowers is very great, there are certain favorites which have been singled out in nearly every land as national emblems. In England the national flower is the rose, while in Scotland it is the thistle, in Ireland the shamrock, in France the iris, in Switzerland the edelweiss, and in Germany the cornflower. A similar position is occupied by the water lily or lotus in Egypt and in India, by the narcissus in China, and by the cherry blossom in Japan.

State Flowers.—The states and territories of the United States are individually symbolized by state flowers. These state flowers are, with the exception of a few cultivated plants, wild flowers characteristic of the native flora of the state in question. (See FLOWERS, SYMBOLISM OF.—*State Flowers.*)

There is no national flower for the United States. A likely candidate, however, is the red columbine. This graceful plant of woodlands, stream borders, and meadows grows wild in all sections of the United States except the Great Plains. It crosses our borders into Canada and Alaska and ranges for a short distance into Mexico, but is unknown in a wild state in the Old World. It is thus a truly all-American wild flower. Its Latin name, Aquilegia, moreover, is derived from the classical word for eagle, our national bird, while its vernacular name, columbine, is suggestive of Columbus and Columbia.

Buttercup Family.—The columbine is placed by botanists in the buttercup family, which is a way of saying that it is related to buttercups, larkspur, monkshood, and clematis. The members of the buttercup family are mostly herbs with numerous, spirally arranged petals, stamens, and carpels. (See FLOWERS for a description of floral organs.) Buttercups with their shiny yellow petals are common plants of open meadows and marshy fields. There are a number of species of larkspur, all of which may be recognized by the single spur produced at the back of the blue, white, or scarlet flower. The columbine, by contrast, has five floral spurs. Besides the red columbine there are a long-spurred yellow columbine in the mountains of the Southwest and a closely related pale blue form in the Rocky Mountains. The monkshood, which gains its name from the blue, cowl-shaped flowers, is found in moist wooded hills. Its roots contain a deadly poison, which formerly was used in various parts

of the world as an arrow poison. The related magnolia family includes the magnolia and tulip tree of eastern and southern woods.

Rose Family.—The rose family contains numerous native trees, shrubs, and herbs. Their flowers are generally similar to those of the buttercup family except that the carpels are more or less buried beneath the other floral parts. The simple pink blossoms of the wild rose are found in thickets and open woods throughout the United States. The shrubby spirea, amelanchier or serviceberry, hawthorn, thimbleberry, blackberry, wild plum, and chokecherry belong in this family. The wild strawberry, with its creeping stems, white flowers, and small fragrant fruits, is found in moist woods.

Pea Family.—The pea family is distinguished by its fruits, which are dry pods, and by its characteristic flowers, which consist of 3 broadly flaring petals plus 2 smaller petals fused around the 10 stamens and single style. The sweet pea, vetch, and clover are common plants of open fields. The blue and purple flowers of the lupines form large masses of color on open plains and along roadsides. The most popular species of lupine is perhaps the bluebonnet, the state flower of Texas. Locoweed is a beautiful, but sometimes poisonous, plant of the western cattle range.

Violet Family.—The blue and yellow violets of woodlands and meadows and their cousin, the yellow pansy of open fields, are common wild flowers in all parts of the United States. Four states have selected the violet as a state flower.

Heath Family.—The heath family, with 5 petals fused into a tube and 10 stamens, includes the rhodondendron or azalea of our moist woods. The Labrador tea, mountain laurel or kalmia, trailing arbutus or mayflower, blueberry, and cranberry are shrubs of boggy or peatty places in the eastern mountains. The manzanita is a gnarled red-barked shrub of arid western brushlands. Indian pipe and pine drops are brown fleshy herbs of dark forest floors, which live as parasites or saprophytes on roots and leafmold. The striking crimson snowplant of pine woods in California is another such humus plant.

Phlox Family.—The phlox family consists of herbs and showy flowers. The flowers are composed of five petals fused into a tube and five stamens adhering to the petals. There are three carpels fused into an ovary with three stigmas, and the fruit is a three-celled capsule. The phloxes themselves are a large and beautiful group of tall leafy perennials in the woodlands, meadows, and sand dunes of the East; the western species are low, matted, cushiony plants of high mountains. Ranging through the West, the Southwest, and into the South is the scarlet gilia, a perennial herb with brilliant red, trumpet-shaped blossoms. The true gilias, which are annuals with mostly blue-violet flowers, are common wildlings of the western desert plains and mountain slopes.

Snapdragon Family.—The snapdragon family includes many of our most beautiful wild flowers. They are herbs with two-lipped tubular flowers, two or four stamens, and two-celled capsular fruits. The snapdragon, a chiefly Mediterranean group, is not the most conspicuous member of the family with us, being relatively uncommon in the West and absent altogether in the eastern flora. Far more characteristic is the pentstemon, a large assemblage of perennials with showy, blue, red, or white flowers. The monkeyflowers, most of which possess handsome golden-yellow flowers, are common herbs of marshes, streams, and springs. In the Indian paintbrush, a common western wild flower, the tips of the erect bunched shoots are brilliant red. The showy parts here are not the flowers, but the leaves and the bracts subtending them. One species of Indian paintbrush is the state flower of Wyoming. Owl's-clover, toadflax, mullein, veronica or speedwell, and collinsia are other wild flowers belonging in this family. The related bignonia family includes the catalpa, a showy tree of the South.

Mint Family.—The mint family, with square stems, aromatic leaves arranged in pairs, and strongly two-lipped flowers, includes the germander, skullcap, dragonhead, hedge nettle, sage, pennyroyal, and mint.

Sunflower Family.—The sunflower is one of our largest families. These plants are herbs or shrubs with small yellow flowers congested into heads. The familiar "flower" of the sunflower is really an inflorescence composed of numerous tiny flowers. Sunflower seeds were eaten by the Indians and are still used to a limited extent for human food. The goldenrod, which is the state flower of Alabama, Kentucky, and Nebraska, comes into bloom in late summer and fall, when other wild flowers have gone to seed. The goldenrod has long been notorious as a hay-fever plant, but recent studies have shown that it does not deserve its unfavorable reputation. Cornflower, aster, fleabane, everlasting, coreopsis, bur marigold, tarweed, groundsel, thistle, dandelion, and sagebrush are other members of the sunflower family.

Lily Family.—The lily family consists of perennial herbs with bulbs or rootstocks, frequently with ribbonlike or lance-shaped leaves, and with handsome flowers composed of six perianth parts, six stamens, and three fused carpels. Many, like the bog asphodel, tiger lily, and false hellebore, are plants of swampy ground or stream courses. Others such as the fawn lily, fritillary, false Solomon's-seal, and trillium are inhabitants of deep woods, while certain kinds of zygadene, wild onion, and Mariposa lily or calochortus have become adapted to dry hillsides. The native blue and yellow irises belong in the related iris family, and the bizarre treelike yuccas and century plants of the Southwest are classified in another related assemblage, the agave family.

Orchid Family.—The large and interesting orchid family is poorly represented with us. The white, pink, and yellow lady's slippers are plants of rich northern and eastern woods. The rein orchis with small greenish-hued flowers arranged in a spike is found in open woods, meadows, and bogs. Coralroot, a brownish or yellowish herb without green foliage, gains its name from the branching coral-like roots which grow parasitically on the roots of other plants in the forest.

Arum Family.—The arum family, with numerous small flowers crowded on a spike and subtended by a large, often showy, bract, includes several interesting herbs of eastern woods and bogs. Among these are the purple and white jack-in-the-pulpit and the foul-smelling skunk cabbage.

Conservation.—The American countryside was formerly carpeted each spring and summer with wild flowers in indescribable abundance. But, since the coming of the white man and his cattle, the wild flowers have been crowded from their original haunts and restricted, in many

WILD FLOWERS

Wild flowers of North America. (1) Trumpet honeysuckle, *Lonicera sempervirens.* (2) Black-eyed susan, *Rudbeckia hirta.* (3) Trumpet-vine, *Bignonia radicans.* (4) Lupine, *Lupinus perennis.* (5) New England aster, *Aster novae-angliae.* (6) Virginia cowslip, *Mertensia virginica.* (7) Bitter-root, *Lewisia rediviva.* (8) Rose mallow, *Hibiscus moscheutos.* (9) California poppy, *Eschscholzia californica.* (10) Yellow lady-slipper, *Cypripedium Calceolus.* (11) Columbine, *Aquilegia canadensis.*

Painted for "The Encyclopedia Americana" by Alexander Seidel of The American Museum of Natural History

WILD FLOWERS

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Wild flowers of North America. (1) Pasture rose, *Rosa virginiana*. (2) Wild orange-red lily or wood-lily, *Lilium philadelphicum*. (3) Pinxter-flower, *Rhododendron nudiflorum*. (4) Spreading globeflower, *Trollius laxus*. (5) Flowering raspberry, *Rubus odoratus*. (6) Joe-pye weed, *Eupatorium maculatum*. (7) Indian pipe, *Monotropa uniflora*. (8) Jack-in-the-pulpit, *Anthurium atrorubens*. (9) Moss pink, *Phlox subulata*. (10) Trailing arbutus, *Epigaea repens*. (11) Bloodroot, *Sanguinaria canadensis*. (12) Dutchman's-breeches, *Dicentra cucullaria*.

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Drawn for "The Encyclopedia Americana" by Alexander Seidel of The American Museum of Natural History

cases to small protected areas. The conservation movement has grown in strength since World War I, and many thoughtful citizens now realize that somewhere a line must be drawn beyond which the destruction of our native wildlife shall not pass. The traditional American custom of gathering armloads of wild flowers for bouquets is prohibited in some states and is everywhere out of harmony with modern conditions.

Collections of dried wild flowers are preserved in museums (or herbaria) in colleges, universities, botanical gardens, and experimental stations throughout the country. Here the specimens are consulted and studied by botanists for compiling regional floras (such as those listed below) or revising and improving the natural classification of any given assemblage of species. Living specimens of wild flowers are preserved in botanical gardens, where they may be viewed by the public. Living wild flowers are grown also in various experimental stations, either as a source of germplasm for the breeding of new ornamental plants or as a means of conducting basic research in botany. See also FLOWERS.

Bibliography.—A knowledge of the names and habits of wild flowers, which increases the pleasure of one's excursions, is naturally a gradual acquisition. The beginner has at his disposal a number of well illustrated books, several of which can be mentioned here: Mathews, F. S., *Field Book of American Wild Flowers* (New York 1912); Armstrong, M., *Field Book of Western Wild Flowers* (New York 1915); Clements, E. S., *Flowers of Coast and Sierra* (New York 1928); Clements, F. E., and E. S., *Rocky Mountain Flowers,* 3d ed. (New York 1928–32); Saunders, C. F., *Western Wild Flowers and Their Stories* (Pasadena 1933); House, H. D., *Wild Flowers* (New York 1935); Sharples, A. W., *Alaskan Wild Flowers* (Stanford, Calif., 1938); Moldenke, H. N., *American Wildflowers* (New York 1949); Zim, H. S., and Martin, A. C., *A Guide to Familiar American Wildflowers* (New York 1950).

One may wish to learn something about the natural relationships of our wild flowers to one another and to the flowering plants of other lands. For this purpose see, among others, the following works: Clements, F. E., and E. S., *Flower Families and Ancestors* (New York 1928); Pool, R. J., *Flowers and Flowering Plants* (New York 1929); Hutchinson, J., *British Flowering Plants* (London 1948).

For a complete catalog of the native wild flowers in any part of the United States one must refer to botanical manuals, such as the following: Coulter, J. M., and Nelson, A., *A New Manual of Botany of the Central Rocky Mountains* (New York 1909); Rydberg, P. A., *Flora of the Rocky Mountains and Adjacent Plains* (New York 1922); Jepson, W. L., *A Manual of the Flowering Plants of California* (Berkeley 1923–25); Kearney, T. H., *Arizona Plants* (Washington Academy of Science Journal 1932); Small, J. K., *Manual of the Southeastern Flora* (New York 1933); Hulten, E., *Flora of Alaska and Yukon* (Lund, Sweden, 1941–50); Peck, M. E., *A Manual of the Higher Plants of Oregon* (Portland 1941); Abrams, L., *Illustrated Flora of the Pacific States,* 4 vols. (Stanford, Calif., 1940–); Britton, N. L., and Brown, A., *An Illustrated Flora of the Northern United States, Canada and the British Possessions,* 3 vols. (New York 1913; reprint 1950); Fernald, M. L., *Gray's New Manual of Botany,* 8th ed. (New York 1950); Kearney, T. H., and Peebles, R. H., *Arizona Flora* (Berkeley, Calif., 1951).

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WILD IRISH GIRL, The, a novel by Lady Morgan, published in 1806. It instantly became a favorite in England, went through seven editions in less than two years, and in 1807 reached its fourth American edition. The story is in the form of letters and suffers from the consequent limitations; but the sketches of Irish life are curious and picturesque. It describes the adventures of a young English nobleman who has been banished to his father's estate in Ireland to induce him to become less frivolous and more studious. He falls in love with Lady Glorvina, the wild Irish girl, daughter of the prince of Inismore, but conceals his English identity. He is about to declare his love for her, when he learns that she is promised in marriage to a mysterious stranger. The stranger proves to be the young Englishman's own father, who graciously gives up his claim to the lady's hand when he learns that his now repentant son is the favored suitor.

WILDBAD or **WILDBAD IM SCHWARZLAND,** town, Germany, in southern Württemberg until 1945, when it became Württemberg-Hohenzollern. It is on the Enz River, 12 miles southwest of Pforzheim. It is one of the most frequented spas of the Black Forest. It is a rail terminus, and also is noted for its hot mineral springs. Pop. (1946) 4,999.

WILDCAT, any of the smaller species of feline animals (family Felidae, q.v.) in its feral condition; a lynx. The term is a general one applying to all the smaller felines; but locally has usually some specific application. Thus in European books and speech the "wildcat" properly and ordinarily means *Felis catus,* formerly well known in all forested districts from the British Isles to Siberia, and still to be found in the less settled districts of the Continent south of Sweden, though extinct in Great Britain, France and Italy; it is also numerous in northern Scotland. The wildcat is larger, heavier and more strongly built than the domestic cat (to which it has contributed little, if anything: see CAT), has a stouter head and shorter and thicker tail, which does not taper; besides other peculiarities. Its body is yellowish gray, with a dark stripe along the spine, and with numerous darkish stripes descending more or less vertically down the sides, marking the limbs transversely and forming rings around the tail. It is noted for its savagery, and thoroughly tamed examples are very rare, if any ever existed. Like most of the wild felines the female makes her nest in a hollow tree, or cleft of rocks, in an abandoned crow's nest, or some similarly convenient place, and brings forth there in early summer an annual litter of young, which show the ferocity of their native disposition from the start.

Lynxes.—The other European wildcat and the North American wildcats are lynxes, formerly set apart in a separate genus (*Lynx*); but most modern zoologists do not do so. "The lynxes," says Mivart, "are animals which present a markedly different aspect from that of other cats. Their legs are long, and their tail is, with one exception (that of the caracal), very short. Their ears also are tufted at the tip. The pupil is linear when contracted. The orbits are incompletely surrounded by bone. They have no tooth representing the common cat's first upper premolar, while that answering to its second upper premolar is largely developed. The intestines are also very short. . . . Still the above given characters are variable in the cat group. In some cats other than lynxes the tail is short, and some have the ears more or less penciled. Some, as we have seen, have long legs, and in many the upper premolar is wanting. The lynxes, therefore, cannot be separated off as a nominally distinct group of genus. The lynxes are very variable in their color and markings, and the Northern lynx also varies greatly in the abundance of its hair.

according to the season, the animal having a very different aspect in winter from that which it presents in summer. The Northern lynxes are generally reckoned as forming two species, one belonging to the Old World (*F. borealis*), and at least one species belonging to the New (*F. canadensis*). The American forms are often also described as alone constituting three species — namely, *F. canadensis, F. rufa,* and *F. maculata.* After a careful examination . . . I am, however, not only quite unable to regard the American varieties, as anything more than varieties, but I am inclined to the opinion that there can be no real specific distinctness between the Northern lynxes of the two hemispheres, their skulls as well as their skins being so much alike.»

The European lynx is still found in northern Scandinavia, Russia and eastward, and in some of the wilder mountain chains of central Europe. It is reddish gray, as a rule, indistinctly spotted or not at all, most prominently when young. A large one will measure 40 inches from the snout to the root of the short, thick tail. The lynx of northern America is very similar, the color grading from nearly uniform grizzly gray in far northern specimens which are the largest in average size, toward the reddish and yellowish, more or less spotted southern specimens, which run much smaller: these colors are always brighter in summer than in winter. The long hair depending from the cheeks is characteristic of the group, especially in old males, and gives a very grim aspect to the countenance. These variations, which are local in some of their manifestations, have led the more recent school of American zoologists, led by Merriam, to name several species and subspecies. Thus the Canadian lynx (*F. canadensis*) is not regarded as findable south of Canada, and is characterized by its long gray unspotted coat. The lynxes or «bobcats» of the United States generally are *F. rufa,* yellowish brown spotted on the sides, with dark brown, and having other markings; a subspecies (*maculata*), more profusely spotted, extends the range of the cat to the Pacific Coast; and various other subspecies, distinguished by color, are found in the Gulf States and westward to Central America. All have substantially the same rapacious qualities and habits, varying with the character of the country and climate in which each variety lives, and the kind of small animals upon which they must depend for food. They are chiefly solitary and nocturnal; and soon disappear from all well-settled regions.

African and Asiatic Wildcats.— The Egyptian or gloved cat (*F. caligata*) is the most interesting of the Old World wildcats, because it is the source, or main source, of our domestic races. (See CAT). It inhabits northern Africa, and is about a third smaller than the European wildcat; it is yellowish, growing nearly white on the belly, and has obscure stripings on the body, limbs and tail, which is rather long, slender and tipped with black, while the feet are usually blackish. Another well-known African cat is the large, long-legged serval (*F. serval*) found throughout the whole Continent. It becomes as much as 40 inches long from nose to root of tail, and the tail may be 16 inches in length. In color it is tawny, with black spots, forming two irregular bands along the back, and black rings on the tail; its fur is a valuable commodity. Three or four other species dwell along the West African Coast, as the rare red-brown «golden-haired» cat (*F. rutila*), the smaller gray, spotted, *F. neglecta,* and the more yellowish *F. servalina,* but none is well known.

Asia and the Malayan archipelago have a large number of wildcats, some of which when better known may prove to be more local varieties of other species. The most familiar are the common Indian wildcat (*F. torquata*), which has much resemblance to the European one, but is more slender, a brighter fulvous in tint and less striped. Another wide-ranging species in India is the chaus, or jungle cat (*F. chaus*), about 26 inches long to the tail, which measures 9 to 10 inches and drops to the heels. It is yellowish gray, more or less dark and unspotted, more reddish on the sides, where it unites with the lower parts; a dark stripe extends from the muzzle to the eye, and there are faint bars on limbs and tail. A very similar species, restricted to the arid plains of northern India, is the «ornate» jungle-cat (*F. ornata*). Another large East Indian cat, known from Nepal to Borneo, but nowhere numerous, is called the baycat (F. *aurata*), in reference to its bay-red color, which is unspotted and becomes whitish on the under surfaces. India also has several spotted cats, of which the best known is the widely distributed fishing-cat (*F. viverrina*), which may be 30 to 32 inches long in body, with a tail 9 to 10 inches long; it feeds mainly on fish, snails and other mollusks, yet is noted for its fierceness, and has even been known to seize and carry away small native children. This cat is dark gray in general color, profusely spotted and striped with blackish like a civet. Smaller, more yellowish and much spotted, is the Indian leopard-cat (*F. bengalensis*) which occurs in all parts of India and eastward to Java. Resembling it, but smaller, is the rare wagati; but more distinct and richly ornamented is the tiger-cat (*F. marmorata*), whose tawny coat is marbled or clouded with elongate wavy black lines and commingling spots. It is of small size, but has a very long spotted tail. In the jungles of southern India the sportsman encounters about grassy places a small handsome species, with slender body and head, and rather short legs and long tail, called the rusty-spotted cat (*F. rubiginosa*), which is greenish gray with white under parts, and has dark stripes and lines of small spots extending from nose to rump, and pretty white marks about the face. A similar species (*F. chinensis*) belongs to southern China and Formosa; and several others in the Malayan region. It is quite likely that future increase of knowledge and connecting specimens will bring them all under one name. In Borneo, however, lives a very distinct little cat (*F. badia*), tinted bright chestnut, white on the breast and belly, and without markings, except a few on the face, and a streak on the long tapering tail. The flat-headed cat (*F. planiceps*) of Malacca, Sumatra and Borneo, is another distinct form. It is about the size of a domestic cat, but the body is unusually long, the neck short and thick, the head globular and flat on top, the legs remarkably short and the tail short and thick. Its

fur is dark-brown above, each hair tipped with white, and it is spotted white on the lower parts, with yellow lines forming a V on the face. Central Asia has several notable wildcats, as the manul (*F. manul*), the steppe cat (*F. caudatus*), and Tibetan tiger-cat (*F. scripta*), all of which are handsomely striped or spotted, or both.

American Tropical Cats.—South and Central America are the home of a large variety of small felines, as well as of the puma and jaguar. Of these the most notable are the eyra, ocelot, and jaguarondi (qq.v.) elsewhere described. In addition to these are several of much local interest. The margay or chati (*F. tigrina*) is a widespread and variable species, which is met with from Mexico to Paraguay, in warm and well-wooded lowland regions. Its fur may be a grizzly gray, or vary from that to a fox-red, profusely marked with black spots and rings, which extend along the tail, but do not form rings. There are three upright bars upon each cheek. The margay measures about two feet in length of body, and its tail about 11 inches. Geoffroy's cat (*F. guigna*) is a little known species of southern Brazil. The Pampas cat or straw-cat (*F. pajeras*) is a well-marked form. It is much larger and more robust than a house-cat, with short thick legs, a short, club-shaped tail, thick neck and small head, with great round eyes and very small ears. This appearance of weight and size is largely due to the unusual length of the hair, which is yellowish gray, marked with transverse brownish bands on the body, patches on the face and rings around the tail. It inhabits the open plains of Argentina, and with simlar habits has become a curious counterpart of the manul of the Asiatic steppes.

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WILDE, wild, **George Francis Faxon,** American naval officer: b. Braintree, Mass., Feb. 23, 1845; d. Dec. 3, 1911. He was graduated from the United States Naval Academy in 1864, was attached to the Brazil squadron 1864–66 and received promotion to lieutenant commander in 1869, to commander in 1885, and while commanding the dispatch boat *Dolphin* in 1885–88 made a trip around the world, the *Dolphin* being the first steel vessel in the United States Navy to accomplish that feat. He became captain in 1898, commanded the ram *Katahdin* in the Spanish-American War and later, in command of the *Boston,* he landed the first marine troops ever landed in China, sending them to guard the legation at Peking. He captured Iloilo in the Philippine Islands in 1899, and was placed in command of the *Oregon* in that year. In 1900 he captured Vigan in the Philippines, and he was in command of the *Oregon* when she was grounded on an uncharted ledge of rock in the Pechili Gulf. In 1901–02 he was in command of the navy yard at Portsmouth, N. H., after 1902, at the Boston yard; after 1906 chairman Massachusetts Nautical Training School Commission.

WILDE, Lady **Jane Francesca Elgee** (Speranza), Irish poet: b. Wexford, Ireland, 1826; d. Chelsea, England, Feb. 3, 1896. She was married to Sir William Robert Wills Wilde in 1851. Her literary career began in 1845 with her contributions in prose and verse to the *Nation.* The publication of her essay *Jacta alea est,* under her pen-name "Speranza," was made the basis of the unsuccessful prosecution of the editor after the suppression of the *Nation* in 1848. Her writings include *Ugo Bassi* (1857), *Poems by Speranza* (1871), *Ancient Legends, Mystic Charms, and Superstitions of Ireland* (1887), *Notes on Men, Women and Books* (1891), *Social Studies* (1893).

WILDE, Oscar (Fingal O'Flahertie Wills), Irish poet: b. Dublin, Ireland, Oct. 16, 1854; d. Paris, Nov. 30, 1900. His father was Sir William Wilde, a noted surgeon, and his mother was Lady Jane Wilde (q.v.). He was graduated from Oxford in 1878, winning the Newdigate prize for English verse. In 1879 he went to live in London, where he soon became the leader of the so-called aesthetic movement and was satirized by Du Maurier as "Postlethwaith" in *Punch,* and by Gilbert and Sullivan in the opera *Patience.* He visited the United States in 1882, lecturing extensively on art topics, and later lectured similarly in his own country and in Paris. As an orator he was a flat failure, but he had a faculty of keeping himself in the public eye. In 1895 he was convicted of a serious moral offense and imprisoned for two years. In prison he wrote *A Ballad of Reading Gaol,* a poem of great force, and *De Profundis* (1905). Thereafter he lived mainly in Paris, under the name of Sebastian Melmoth. He also wrote *Poems* (1880); *The Happy Prince and Other Tales* (1888); *Lord Arthur Savile's Crime, and Other Stories* (1891); and the plays, *Guido Ferranti, Lady Windermere's Fan, A Woman of No Importance, The Importance of Being Earnest,* and others. His comedies are extremely clever, and his poems are characterized by melody of movement and beauty of thought. Time has gradually tempered the abuse heaped on Wilde at the time of his conviction. Several of his plays were successfully revived on the New York stage in the late 1940's.

Complete editions of his works: 14 vols. (London 1908); 14 vols. (Boston 1910); 4 vols. (Paris 1936). Biographies and criticism: Sherard, R. H., *The Life of Oscar Wilde* (London 1906); Ransome, A., *Oscar Wilde: A Critical Study* (London 1912); Douglas, Lord Alfred, *Oscar Wilde and Myself* (London 1914); Harris, Frank, *Oscar Wilde: His Life and Confessions,* together with *Memories of Oscar Wilde,* by Bernard Shaw, 2 vols. (New York 1918); Symons, A., *Oscar Wilde: A Study* (London 1930). For Wilde's family see Wilson, T. G., *Victorian Doctor* (New York 1946).

WILDE, Richard Henry, American scholar: b. Dublin, Ireland, Sept. 24, 1789; d. New Orleans, La., Sept. 10, 1847. He came with his parents to the United States in 1797 and settled in Georgia, where he studied law, and in 1809 was admitted to the bar. He was elected attorney general of his state, and in 1815–17, 1824–25, and in 1827–35 was a member of Congress. He spent the years 1835–40 in Europe, made a special study of Dante and Tasso, and was instrumental in the discovery of a portrait of Dante by Giotto on the wall of the chapel of Bargello. He subsequently

removed to New Orleans, re-engaged in law practice, and in 1844 accepted the chair of constitutional law at the Louisiana State University. He wrote the widely popular poem, *My Life is Like the Summer Rose,* and also published *Conjectures and Researches Concerning the Love, Madness and Imprisonment of Torquato Dante* (1842). His poem *Hesperia,* edited by his son, was published in 1867.

WILDE, Thomas. See TRURO, THOMAS WILDE, BARON.

WILDER, wĭl'der, **Alexander,** American physician and author: b. Verona, N.Y., May 14, 1823; d. Sept. 19, 1908. He was graduated at Syracuse Medical College in 1850, and in 1852 began an editorial career on the Syracuse *Star* being subsequently connected with the Syracuse *Journal* (1853), New York *Teacher* (1856), and New York *Evening Post* (1858–1871). He was an anti-Tweed alderman in New York in 1872, inspector of schools in 1873, and from 1875 to 1895 secretary of the National Eclectic Medical Association. He was president of the New York School of Philosophy.

WILDER, Burt Green, American scholar and physiologist: b. Boston, Mass., Aug. 11, 1841; d. Jan. 22, 1925. He was graduated from the Lawrence Scientific School at Harvard in 1862, was assistant surgeon in the Union army in 1863–1865, and in 1866 was graduated from the medical department at Harvard. He was assistant in comparative anatomy at the Harvard Museum of Comparative Zoology in 1866–1867, and in 1867 accepted the chair of zoology at Cornell, which he occupied until 1916, when he was made professor emeritus.

WILDER, Marshall Pinckney, American horticulturist: b. Rindge, N.H., Sept. 22, 1798; d. Boston, Mass., Dec. 16, 1886. He was engaged as a merchant in the West India trade at Boston after 1825, in 1839 was chosen to the State legislature, was president of the State senate in 1850, and in 1849 served as member of the executive council. He was prominent in the organization of the Constitutional Union Party, was a delegate to the convention which nominated Bell and Everett in 1860, and throughout the Civil War was a firm supporter of the Union. He founded the Massachusetts Agricultural Society, the Massachusetts Agricultural College, and was active in establishing the Massachusetts Institute of Technology.

WILDER, Marshall Pinckney, American professional entertainer: b. Geneva, N.Y., Sept. 19, 1859; d. Jan. 10, 1915. His occupation was at first a peddler, and later a stenographer, but he abandoned it in order to become a drawing-room entertainer, in which capacity he became widely popular. Though a hunchback he possessed such a pleasing presence with unfailing good humor that he made friends everywhere. At first he entertained for 50 cents an evening, but in 1883 he went to London, was well received by royalty, and his fame was thus established. In 1899 he began to appear in vaudeville. In 1904–1905 he toured around the world. He published *People I've Smiled With; The Sunny Side of the Street* (1905); *Smiling Around the World* (1907).

WILDER, Thornton Niven, American author: b. Madison, Wis., April 17, 1897. He spent part of his childhood in Hongkong and Shanghai, because his father was in the consular service. He later went to school in California and attended Oberlin College from 1915 to 1917. During World War I he served in the coast artillery and then was graduated from Yale University in 1920. After a period of study at the American Academy in Rome, he taught at Lawrenceville Academy for seven years, received a master's degree at Princeton University in 1925, and was a lecturer in English at the University of Chicago.

Mr. Wilder's first published work was a novel, *The Cabala* (1926), followed by *The Bridge of San Luis Rey* (1928) which won the Pulitzer Prize in 1928 as the best novel of the year. His other published fiction includes *The Woman of Andros* (1930) and *Heaven's My Destination* (1935). He had long been interested in playwriting, and as early as 1926 his play *The Trumpet Shall Sound* was produced by the American Laboratory Theatre. His first play to be famous was *Our Town,* which was awarded the Pulitzer Prize in 1938 as the best play of the year, making him the first writer to receive the award in two different literary fields. *Our Town* was an experimental drama, performed on an almost bare stage, with stepladders to indicate the upstairs of a house and a group of folding chairs for a graveyard. In addition to highly successful adaptations that he has made of *A Doll's House* and *Lucrece,* Mr. Wilder has written two other plays, *The Merchant of Yonkers* (1939) and *The Skin of Our Teeth* (1942), the latter winning him a third Pulitzer Prize. See also BRIDGE OF SAN LUIS REY, THE; OUR TOWN; also DRAMA—*Modern* (United States); NOVEL—*Modern* (American).

WILDERNESS, The Battle of the. On March 9, 1864, President Lincoln handed to General Grant his commission as lieutenant general and two days later placed him in command of all the armies of the United States. Grant made immediate preparations for an early campaign to be conducted simultaneously, east and west. He made his headquarters with the Army of the Potomac. Before coming to the East he had expressed himself as favoring a coast movement south of James River, and an advance on Richmond on that line. After his arrival at Washington and a study of the problem he proposed to act with the Army of the Potomac on what was known as the overland route from the Rapidan to the James, while General Butler, with 30,000 men, should ascend James River from Fort Monroe and establish himself in an intrenched position near City Point, whence he could operate against Richmond and its communications with the south, and at a proper time form a junction with the Army of the Potomac, moving down from the north. At the same time General Sigel, commanding troops in West Virginia and the Shenandoah Valley, was instructed to form two columns, one of 10,000 men, under General Crook, to move from the Kanawha and operate against the Virginia and East Tennessee Railroad, the other 7,000 strong, under Sigel, in person, to advance, as far as possible, up the Shenandoah Valley, to draw detachments from Lee. Grant's main reliance, however, was the

Army of the Potomac, which, 30 April 1864, was composed of the Second, Fifth and Sixth corps of infantry and a cavalry corps, commanded respectively by Gens. W. S. Hancock, G. K. Warren, John Sedgwick and P. H. Sheridan. The Ninth corps, Gen. A. E. Burnside, united with the Army of the Potomac on 6 May, but acted under the immediate orders of General Grant, until the 24th, when it became a part of the Army of the Potomac.

The strength of the army, including the Ninth corps, 30 April, was 118,769 officers and men, with 316 guns. The army was commanded by Gen. George G. Meade. Formed in battle line, two ranks deep, with one-third in reserve, it would cover a front of 21 miles. Its train of 4,000 wagons was 65 miles long. The assigned duty of this army was to attack the Army of Northern Virginia, and by constant hammering destroy it and take Richmond. The army of Northern Virginia, commanded by Gen. R. E. Lee, was composed of the First, Second and Third infantry corps, commanded by Gens. J. Longstreet, R. S. Ewell and A. P. Hill. A cavalry corps of two divisions (Wade Hampton's and Fitzhugh Lee's) was commanded by Gen. J. E. B. Stuart. The most reliable estimate gives Lee's strength, present for duty, on 1 May 1864, as 48,700 infantry, 4,854 artillery and 8,399 cavalry, an aggregate of 61,953 officers and men, with 224 guns. On 1 May the Army of the Potomac was encamped in the vicinity of Culpeper Court House, between the Rapidan and the Rappahannock, and the Ninth corps on the railroad from Manassas Junction to the Rappahannock. Lee's army lay south of the Rapidan, Ewell's corps above Mine Run and A. P. Hill's on Ewell's left, higher up the Rapidan. Longstreet's corps was near Gordonsville. Stuart's cavalry lay along the lower Rappahannock. Lee's headquarters were near Orange Court House, 70 miles from Richmond.

Lee's army being the first objective, it was finally determined to cross the Rapidan, turn his right and compel him to fall back toward Richmond or come out of his intrenchments and give battle on open ground. The principal objection to this movement was the difficulty presented by the Wilderness, a forest of unusually dense growth, with an almost impenetrable undergrowth, where infantry could pass with great difficulty and where cavalry and artillery could not be used. It was thought to avoid this difficulty by moving at night, crossing the Rapidan and getting through the Wilderness before Lee could discover the movement and intercept it by moving on the Orange turnpike and Orange plankroad. These two roads lead from Orange Court House down the Rapidan toward Fredericksburg. They follow the general direction of the river and are almost parallel to each other; the turnpike nearest the river and the plank road a short distance south of it. Grant's proposed route lay directly across these two roads along the western borders of the Wilderness. The movement began at midnight of 3 May. Hancock's Second corps, preceded by Gregg's cavalry division, crossed the Rapidan at Ely's Ford and moved to Chancellorsville, where the entire corps with its trains had arrived by noon of the 4th. Warren's corps, preceded by Wilson's cavalry, crossed the river at Germanna Ford and marched to Wilderness Tavern, at the intersection of the Germanna road by the Orange turnpike. It reached its position by 2 P.M. of the 4th.

Wilson's cavalry was thrown forward to Parker's Store on the Orange plankroad. Sedgwick's Sixth corps followed Warren's across the Germanna Ford and halted a short distance beyond it. The crossing of the river was very gratifying to Grant who regarded it as a great success, and it removed from his mind the most serious apprehension he had entertained "that of crossing the river in the face of an active, large, well-appointed and ably commanded army, and how so large a train was to be carried through a hostile country and protected." At noon of the 4th Grant knew that Lee was aware of his movement, upon which he sent a dispatch to Burnside to make a forced march from beyond the Rappahannock to Germanna Ford, and by the morning of the 5th his advance was crossing the Rapidan. The orders for the 5th were for Sheridan, with two divisions of cavalry, to move against the Confederate cavalry, near Hamilton's Crossing, and at 5 A.M. Wilson's cavalry division was to move to Craig's Meeting House and reconnoitre the Orange pike and plankroads and other roads on his right and left. Hancock's Second corps was to march from Chancellorsville to Shady Grove Church and extend its right toward Parker's Store on the Orange plankroad, to which point Warren's corps was ordered to advance from Wilderness Tavern. Warren, in turn, was to extend his right toward Sedgwick's Sixth corps, which was ordered to Wilderness Tavern.

General Lee interfered with the full execution of these orders. He had been expecting Grant to move on his right and when he saw on the morning of the 4th that the movement was being made, determined to attack him before he could get out of the Wilderness and ordered Ewell to march by the Orange pike and A. P. Hill down the plankroad, and that night Ewell bivouacked within five miles of Wilderness Tavern, and Hill's advance division halted for the night at Mine Run, seven miles from Parker's Store on the plankroad, and about 10 from the intersection of the Brock road. Longstreet moved from near Gordonsville at 4 P.M. Stuart's cavalry was drawn in and ordered to cover the Confederate right. On the morning of the 5th Ewell continued his march on the Orange pike, under instructions to regulate his march with that of A. P. Hill, on the plankroad, and both informed that it was not desired to bring on a general engagement before Longstreet came up, who was under orders to follow Hill on the plankroad. When Ewell was two miles from the Wilderness Tavern, he halted, as he was three or four miles farther advanced than Hill. Warren had discovered that the Confederates, under Ewell, were in force two miles beyond Wilderness Tavern and before 7 A.M. had informed Meade of the fact, who ordered Warren to make an attack with his whole force. Sedgwick was directed to move up by a cross road, attack the enemy and connect with Warren on the turnpike, and a dispatch was sent to Hancock, informing him of what had become known and directing him to halt at Todd's Tavern, until further de-

velopments. Warren had started early in the morning for Parker's Store, on the Orange plankroad, and when near it Crawford's division had been ordered to halt in a good position on high ground, and finding that Wilson's cavalry at Parker's Store needed assistance Crawford threw forward a skirmish line that encountered the flankers of A. P. Hill's corps.

Soon after 8 A.M. Crawford was informed by Warren that Griffin's and Wadsworth's divisions would attack Ewell on the turnpike and he was ordered to join in it with one of his brigades. Between 9 and 10 A.M. Hancock was ordered to move up the Brock road to the Orange plankroad and be prepared to move out that road toward Parker's Store, and about the same hour three brigades of General Getty's division of Sedgwick's corps were ordered from the Wilderness Tavern to the intersection of the Brock road with the Orange plankroad, and directed to move out the latter road and attack the enemy, and, if they could, drive them back beyond Parker's Store. As described by Humphreys, "The Brock road begins on the Orange pike about a mile east of the old Wilderness Tavern, and runs in a southeast direction to Spottsylvania Court House, intersecting the Germanna plank, the Orange plank, the Furnace, the Catharpin and other roads running in a southwest and south direction." Ewell had formed for battle across the Orange pike when about noon Warren opened the attack. Griffin's division advancing on both sides of the pike struck Johnson's division, broke it and drove it back. Rode's division was thrown in on Johnson's right, south of the pike, and supported by Early, who was formed across the pike, the line was re-established. After a severe and bloody fight Griffin was driven back, losing many prisoners and two guns. Wadsworth's division, which had advanced on the left of Griffin, lost direction, exposed its left and was thrown back in confusion. McCandless' brigade of Crawford's division, attempting to unite with Wadsworth's left, was nearly surrounded by Ewell's right and fell back with heavy losses, and Crawford's entire division had to be drawn in.

Thus all the ground gained by Warren was given up and he assumed a new line somewhat in rear, but still in front of Wilderness Tavern, with his right on the Orange pike. He had lost more than 3,000 men. On his right General Wright's division of Sedgwick's corps came up early in the afternoon and with Neill's brigade of Getty's division formed within 300 yards of Ewell's front and repulsed one of his attacks. Soon after this Seymour's brigade of Rickett's division came up on the right of Neill, and about 5 P.M. two brigades of Sedgwick attacked Ewell's left and were repulsed. Meanwile General Getty, who had arrived at the crossing of the Brock road and the plankroad, had been ordered to attack. Heth's Confederate division was in his front supported by Wilcox's. Hancock, who had been ordered from Todd's Tavern, 10 miles distant, by the Brock road, was instructed to support Getty, drive A. P. Hill beyond Parker's Store and connect with Warren's left. It was 3.15 P.M. when Getty received his order to attack. Meanwhile Hancock's advance had arrived and began intrenching on the Brock road. At 4.15 Getty advanced to the attack through the thick woods and had gone less than 400 yards beyond the Brock road, when he became hotly engaged with Heth's division. Although Hancock had not completed his dispositions he moved forward to Getty's support and the fight became fierce and deadly at very close quarters and continued until near 8 P.M., when darkness put an end to the fierce contest. Hancock had not gained much ground, but Hill's lines had been broken and his right driven back by two brigades of Barlow's division. While Hancock and Getty were engaged, Wadsworth's division had been ordered in a southeast direction to strike the flank of the Confederates engaging them, but did not become seriously engaged and was halted by darkness, about a half mile from the Brock road.

The Union army had fought in detachments, with no connection of its corps or divisions. Grant said that he had never seen such hard fighting, but prepared to renew it next day, and Hancock, Warren and Sedgwick were ordered to attack at 5 o'clock next morning, and Burnside was ordered to have two divisions in position between Warren and Hancock so as to advance with them. Each corps commander was advised of the instructions given to the others. To note briefly the action of the cavalry on the 5th: Wilson's division, after leaving 500 men at Parker's Store, had proceeded toward Craig's Meeting House on the Catharpin road, and was driven back on that road as far as Todd's Tavern. General Gregg had found nothing at Fredericksburg, but had discovered two brigades of cavalry falling back from Hamilton's Crossing to Lee's right flank, and fell back to Todd's Tavern before 3 P.M. to check the enemy pursuing Wilson and drove them back beyond Corbin's Bridge.

During the night of the 5th Ewell's and Hill's corps strengthened their intrenchments and put artillery in position, and a few minutes before 5 A.M. of the 6th opened the second day's fight by an attack upon the Union right, which was promptly met by the advance of Wright's division of the Sixth corps, which made two vigorous assaults against the Confederate left, which were repulsed with severe loss. Warren made several attacks on Ewell's right which were repulsed. These persistent and unsuccessful attacks were continued until after 10 o'clock, when Sedgwick and Warren were directed to suspend them, to strengthen their intrenchments and throw up new works, in order that a part of their troops might be available for an attacking force to move from the vicinity of Hancock's right, which had been desperately engaged. Hancock had disposed Gibbon's and Barlow's divisions, both under command of General Gibbon, to defend his left flank against an apprehended attack by Longstreet, and at 5 A.M. launched Birney's, Mott's and Getty's divisions, all under General Birney, along the Orange plankroad, Wadsworth's division of Warren's corps at the same time advancing on Birney's right. They fell upon Heth's and Wilcox's divisions of Hill's corps with great fury and after a desperate contest broke them and drove them a mile and a half, through the dense woods, under heavy loss, and back on the trains and artillery, and General Lee's headquarters. Just before Hill's troops gave way the head of

Longstreet's corps, which had marched nearly all night, came upon the field at Parker's Store and was hastened along the plankroad to relieve the divisions of Heth and Wilcox. Kershaw's division was in the lead and began to form on the right of the road.

Humphreys says: "The advance through the forest, underbrush, and swamps more than a mile, in a hot contest, had separated and disordered Hancock's corps, and Birney's left, met in this condition by Kershaw's division, was not only brought to a standstill, but at some points swayed back and forward, until at length Kershaw, himself leading his division, forced Birney's left back as far as his center. Wadsworth's advance had crowded many of Birney's troops to the south side of the plankroad, so that the greater part of his, Birney's, command was on the left of that road. Field's division of Longstreet's corps following close on Kershaw's division, some of it coming on the ground at double-quick, was formed on the Confederate left of the plankroad, and, advancing, at once became hotly engaged with Birney's right and Wadsworth's troops, Gregg's Texans and Benning's Georgians in the lead, bearing the brunt of the fight and losing heavily in killed and wounded. R. H. Anderson's division of Hill's corps, following Field's division, formed on the same part of the line, one portion uniting with Field's troops in the attack, the other portions supporting. It was when Hancock's troops were partially checked by the fresh troops of Longstreet that the necessity of readjusting his formation became imperative. Regiments were separated from their brigades and mixed with others, and the line of battle was very irregular, and commanders were in this way losing the control of their troops. This was about half past six o'clock."

At 9 A.M. Hancock again attacked with the divisions of Birney, Mott, Wadsworth, Stevenson's of Burnside's corps, and three brigades of Gibbon's division and though fighting furiously made no headway, and at 11 o'clock the firing on his front died away. Meanwhile Longstreet had discovered that Hancock's left extended but a short distance from the plankroad and he moved a part of his command to the right to attack Hancock's left and rear, the flank movement to be followed by a general advance of his entire corps. The attack first fell on the left of the advanced line held by Frank's brigade, partly across the Brock road, which was fairly overrun and brushed away; it then struck the left of Mott's division, which in turn was driven back in confusion to the Brock road, and the confusion spread to the troops on the right, and Hancock was compelled to withdraw his entire corps to the Brock road, from which they had advanced in the morning, where they were reformed in two lines behind their intrenchments. Wadsworth, on the right of Hancock, made heroic efforts, but his troops broke, and while striving to rally them he was mortally wounded and died within the Confederate lines next day. When this movement had succeeded Longstreet ordered a general advance, and while riding at the head of column, moving by the flank down the plankroad, when opposite the force that had made the flank movement, which were drawn up parallel with the road, about 60 yards from it, a volley was fired which killed General Jenkins, commanding the leading brigade of Field's division, and severely wounded General Longstreet. Lee soon came up, postponed the attack to a later hour and extended his line so that its right rested on the unfinished Orange Railroad.

Meanwhile a brigade of the Ninth corps, which had been sent to the left, under Gibbon, swept down in front of Hancock's line from left to right and cleared it of the enemy. In the action of the previous day there had existed an interval between Warren on the turnpike and Hancock on the plankroad, through which Burnside was expected to advance and attack Hill and Longstreet in flank, but in advancing through the woods the enemy was encountered on a wooded crest near the plankroad. An attack was not deemed advisable and Burnside's troops were moved farther to the left. It was not till afternoon and after Hancock's repulse that they became engaged, without accomplishing much, and toward evening they fell back and intrenched. The lull that had followed the successful attack of Longstreet gave Hancock time to re-establish his position now strengthened by fresh troops sent by Meade, and Hancock was directed to renew the fight at 6 P.M. But again Lee anticipated the Union commander, and at 4.15 P.M., having gotten well in hand the troops of Longstreet and Hill, he advanced in force against Hancock's intrenched lines, until he came within 100 yards of the front one, when he opened a severe fire, which was heaviest on Hancock's left, and at the end of half an hour a portion of Mott's division and of a brigade of Birney's gave way in disorder.

The moment this break occurred the Confederates pushed forward and Anderson's brigade of Field's division took possession of that part of the first line of intrenchments and planted their colors on them. Near the point where the line was broken through a fire had, during the afternoon, sprung up in the woods, and at the time of Lee's attack had communicated to the log breastworks on that part of the line. At the critical moment they became a mass of flames, which could not be extinguished and which extended for many hundred yards to the right and left. The heat and smoke were driven by the wind into the faces of the Union troops, preventing them on portions of the line from firing over the parapet, and at some points obliged them to abandon it. It was this condition of affairs that permitted Anderson's brigade to seize a part of the breastworks, from which they were quickly driven by Carroll's brigade, which was near at hand and which rushed upon them at the double-quick By 5 P.M. Lee's troops had been completely repulsed on Hancock's front, and fell back with heavy losses in killed and wounded.

Just before dark Ewell moved two brigades of Early's division around the right of Sedgwick's corps, held by Ricketts' division, and in co-operation with the rest of Early's division, succeeded in forcing Ricketts back in some confusion, capturing Shaler and Seymour, brigade commanders, and a large number of their men. Wright's division, also, was thrown into some disorder but Wright restored order

and Early drew back and formed a new line in front of his old one.

During the night an entirely new line was taken up by the Sixth Corps, its front and right thrown back, a change which was conformed to by the right of the Fifth Corps. On the left Sheridan's and Stuart's cavalry had some severe fighting at and near Todd's Tavern in which Sheridan had the advantage. On the morning of the 7th reconnaissances were made of the Confederate position which was found well intrenched; neither commander showed any disposition to renew the fight on that field, and Grant decided to continue the movement by the left flank, and when darkness came the Union columns began their march for Spotsylvania Court House. The Union troops engaged numbered about 101,000; the Confederates numbered about 60,000. The Union losses, as officially reported, were 2,246 killed, 12,037 wounded and 3,383 missing, an aggregate of 17,666. The Confederate reports are very incomplete; the most reliable estimate places their entire loss at 7,750.

Consult Swinton, William, *Twelve Decisive Battles of the War* (New York 1867); Humphreys, A. A., *Virginia Campaigns of '64 and '65* (New York 1883); Messerve, F. H., *Grant in the Wilderness* (New York 1915).

E. A. CARMAN.

WILDERNESS ROUTE, in American history, a famous emigrant road or trail from the Atlantic seaboard to Ohio through Cumberland Gap. Thousands of emigrants passed over this road to Ohio and Kentucky. The "Wilderness Road" was marked out by Daniel Boone. In 1775 the Transylvania Company, with Col. Richard Henderson as head, engaged Boone to mark out a road from Fort Wautaga, on a branch of the Holston, to the Kentucky River, where the company's newly-purchased lands lay. "This I accepted," wrote Boone, "and undertook to mark out a road in the best passage through the wilderness to Kentucky with such assistance as I thought necessary to employ for such an important undertaking."

WILDES, Frank, American naval officer: b. Boston, Mass., June 17, 1843; d. on steamer *China,* off San Francisco, Cal., Feb. 6, 1903. He was graduated from the United States Naval Academy in 1863, served in the West Gulf Squadron, and later on the monitor *Chickasaw.* He was promoted master in 1866, became commander in 1880, was in charge of the Portsmouth, N. H., Navy Yard in 1885–1888, and in 1894 was commissioned captain. He commanded the cruiser *Boston* at the Asiatic Station in 1895–1898, and served under Dewey at the battle of Manila, May 1, 1898. In 1901 he was advanced to the grade of rear admiral, was assigned to the Asiatic Station as junior squadron commander, and in 1903 was ordered home on sick-leave, but died on the way.

WILDFOWL, in modern usage, water birds, as ducks, geese and swans, pursued by gunners for sport or for market. American methods of wild fowling will be found where these birds are described. (See DUCKS.) An interesting method in Europe, still extensively pursued in some parts of England, at the Fens, is by decoying wild ducks in large trap-ponds. The pond is constructed in a secluded place, well sheltered by trees, and with a plentiful supply of reeds and sedges. From this pond pipes or narrow passages are led, 60 to 80 yards, gradually narrowing toward the termination. Above, the pipe is bridged and covered by a light network, and at its termination it ends in a tunnel net, which is, as a rule, carried out on to the land. Decoy ducks, which come to be fed at the call of the attendants, are used to entice their wild neighbors into the pipe; but the decoy dog is perhaps a more valuable ally of the fowler. This dog is named a "piper." It is of a small breed, and indulges in playful gambols by the side of the pipe, appearing now and then in advance of the fowl, which, led by curiosity, swims onward toward the dog, and is thus drawn toward the terminal net. The dog preserves a perfect silence during its maneuvers. Devices of the same character are used in the Orient, especially in Japan. Another Old World method is by employing the stalking horse, still used in some parts of England; the body of the horse—which requires special training for its work—being used to conceal the sportsman from the game.

Consult Ward, R., *Records of Big Game* (London 1935); Bishop, R. E., *Birds* (Philadelphia 1936); Scott, P. M., *Morning Flight* (New York 1936); Dalgety, C. T., *Wild-fowling* (New York 1937).

WILDLIFE, Conservation of, in America. —Previous to the coming of the white settlers, North America possessed an abundance and variety of wildlife not surpassed by any other continent. There were reasons for this: Wildlife, like vegetation, is modified as its habitat changes and it varies in form and abundance according to climate, soil fertility, and altitude. North America, with its crest in the icy Arctic and its base in the warm subtropical region of the Gulf of Mexico; with its Rocky Mountains in the West and its Alleghenies in the East; with its arid deserts, fertile plains, and well-watered valleys lying between, has within its boundaries almost every possible variation in temperature, precipitation, soil fertility, and vegetative cover. Altitudes range from ridges that are thousands of feet above sea level to depths of the Death Valley that are actually below sea level. Between the intense subzero temperature of the Arctic wastes and the moist, tropical climate of the Isthmus of Panama are recorded infinite gradations of climate and temperature.

This diversity results in amazing differences in the types of both fauna and flora. The tiny lichen clinging to a glacier-scored rock protruding above the Arctic ice cap requires half a century for a few inches of growth, while along the Gulf the rank jungle springs up almost as rapidly as the axe and the machete can cut it down. The brown bear of Alaska—the largest meat-eating land animal, and the pigmy shrew, weighing less than one-fifth of an ounce, are alike able to find precisely the conditions each requires in order to live. So does the California condor, the largest living bird, with a wing spread of almost 10 feet, and so also does the wren, scarcely as large as one's thumb. The narwhal, the sea lion, the polar bear, and the manatee, together with thousands of other species, have their homes in the seas or on the shores of a continent where nature seems to have exerted her limitless capacity for providing accommodation for the greatest possible number and variety of creatures.

The white pioneers, explorers, and trappers saw such an abundance of game and other wildlife when they came to North America that they

could not adequately describe it. They spoke of flights of pigeons so tremendous that they "darkened the sun for hours on end," and recounted tales of bison herds that covered the prairies for mile after mile.

Wildlife has made a tremendous contribution to the establishment of our new world economy. The abundance of game and fur animals and of fishes aided the pioneers and settlers in establishing themselves in the new land. Supplies from Europe had to be brought over a long and hazardous ocean route, a communication line far too tenuous and inadequate to support even the smallest outpost of civilization against the rigors of the wilderness. For a long time after the land had been cleared and crops were being harvested, the settlers still found themselves dependent on the wild game and fur animals for a very considerable proportion of the essentials of life.

Except for the fur animals and the bison, there was for many years no direct exploitation of wildlife. It was at this time, however, that some of the great American fortunes were founded upon the fur trade. These remote trading posts in a few years garnered the wealth of fur and left to posterity scarcely more than scattered remnants of what had been a tremendous resource. The pelts of fur animals and the hides of bison were commodities that would endure transportation from the wilderness to the settlements, but the flesh of game birds and mammals could not be sent back over the long trail.

Killing for the market did not become a serious factor in the reduction of game until stimulated by the growth of cities and towns nearer to the game fields, and the development of railways. Traffic in game as food flourished after the Civil War and probably reached its peak in the 1880's. During that time uncounted millions of passenger pigeons, prairie chickens, grouse, ducks, geese, rabbits, antelope, bighorn sheep, bison, and other food species were annually sent to market by gunners who, except for a few months in midsummer, shot and snared game the whole year round. It was during this time that the passenger pigeon was exterminated and certain other game species were so badly reduced that they have never since recovered.

The early white settlers and their successors for many years had no appreciation of the organic relationships in which wildlife is involved. Their methods of land utilization were extremely destructive of essential water reservoirs and vegetative cover, and as those methods destroyed basic resources they at the same time depleted the wildlife. The wildlife problem in the United States and Canada in recent years, therefore, has been one of restoration—correcting mistakes, restoring wildlife to something approaching its former abundance, and preparing for future management.

There is no private ownership of wildlife in the United States. This valuable and invaluable resource belongs to the people. Protection of the resource is thus a public problem and as such a governmental concern. The states have jurisdiction over all the wildlife within their borders with the exception of one group. That group—the migratory birds—is protected by federal law under treaties with Great Britain and Mexico, because these birds migrate over vast stretches of the country without regard for state or international boundaries. The federal government, as in other government fields, has also been called on to carry on many wildlife investigations that can be more efficiently done by centralized efforts.

The Fish and Wildlife Service, the special agency of the United States government for conserving wildlife resources, was established on June 30, 1940, consolidating the work of the Bureau of Fisheries, which had been functioning then for nearly 70 years, and the Bureau of Biological Survey, which began its existence in 1885. Throughout its history the Fish and Wildlife Service has collected information on the geographic distribution of animals and has intensively studied the migration of both birds and fishes. In the course of the migration work, millions of records from all sources have been assembled.

The technique of bird-banding has been adopted, improved, and extended. Since 1920, banding work in North America has been under the direction of the Fish and Wildlife Service in cooperation with the Dominion Wildlife Service in Canada. The peculiar importance of this work arises from the tracing of the movements of individual birds, thus making possible more accurate definition than has ever before been possible, of migration routes, general bird flyways, and winter and summer ranges of species. The scientific data bearing on the ranges and movements of birds are indispensable to proper conduct of wildlife management problems involving more than a single state, hence play a leading part in those highly important activities that only the federal government can conduct. Among these are the promulgation of regulations protecting birds migrating between the United States and Canada and Mexico—an annual task since 1918—and the establishment of a system of migratory bird refuges giving adequate protection to wild fowl on the breeding and wintering grounds and throughout the major flyways of the United States.

The federal refuge program in the United States was initiated when President Theodore Roosevelt set aside Pelican Island in Florida on March 14, 1903. The refuge system grew slowly from that time on but funds for the proper administration and maintenance of these areas did not follow the growth of the system. With the passage of the Migratory Bird Conservation Act of 1929, which authorized appropriations for the establishment, improvement, and maintenance of such refuge areas, the refuge program really got under way. The Migratory Bird Hunting Stamp Act which became effective on July 1, 1934, supplemented and supported the Migratory Bird Conservation Act of 1929 by providing funds for the purchase and maintenance of areas for migratory waterfowl refuges.

Out of the total of 282 national wildlife refuges administered on June 30, 1951, by the Fish and Wildlife Service, 196 of these, with a total of 3,122,231 acres of marsh and water habitat, are dedicated to waterfowl production and protection. There are three types of waterfowl refuges—production, migration, and wintering refuges. The production refuges serve also as feeding and resting grounds for the bird migrating from more northern areas.

The development of land-use policies favorable to wildlife is gradually bringing about an important change in the utilization of wildlife itself. Laws, regulations, and ordinances concerned with the taking of game, fur animals, and fishes constitute a class of legislation that is nearly as old

as the history of the white man in America. By such measures the colonists tried to maintain an abundance of wildlife within easy reach of their settlements. Unable as yet to depend entirely upon their crops and domestic animals for food and clothing, it was important that the settlers be able to supplement their supplies from the adjacent wilderness. They endeavored to conserve conveniently available resources of game and fish by regulating individual use. This form of regulation, however, did not produce the desired results. Game and fur soon became scarce in the vicinities of the settlements, and hunters and trappers were compelled to go farther and farther into the wilderness.

Since that early effort thousands and thousands of similar laws have been enacted and many millions of dollars have been spent in attempts to prevent the individual from taking more than specified quantities of game, fishes, and fur from the common supplies. It has been only in recent years that results have been even partially satisfactory or have seemed to justify the trouble and expense involved.

During the period 1920–1950 the Congress has passed many acts in whole or in part to conserve and regulate the use of wildlife resources. They include international agreements such as the Migratory Bird Treaty acts of 1918 and 1936 with Great Britain and Mexico. One of the most significant measures in our conservation history is the Federal Aid in Wildlife Restoration Act of 1937. For purposes of wildlife rehabilitation it authorized the apportionment to the states of funds derived from excise taxes on arms and ammunition. Activities under this program have featured valuable management investigations and the purchase, development, and maintenance of land to promote the preservation and increase of useful birds and mammals.

A comparable service for the fisheries, which sport fishermen have been seeking since 1939, became a reality on July 1, 1951, when the Fish and Wildlife Service began the administration of the Dingell-Johnson Act (Public Law 681, 81st Congress) which provides federal aid to the states for fish restoration and management. This has been hailed as "the biggest step forward in the field of conservation for many years."

The era of wildlife exploitation is now drawing to a close in this country. Its last stages are marked by the increasing determination manifested by state and federal agencies, by sportsmen and conservationists, and by the general public to apply methods and administrative policies of a positive nature—methods and policies that will prevent further unnecessary losses of wildlife and restore the valuable species to the maximum abundance consistent with modern civilization. Wildlife has a very great economic value and it also furnishes a means for recreation and relaxation that may well become of even greater importance than are its financial values to human beings subjected to the increasing strains and stresses of modern ways of living and working.

ALBERT M. DAY,
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WILDWOOD-BY-THE-SEA, city, New Jersey, in Cape May county; 80 miles southeast of Philadelphia, Pa.; on the Atlantic Ocean, with the Inland Water way (Maine to Florida) on the opposite side; altitude 4 feet; served by the Pennsylvania-Reading Seashore Lines. Industries include seafood, fertilizer, cement blocks, poultry, fruit, and truck. Settled in 1882, the borough of Wildwood (incorporated 1898) was consolidated with Holly Beach City and incorporated as a city in 1911. There is a commission form of government. Pop. (1950) 5,475.

WILES, Irving Ramsay, American artist: b. Utica, N. Y., April 8, 1861; d. July 29, 1948. He was the son of Lemuel L. Wiles, also an artist and director of fine arts at Ingham University, Le Roy, N. Y. He studied under his father and at the Art Students League, New York, and under Carolus-Duran in Paris in 1882–1884. He afterward established himself in New York and specialized in the painting of figures and portraits. His fine conception of line and coloring and his strong and sympathetic characterizations have gained him a high place among American artists. He was elected to the National Academy in 1897. He received gold medals at the expositions at Buffalo (1901); St. Louis (1904); Buenos Aires (1910); and at San Francisco (1915); and was awarded the Proctor portrait prize at the National Academy of Design.

WILEY, Andrew Jackson, American irrigation engineer: b. New Castle County, Del., July 15, 1862; d. Monrovia, Calif., Oct. 8, 1931. Graduating at the head of his class in Newark Academy, Newark, Del., he attended Delaware College which awarded him his engineering degree in 1882. After a year of surveying and construction for the Baltimore and Ohio Railroad Company he entered irrigation work at Boise, Idaho, with the Idaho Mining and Irrigation Company, which connection he resumed in 1888 after a two-year period as assistant engineer on construction in Montana for the Union Pacific Railway Company. From 1892 to 1898 he was chief engineer and manager of the Owyhee Land and Irrigation Company engaged in construction of large irrigating projects. Thereafter he was continuously occupied with irrigation and power projects in Idaho, Oregon, California, and other Western states. From 1902 he also served as consultant to the U.S. Bureau of Reclamation and held a similar post with the Department of the Interior from 1925. His assignments included virtually all the major government dams constructed during the first three decades of the century. In 1927–1928 he was consultant for the British government in selecting dam sites in the Himalaya Mountains.

WILEY, Calvin Henderson, American educator: b. Guilford County, N. C., Feb. 3, 1819; d. Winston, N. C., Jan. 11, 1887. Graduating at the University of North Carolina in 1840, he studied law and began practice at Oxford, S. C., in 1841, also editing the Oxford *Mercury*. In the late 1840's he published two novels. While serving in the North Carolina legislature (1850–1852) he secured provision for a superintendent of common schools; during the 13 years of his tenure of that office he effected a complete reorganization of North Carolina's educational system. With Braxton Craven he helped promote the work of the Normal College, first semi-public teacher training institute in the state.

WILEY, Harvey Washington, American chemist: b. Kent, Ind., Oct. 18, 1844; d. June 30,

1930; graduated Hanover College, 1867; from the Indiana Medical College in 1872; from Harvard in 1873, and in 1878–79 studied abroad, chiefly at the University of Berlin. He was professor of chemistry at Purdue University in 1874–83, and in 1881–83 was also State chemist of Indiana. In 1883 he became chief chemist of the United States Department of Agriculture, holding the position until 1914. In 1905 he was appointed consulting professor at the Brooklyn Polytechnic Institute. From 1899 to 1914 he was professor of agricultural chemistry at George Washington University. He was president of the American Chemical Society, 1893–95 and was sent to Europe several times as the leading American scientist on the chemistry of foods. He made a specialty of sugar and glucose investigations and was interested in the prevention of food adulteration. In this work he was so active, and wrote so much against the use of artificial «preservatives» in foods, that he gradually antagonized the leading food companies of the country, and through political pressure was removed from the Department of Agriculture. He was deserving of high commendation for his long fight to help keep pure the food of the nation. He published 'Songs of Agricultural Chemists' (1892); 'Principles and Practices of Agricultural Chemistry' (3 vols., 1894–97); 'Foods and Their Adulterations' (1911); 'The Lure of the Land' (1915); 'Beverages and Their Adulterations' (1919); 'History of a Crime Against the Food Law' (1929); and many government bulletins.

WILEY COLLEGE, an institution for the education of the colored race, located in Marshall, Tex. It was founded in 1873 by the Freedmen's Aid and Southern Educational Society of the Methodist Episcopal Church, by which it is now chiefly supported. It is open to both men and women. It has elementary, secondary and collegiate departments, and normal, commercial and industrial courses. The Collegiate Department confers the degrees of A.B. and B.L. Industrial work and instruction is given in carpentry, bricklaying, printing, sewing and cooking. The grounds and buildings in 1939 were valued at $250,000. The income now is small amounting to $90,352 approximately. The college campus has 53 acres, and the Carnegie college library holds 15,000 books.

WILFRID, or **WILFRITH, Saint,** Anglo-Saxon prelate: b. about 634; d. Oundle, Northamptonshire, 709. He studied at Lindisfarne, became a monk, and in 653 accompanied Benedict Biscop to Rome in order to obtain an authoritative answer to the question of the proper time for celebrating Easter. On his return he obtained from Alchfrid, king of Northumbria, a grant of land and a monastery at Ripon, and here he was ordained priest in 664. In this same year he took a leading part in the conference at Whitby, where he persuaded the king to decree that, in the celebration of Easter, the Roman usage should be substituted for that of the Scottish Church, which had hitherto prevailed in Northumbria. At this time also the king appointed him archbishop of York, but having gone to France to be consecrated by a bishop holding orthodox views on the Easter question, he found on his return that his see was occupied by one of the opposite party, and he did not get possession till 669. Becoming obnoxious to King Egfrid (who had succeeded Alchfrid in 670), the king, to reduce his influence, divided his diocese into three, and when Wilfrid opposed this proceeding, deprived him of his see altogether (678). Wilfrid thereupon set out for Rome to obtain from the Pope a reversal of the king's act of deposition. Having been driven by a storm on the coast of Friesland, he preached to the people (who had no difficulty in understanding the Anglo-Saxon) with such effect that all the princes and many thousands of the people offered themselves for baptism. Having reached Rome he easily obtained from the Pope the desired decision, but during the reign of Egfrid remained under persecution or in exile; in 687, however, Aldfrid, who had succeeded Edfrid, reinstated him. But Aldfrid also in course of time was offended by his devotion to Rome, and Wilfrid was again deposed in 691. He then made another journey to Rome, and did not return till 705. Consult Eddis, 'Vita Wilfridi,' in 'Historians of York' (Vol. I, 'Rolls Series'); Bright, 'Early English Church History' (3d ed., 1897); Hunt, 'The English Church from its Foundation to the Norman Conquest' (1899).

WILGUS, William John, American railroad engineer: b. Buffalo, N. Y., 20 Nov. 1865. He studied civil engineering and entered railroad service in 1885; and was later division engineer of construction on the Minnesota and Northwestern Railroad. He was in charge of the construction of the Chicago Union Transfer Railroad in 1890–93; and in 1893–1907 he was with the New York Central Railroad. He was chief engineer of construction with that railroad in 1899–1903; and later, as vice-president in charge of construction on the New York Central, he superintended the electrification of lines and construction of the Grand Central terminal. He was chairman of the board of engineers constructing the tunnel under the Detroit River. Since 1908 he has been established as a consulting engineer; as such for the New York Transit Commission (1923–24) and for the Regional Plan of New York. He was colonel in the Railway Transportation Corps with the A.E.F. He was awarded the Legion of Honor, the D.S.M., the Rowland Prize of the American Society of Civil Engineers (1909), and the Telford Medal of the Institute of Civil Engineers, London (1911).

WILHELM II, ex-German emperor. See WILLIAM II (Vol. 29, p. 332).

WILHELM MEISTER, Goethe's greatest novel, consists of 'Wilhelm Meister's Apprenticeship,' published in 1796, and 'Wilhelm Meister's Travels or the Renunciants,' published in final form in 1829. Both parts of the novel deal with the adventures of a young man and the development of his character, each part, however, being conceived from a different point of view. In the 'Apprenticeship' Wilhelm Meister, the son of a well-to-do merchant, decides to join a band of strolling actors, both from personal enthusiasm for their profession and for the noble purpose of raising the German stage to a higher level. But he realizes, after some time, that he is not a born

actor; the company to which he belongs can not keep up the high standard which it had reached in the presentation of Shakespeare's 'Hamlet' (book 5), and makes the stage a place of cheap amusement instead of a place of education; the life of the actors is of an indifferent, drifting nature, depending on the opportunities of the moment. Wilhelm withdraws from the stage and feels more at home with a certain secret society — The Society of the Tower — whose members as a rule belong to the nobility. Real culture and superior skill in worldly matters can be found among them. The high goal which they pursue in the education of man is to develop and to reconcile with each other all the qualities with which the individual is endowed by nature. The common problem which all men have to solve in the course of their lives is the reconciliation of the moral and the sensual, the ideal and the real, while art and perhaps religion are considered the means for attaining such a complete, harmonious personality. Man is to make himself a work of art which, independent of its surroundings, has its object exclusively in itself. Against this inspiring conception of man by which Wilhelm is attracted and which his fiancée Natalie and to some extent also her aunt represent (Cf. 'Confessions of a Fair Saint,' book VI), stand out the pathetic figures of Mignon and the harper, who are doomed to a tragic end. Characteristic features of Germany in the 18th century are the separation of classes into nobles and commoners, the conception of the theatre as a place of education, and the tendency to form secret societies. The construction of the 'Travels' is decidedly loose. Wilhelm himself no longer plays so prominent a part; reflections and maxims, descriptions of conditions and institutions take up a great deal of space, and a number of short stories but vaguely connected with the main story are inserted at different places. The whole is conceived in a new spirit, the spirit of renunciation, the power of which every individual must experience in the course of his life and without which mutually beneficial relations with our fellowmen cannot be established. Accordingly a new standard is set up for the individual and for society. Above all, the individual is to be made a useful member of society, and to this end it is necessary that he should confine his best efforts to one definite activity; Wilhelm chooses surgery for his specialty. The separation of classes, already disregarded at the end of the 'Apprenticeship,' where marriages between nobles and commoners are contracted, is set aside for democratic ideas in the 'Travels' where noblemen in leading positions consider themselves no better than their fellow-workers. The feeling between men has become wider and freer, and so has the feeling between countries. While, in the first part of the novel, emigration to America is rejected, the second part pronounces both emigrating and staying at home equally good, indeed the chief characters — among them Wilhelm — make up their minds to go to America. For good men are at home anywhere where they are useful. A world-society is hoped for which will inform its members about all parts of the world and foster in them a "world-piety" which respects all forms of religion and government serving mankind while fulfilling their special tasks. The individual, æsthetic man of the 18th century is replaced by the social, practical man of the 19th century; the ideal of the harmony of the individual is eclipsed by the ideal of the harmony of the world. We see the author of 'Wilhelm Meister' like the colossal mythical statue of Apollo at Rhodes standing as it were on the shores of two centuries. Consult edition of Goethe's works in 'Deutsche National-Literatur' (Vols. XV–XVI, 1882–98); 'Wilhelm Meister's theatralische Sendung' (1911); English translations in 'Everyman's Library,' by Carlyle, and in 'Bohn's Libraries.' Bielschowsky, 'Goethe' (Vol. II, 26th edition, pp. 128–183, 513–568); Creizenach, introductions and notes in 'Goethe's Sämtliche Werke, Jubiläums-Ausgabe' (Vols. XVII–XX).

EWALD EISERHARDT.

WILHELM TELL. Schiller's most popular play, if not his best, is 'William Tell' of which more copies have been sold than of any other German work of literature. During the years 1899 to 1905 a yearly average of 232 stage performances in German lands was maintained, a record equalled by no other German drama. Many critics condemn its structure, others find Tell's slaying of the tyrant Gessler from ambush morally indefensible; but it has become the national poem of the Swiss people. Read and seen on the stage in Germany's dark days it inspired the revolt against the despotism of the great Napoleon, and again in 1848 and later in 1870 its powerful influence was felt and the Rütli oath became the motto of the new empire. On the 100th anniversary of Schiller's birth in 1859 the 'Urkantone' dedicated the immense Mytenstein near the Rütli "To Schiller, Tell's Singer."

Although every child knows the story of Tell's appleshot, it is not Tell but the Swiss people who are the heroes of the drama, or more exactly the three forest cantons Schwyz, Uri and Unterwalden, who by their historical defeat of the forces of the duke of Austria at Morgarten in 1315 and by later victories made themselves independent of the House of Habsburg while remaining in the empire down to the Thirty Years' War. Still, the drama is built about the Tell legend, for history knows no Tell, nor any tyrannical Gessler, nor was there any revolt against Kaiser Albrecht, as in the drama, which follows the chronicle of Ægidius Tschudi (1505–72). The legend, itself, most probably came we know not how, from the Dane Saxo Grammaticus, who wrote in the 12th century, but long before Goethe's visit to the Forest Cantons in 1797, it had been accepted by the Swiss as fact. Goethe had wished to treat the subject in an epic, but resigned it to Schiller for dramatic treatment, helping him with all his data and knowledge of Swiss customs, topography and local color, for Schiller never saw Switzerland. It was finished and first produced in March 1804, and rapidly made its way over delighted Germany, but was not tolerated in Vienna till 1827.

In their revolt against Habsburg tyranny, representatives of the three original cantons met on the Rütli and swore their "desire to be a united people of brothers, to be separated

in no trial and danger; to be free as their fathers were; to suffer death rather than live in servitude; to trust in God on high and not to fear the power of men." Hence Schiller carried three parallel plots, of which Tell, the yeomanry and the nobles were the protagonists, but all blend into one compact whole, leading from a common revolt against tyranny to common success.

WILHELMINA I, vĭl-hĕl-mē'nä (WILHELMINA HELENE PAULINE MARIE), queen of the Netherlands: b. The Hague, Aug. 31, 1880. She is the daughter of King William III (q.v.) of the Netherlands by his second wife, Emma of Waldeck. Upon her father's death in 1890 Wilhelmina became queen, but during the years of her minority her mother ruled as regent. Soon after Wilhelmina's 18th birthday, on Sept. 6, 1898, she was crowned at Amsterdam. On Feb. 7, 1901 she married Henry Wladimir Albert Ernst, duke of Mecklenburg-Schwerin (b. 1876, d. 1934). Their only child, Princess Juliana (b. April 30, 1909), married on Jan. 7, 1937 Prince Bernhard zu Lippe-Biesterfeld (b. 1911). Children of this union are the princesses Beatrix (b. Jan. 31, 1938), Irene (b. Aug. 6, 1939) and Margriet Francisca (b. Jan. 19, 1943). After Germany's invasion of the Netherlands on April 10, 1940, Queen Wilhelmina and the royal family together with leading government officials escaped to England. In the summer of 1942 she visited Canada and the United States where on July 14 she addressed Congress and accepted a warship for the Netherlands navy. The following summer she visited President Roosevelt at Hyde Park. After the invasion of France by United Nations armies in the summer of 1944 the queen remained watchfully in London. When the liberating armies approached her country's borders she named Prince Bernhard on Sept. 3 head of the home resistance forces; on the same day General Eisenhower warned the Netherlands "underground" to wait instructions from their leaders before starting uprisings. Crown Princess Juliana, who had been living in Canada, arrived by airplane in London on Sept. 9. A fortnight later King George VI conferred on Queen Wilhelmina (the first foreign woman so honored) the Order of the Garter. After five years of exile, the queen, on March 13, 1945, visited liberated areas of her kingdom and was greeted by cheering throngs in several cities. After the celebration of her 50th anniversary on the throne she abdicated and was succeeded by Juliana (q.v.) who took the oath as queen of the Netherlands at a ceremony held in the Nieuwe Kerk, Amsterdam, Sept. 6, 1948.

WILHELMSHAVEN, vĭl'helms-hä-fĕn, Germany, town and naval station, on the northern coast of the state of Oldenburg, at the west entrance of the Bay of Jade, 40 miles northwest of Bremen, with which it is connected by rail. In 1853 the land was bought from Oldenburg by Prussia, and the town laid out in 1856; it was first used as a naval station in the Franco-Prussian War, and subsequently was made a fortress of the first rank. The harbor and fortifications were built at great cost, as the ground is soft and marshy and without natural advantages. The harbor basin, which is artificially constructed and walled with granite, is connected with the bay by a canal and contains three large dry docks; it was defended by forts of immense strength and provided with a torpedo station. The naval workshops were located here. The town was subjected to terrific bombardment from the air by the British following the outbreak of war in Europe in 1939. Pop. about 30,000.

WILIBALD, Alexis, pseudonym of Wilhelm Haring (q.v.).

WILIBRORD, wĭl'ĭ-brōrd, or **WILLIBROD, Saint,** English missionary, called the Apostle of the Friesians: b. Northumbria, about 657; d. about 738. He was brought up in Saint Wilfred's monastery at Ripon, spent 13 years in Ireland, and at 33, with several associates, embarked as a missionary for Friesland, where he was warmly welcomed by the Franconian prince, Pepin. Wilibrord made two visits to Rome (692 and 695), and on the latter occasion was made bishop by Pope Sergius over all the converted Friesians. In that part of Friesland under the rule of the Franks, he founded many Christian churches, some of which were destroyed a few years later in consequence of the successes of the pagan Friesians. He was buried in the monastery of Echternach, near Treves, and is commemorated in the Roman Catholic Church on November 7.

WILKES, wĭlks, **Charles,** American naval officer and explorer: b. New York, 1798; d. Washington Feb. 8, 1877. He entered the navy as a midshipman in 1818, served on the Mediterranean Station in 1819–20, in the Pacific 1821–23 and was then selected for separate command. In 1826 he was promoted lieutenant, and in 1830 was appointed to take charge of the government charts and instruments. In 1838 he was put in command of an expedition for exploring and surveying the Southern seas, the first scientific expedition ever fitted out by the United States government. During the next five years the expedition visited Madeira, Rio de Janeiro, Tierra del Fuego, Chile, Peru, the Paumota group, Tahiti, Tutuila and the Samoan group, New South Wales, the Antarctic regions, New Zealand, the Fiji group, the Sandwich (Hawaiian) Islands, the Columbia River, Willamette Valley, the coast of California, the Philippine Islands, Sulu Archipelago, Saint Helena, Singapore and the Polynesian Islands. The results of the expedition were published in 19 volumes, those on *Hydrography* and *Meteorology* being written by Wilkes himself, who also wrote the *Narrative of the United States Exploring Expedition* (1845). Wilkes claimed to have discovered an Antarctic continent, but the claim was long disputed. Shackleton's subsequent discoveries tend to prove the accuracy of Wilkes' announcement. In 1843 he was made commander, in 1855 a captain, and at the beginning of the Civil War in 1861 was placed in command of the *San Jacinto,* in which he went to the West Indies in search of the Confederate vessel *Sumter.* On Nov. 8 of that year he took the Confederate commissioners Mason and Slidell from the British mail steamer *Trent.* (See TRENT AFFAIR, THE.) In 1862 Wilkes was in command of the Potomac flotilla and afterward of the flying squadron that operated against blockade runners. In July 1862 he was promoted commodore, in 1864 was placed on the retired list, and thereon in July 1866 be-

came rear admiral. Besides those above mentioned his publications are *Western America, Including California and Oregon* (1849); and *The Theory of the Wind* (1855).

WILKES, John, English political reformer: b. London, 1727; d. 1797. The son of a wealthy distiller, he was educated at the University of Leiden (Leyden). Returning to England in 1746, he became a member of a secret fraternity of rich profligates known as the "Mad Monks of Medmenham Abbey." In 1757 he was elected to Parliament as member of Aylesbury, and in 1762 he founded *The North Briton,* a periodical in which he launched bitter attacks upon the foreign policies of the 3d Earl of Bute, Tory prime minister. His criticism of the king's speech from the throne in No. 45 of *The North Briton* (April 23, 1763) brought his arrest and prosecution for libel. A second charge was also brought against him for printing an obscene poem, entitled *An Essay on Woman,* and he was found guilty of blasphemy as well as libel. Released from prison on the ground that his arrest had been a breach of parliamentary privilege, he withdrew to France, and in 1764, as he did not appear to receive sentence, he was expelled from the House of Commons and was outlawed. He returned to England in 1768 and was elected to Parliament for Middlesex, but shortly was arrested, fined, and imprisoned. In 1769 he was expelled from the House of Commons, but Middlesex immediately re-elected him; and once again he was expelled. After a third election the other candidate, although he had got but a small minority of the votes, was declared duly returned. In 1770 Wilkes was released from his imprisonment. He was now more than ever the idol of the people, receiving the support of London merchants and of wild mobs who rioted to the cry of "Wilkes and Liberty!" Besides conducting a political campaign for the drastic reform of Parliament and the curbing of ministerial powers over individual opponents, he became successively alderman of the City of London, sheriff for Middlesex, and, in 1774, lord mayor of London. In that year he was once again elected member of Parliament for Middlesex; he was allowed on this occasion to take his seat without encountering opposition from the government, and served till 1790. He introduced in 1776 a bill for parliamentary reform, and following outbreak of the American Revolution he championed the cause of the colonists in the House of Commons. In 1769 he had sued the secretary of state for illegal arrest and was awarded damages (thus establishing the illegality of general warrants); and he obtained another personal triumph in 1782, when the resolutions respecting the disputed Middlesex elections were ordered to be expunged from the journal of the House of Commons. Thereafter, however, he took little part in parliamentary affairs. From the year 1779 he was chamberlain of the City of London. Wilkes, as a writer and speaker, did not reach beyond mediocrity. Although his private character was most licentious, he possessed elegant manners, fine taste, ready wit, and pleasing conversation. His *Letters and Speeches* were published by himself in 1786; and much light is thrown upon his conduct by the *Letters from the Year 1774 to the Year 1786 to His Daughter* (1894).

Consult Postgate, R. W., *That Devil Wilkes* (London 1930); and the study in P. C. Quennell's *Profane Virtues* (London 1945).

WILKES-BARRE, wĭlks'bär-ĕ, city, Pa., Luzerne County seat, on the Susquehanna River 18 miles southwest of Scranton. It is served by the Central Railroad of Pennsylvania; the Delaware and Hudson; the Delaware, Lackawanna and Western; the Lehigh Valley; the Pennsylvania; and the Lackawanna and Wyoming Valley (interurban electric) railroads. Situated in the picturesque and historic Wyoming Valley, between two ranges of the Blue Ridge Mountains, it has a moderate climate, the mean annual temperature being about 49°F.; the average annual rainfall is around 37 inches. The city contains Wilkes College, Kings College, and the Wyoming Historical and Geological Society's library and museum. A new Veterans Hospital was completed in 1952. The Fell Tavern, erected in 1897, stands on the site of the old Fell Tavern, built in 1787, where, in 1808, anthracite coal was first burned in an open grate by Judge Jesse Fell, who thus demonstrated its utility as a fuel for domestic purposes. On the River Common are monuments marking the sites of the old Forts Durkee and Wyoming; and the Public Square contains a monument to John Wilkes and Col. Isaac Barré (qq.v.). The Frances Slocum Playground commemorates the site of the Slocum House, from which Frances, at the age of five, was in 1778 seized and carried away by the Delaware Indians. Prospect Rock, adjacent to the city, affords a splendid view of Wilkes-Barre and its environs. The city is in the heart of the Pennsylvania anthracite coal region, and is the commercial and industrial center of an agricultural district. There are railroad shops, and manufactures include textiles, food products and beverages, wire cables and fabricated metals, tobacco, needles, lumber and paper products.

History.—The site of the city of Wilkes-Barre was settled in 1769, under the auspices of the Susquehanna Company (q.v.). In the spring of that year John Durkee, who held an interest in the company, led a group of over 100 emigrants from Norwich, Conn., to the site, and here laid out a settlement, erecting a stockade for its protection, called Fort Durkee. He subsequently named the settlement Wilkes-Barre, in honor of John Wilkes and Col. Isaac Barré, champions in the British Parliament of the rights of the American colonies. The establishment here and at other points in the adjacent area of settlements by Connecticut citizens, based upon claims of Connecticut to the Wyoming Valley (q.v.), resulted in the Pennamite Wars (q.v.). Wilkes-Barre was burned on July 4, 1778, by the British and Indians, following the Battle of Wyoming on July 3, and again in July 1784 during one of the Pennamite Wars. Upon the creation of Luzerne County in 1786 it became the county seat, and in 1806 was incorporated as a borough. The municipality has the commission type of government. Its population rose from 4,253 in 1860 to 76,638 in 1950.

WILKIE, wĭl'kĭ, Sir **David,** Scottish genre and portrait painter: b. Cults, Fifeshire, Nov. 18, 1785; d. at sea, off Gibraltar, June 1, 1841. He studied painting at the Trustees' Academy, Edinburgh, and following his return to Cults in 1804 he painted *Pitlessie Fair,* first of a series

of pictures depicting humble life for which he became well known. These included *Village Recruit, Village Politicians, Blind Fiddler, Rent Day, Blindman's Buff, Distraining for Rent, The Penny Wedding,* and *Reading of the Will.* From 1805 he worked in London. He became a Royal Academician in 1811, and in 1830 he was appointed painter in ordinary to the king.

WILKINS, wĭl'kĭnz, Sir **George Hubert,** Australian polar explorer and aviator: b. Mount Bryan East, South Australia, Oct. 31, 1888. He went to the Canadian Arctic in 1913 as photographer in the expedition led by Vilhjalmur Stefansson (q.v.), and though he lost his equipment through the sinking of the *Karluk* he rose to second in command. In 1917 he joined the Australian Flying Corps for service in World War I, before the conflict ended earning decorations for bravery. He was second in command of the British Imperial Antarctic Expedition during 1920–1921, and the following year he returned to the Antarctic as naturalist with the last expedition of Sir Ernest Henry Shackleton (q.v.). From 1923 to 1925 he headed an expedition to tropical Australia and neighboring islands on behalf of the British Museum. In 1926 he went to Point Barrow, Alaska, hoping to fly across the Arctic regions, but found that he was unable to lift his heavy trimotor plane from the ground. Returning to Point Barrow in 1927, he made a flight of 520 miles across previously unexplored country toward the northwest. In 1928, with Carl Ben Eilson as pilot, he flew from Point Barrow to Spitsbergen, a distance of 2,100 miles, in 20½ hours. The same year he received a knighthood. Going to the Antarctic with Eilson in the fall of 1928, he flew across Graham Land from a base on Deception Island, discovering several hitherto unknown islands in the course of the 600-mile journey. In 1931 he intended to make an expedition under the North Pole in the submarine *Nautilus;* the old vessel was found to be too dilapidated to make the voyage, and in November of that year she was sunk in a Norwegian fjord. His books included *Flying the Arctic* (1928); *Undiscovered Australia* (1928); *Under the North Pole* (1931).

WILKINS, Mary Eleanor. See Freeman, Mary Eleanor Wilkins.

WILKINSBURG, borough, Pennsylvania, in Allegheny County; altitude 922 feet; 7 miles east of Pittsburgh; served by the Pennsylvania Railroad. It is chiefly a residential community with little industry and manufacturing. Settled about 1780, it was first called McNairsville, and then Rippeyville. In 1887 it became a borough and was named for William Wilkins (1779–1865), secretary of war in 1844–1845. It has a mayor and council. Pop. (1950) 31,281.

WILKINSON, Ellen (Cicely), British public official: b. Manchester, 1891; d. London, Feb. 6, 1947. The daughter of a cotton operative, she won scholarships which enabled her to continue her education after attending primary school, eventually securing a master's degree at the University of Manchester. For two years she taught school in Manchester, and after joining the Independent Labour Party in 1912 she became a trade union organizer and agitator for woman suffrage. In 1914 she formed the National Union of Women's Suffrage Societies, and the next year she became national organizer for the National Union of Distributive and Allied Workers. She was one of the founders of the British Communist Party in 1920, but four years later she transferred her support to the Labour Party and was elected to Parliament for the large industrial constituency of Middlesbrough. While in the House of Commons she spoke for the unemployed in the depression of the 1920's, secured adoption of a resolution calling for an early Anglo-Russian commercial agreement, and took an active part in the General Strike of 1926. With the fall of the Labour government in 1931 she lost her parliamentary seat, and during the next few years she was engaged in writing and in visiting parts of India, Europe, and the United States. In 1935 she returned to Parliament as Labour member for Jarrow, a northeastern shipbuilding town which for many years had suffered industrial depression; the following year she led 200 jobless Jarrow workers on a 300-mile hunger march to London. As a member of Parliament she was not concerned only in the difficulties of workers in her own area. In 1938 she did a notable piece of work in initiating and carrying through the House of Commons the Hire Purchase Act, which prevented confiscation of goods after a specified number of time payments had been made on them. When Prime Minister Winston Churchill, during World War II, formed the coalition government in May 1940 she was appointed parliamentary secretary to the Ministry of Pensions, and the following October she was transferred to the Ministry of Home Security as parliamentary secretary to Herbert Morrison. Her task was to organize civilian defense, including 5,000,000 women as fire wardens, and to provide food and shelter for Londoners whose homes had been bombed. She continued this work until dissolution of the coalition government in 1945; and after the victory of the Labour Party at the general election that same year she was appointed minister of education. One of the most dynamic and colorful figures in the British labor movement, she was the first woman of the Labour Party to be elected to Parliament, the first woman to become minister of education, and the second woman to achieve Cabinet rank in Britain. In 1945 she was one of the British delegates to the United Nations Conference in San Francisco, and the following year she served as chairman of the preparatory commission for the United Nations Educational, Scientific, and Cultural Organization, meeting in London. Her book, *The Town That Was Murdered* (1939), dealt with unemployment in Jarrow. She was also author of *Clash* (1929); *Peeps at Politicians* (1930); *Division Bell Mystery* (1932); *Why War?* (1934); and *Why Fascism?* (1934, with E. Conze).

WILKINSON, James, United States army officer and adventurer: b. Benedict, Md., 1757; d. Mexico City, Dec. 28, 1825. He studied medicine in Philadelphia, and at the outbreak of the American Revolution he joined the Continental Army. Commissioned captain with effect from September 1775, he became intimate with Benedict Arnold and Aaron Burr (qq.v.). As a member of Arnold's expedition to Canada, in 1776 he was in the retreat from Montreal to Albany, N. Y. He served at Trenton and Princeton,

N. J., and in 1777, with the rank of lieutenant colonel, he was adjutant general in the Saratoga campaign under Horatio Gates (q.v.). In that campaign he appropriated as his own the information of the British position and strength which had been secured by Col. John Hardin, and after the surrender of Gen. John Burgoyne (q.v.) he was commissioned to bear the news to Congress; he also carried with him the recommendation of Gates that he be appointed brigadier general. He was 18 days in making the journey, and the news was a week old when he delivered his message. Congress refused to grant his promotion at that time, but a few weeks later, through the influence of Gates, he was brevetted brigadier general. In 1778 he was appointed secretary of the board of war, of which Gates was also a member. He was deeply implicated in the Conway Cabal (q.v.), which his indiscretion betrayed, and before the year was out he was forced to resign his brevet rank, though retaining his colonelcy. Thereafter he took no further active share in the war until 1779, when he was appointed clothier general of the Continental Army, an office he continued to hold until 1781. He removed to Kentucky in 1784 to engage in trade in the Mississippi region, and in 1786 founded Frankfort, Ky. There he gained considerable political influence and intrigued with Esteban Rodríguez Miró, Spanish governor of Louisiana, to bring Kentucky under the protection of Spain. His reward for this betrayal of his country was to be the exclusive control of commerce on the Mississippi and a yearly pension from the Spanish government. The plot was to be consummated at the convention which met in 1788 for the purpose of forming a constitution for the new state of Kentucky. Wilkinson's influence, however, proved insufficient, and the plot, becoming known to other leaders, fell through. The part of Wilkinson remained a secret, and though he continued to receive his pension from the Spanish government, he applied in 1791 for service in the United States Army. His treasonable act not being known, he was commissioned lieutenant colonel and served under Anthony Wayne (q.v.) against the Indians north of the Ohio. He was promoted brigadier general in 1792, and in 1796 he took over Detroit, Mich., from the British. Following the death of Wayne in that year he was made commander in chief of the United States Army. In 1803 he was associated with William Charles Coles Claiborne (q.v.) as United States representatives in taking over the Louisiana Purchase from the French, and in 1805 he was appointed governor of Louisiana Territory. In this position he engaged with Aaron Burr in the latter's scheme of intrigue. In 1806 Wilkinson, perceiving an opportunity to drive a double bargain, betrayed the plot to the United States government and at the same time demanded from the viceroy of Mexico a reward for saving that viceroyalty for Spain. The assertions of Burr as to Wilkinson's complicity in the plot were generally believed, but at that time no proof of his guilt was obtainable; nevertheless he barely escaped indictment on the same charge with Burr in 1807. Inquiry concerning his pension from the Spanish government was made in that year upon a resolution of John Randolph (q.v.), but he was exonerated. Charges were again made against him in 1810 on the score of complicity with Burr and of receiving pay from the Spanish government, but he was finally acquitted by court-martial in 1811 and resumed command in the army. In 1813, during the War of 1812, he was given the rank of major general and command of the United States forces on the Canadian frontier. He conducted the abortive campaign against Montreal, and because of incompetence he was superseded in 1814. Thereupon he was brought before a court of inquiry on such serious charges as neglect of duty, conduct unbecoming an officer, and drunkenness. In 1815, however, he was acquitted and honorably discharged from the army. From 1821 he resided in Mexico, there obtaining options on land in Texas.

WILKINSON, Jemima, American religious visionary: b. Cumberland, R. I., 1753; d. Jerusalem, Yates County, N. Y., July 1, 1819. She was educated as a Quaker and at 20, after a severe attack of fever, she professed that she had been raised from the dead, that her carnal life was ended, and that henceforth her body was reanimated by the spirit and power of Christ. She pretended to work miracles and, though entirely illiterate, induced many intelligent people to become her followers. Churches were established by her adherents in Rhode Island and Connecticut, and in 1786 it was decided to found a colony in Yates County, N. Y., near Seneca Lake. This was established in 1790. At the colony, to which she was accompanied by two "witnesses," Sarah Richards and Rachel Miller, she exacted from the colonists the most complete submission and the most menial services, her influence over them being practically supreme. She insisted on the Shaker doctrine of celibacy, and the exercises at her religious meetings resembled those of that sect. Although she never relinquished her pretensions, after some years her influence waned, and the latter part of her life was embittered by jealousies and annoyances which she bore with no great fortitude. The sect was broken up after her death.

WILKINSON, Sir John Gardner, English Egyptologist: b. Haxendale, Westmorland, Oct. 5, 1797; d. Llandovery, Caermarthenshire, Wales, Oct. 29, 1875. He was educated at Harrow School and Oxford University, and from 1821 till 1833 he resided in Egypt, making a thorough study of ancient monuments. His first work of note was *Materia Hieroglyphica,* published in 1828, and this was followed by *Topography of Thebes and General Survey of Egypt* (1835) and *Manners and Customs of the Ancient Egyptians* (1837). Other works of importance were *The Egyptians Under the Pharaohs* (1851), *A Popular Account of the Ancient Egyptians* (1853), *Architecture of Ancient Egypt* (1853).

WILKINSON, Marguerite Ogden (Bigelow), Canadian-American poet and anthologist: b. Halifax, Nova Scotia, Nov. 15, 1883; d. New York City, January 12, 1928. She was educated in the United States, and in 1909 married James G. Wilkinson, principal of the Roosevelt School, New Rochelle, N. Y. Her first book of verse was *In Vivid Gardens,* published in 1911, and this was followed by *By a Western Wayside* (1912), *The Great Dream* (1923), and *Citadels* (1928), the last consisting of religious poems. Among the poetry anthologies which she compiled were *Golden Songs of the Golden State* (1917), *New Voices* (1919), *Contemporary Poetry* (1923), and *Yule Fire* (1925).

WILL. It has been usual to classify mental phenomena under the three headings of cognition, feeling and will or conation. In the last class are included all those processes in which the mind is regarded as effecting some change in its own states, or in the physical environment by means of bodily movements. These changes may take place in a more or less conscious way: that is, in producing changes by means of inner or outer acts of will, we may be more or less explicitly aware of the nature of the result to be attained and of other possible lines of action. It is an essential characteristic of the states that we name impulses or instincts that they are not deliberative. These processes, however, as expressions of the appetitive or active powers of the mind, are conative in character. Automatic or reflex acts, on the other hand, being brought about without any mediation of consciousness, cannot be regarded as belonging to will at all. In impulse the act is initiated by a feeling of uneasiness or craving which has a tendency to discharge immediately in some movement to relieve this feeling. It is from such immediate and impulsive reactions of consciousness that those more explicit and conscious processes that we call voluntary acts develop. We are not born with the power of performing voluntary acts, but this is a progressive acquirement that presupposes an experience of the results of involuntary acts, and the means of obtaining or avoiding these results. The development of will, in the true sense in which it is an endowment that belongs only to rational beings, as it passes from the stage of impulse and instinct, involves a growing consciousness of the relative value of various ends, and also of the means that may be used for the realization of these ends. The development of will is thus only possible through the development of the mind as a whole. Moreover, it is to be noted that this development implies further the systematic integration and union of the rational and emotional sides of mind with its active or conative aspect. As mind develops, all of its functions become more closely and organically connected.

What has just been said may serve to show the fallacy in the view of the older psychology which regarded will as a distinct faculty, opposed, as if it were a separate department, to feeling and cognition. It was too often forgotten in making this division that these faculties were not each *sui generis,* and that the so-called "faculty" is only an abstraction if thought of as a kind of entity apart from the concrete processes of consciousness. Moreover, the emotional and cognitive states of mind do not exist in separation from the conative aspect, but the latter is necessarily implicated and involved in them. It has been one of the most important achievements of recent psychological analysis to exhibit the presence of will in various intellectual processes, like perception, association and thinking, in the form of the selective activity of attention. The true view then is that cognition, feeling and conation are "moments" or "aspects" of mind that can be distinguished by analysis, but which exist and function concretely only in relation to each other. At the present time, psychologists are not agreed as to whether it is possible to discover by analysis any definite conative process as a structural element in conscious life, corresponding to the elementary sensations or feelings. The reality and functional efficiency of the will is not really at stake in this question, however, as has been too hastily assumed by certain representatives of both parties to the dispute. Even if it is found that the processes of will cannot be isolated as separate and distinct states of mind, there will be no ground for denying the real activity of the subject. The truth seems to be that will cannot properly be represented in the form of one particular kind of mental content, just because it is the expression of the attitude of the self toward all mental content.

We have seen that those processes of fully explicit will that we term voluntary acts are always accompanied by a somewhat clear consciousness of the end to be realized and of the relation of means to this end. Moreover, in a fully deliberative act of will, there is also a recognition of various competing possibilities and a conscious selection of one to the exclusion of the others. Instead of allowing an impulse to pass at once into action in accordance with the immediate demands of some single want or uneasiness, in voluntary states consciousness takes control, looking before and after and comparing the consequences of different lines of action. In many cases its efficiency and control are shown by checking or inhibiting the immediate impulse by the thought of some more valuable end with which it conflicts.

How are such volitions to be described psychologically? What actually goes on when a decision is voluntarily made? If we leave out of account the various sensations of muscular strain that accompany volitions, we may say that the essence of the act consists in fixing one alternative and holding it fast before us by means of selective attention. This attention is not passively determined by the greater intensity or immediate attractiveness of one object, but is the result of the fullest activity of the subject, and is at once a psychological fact and a moving force in the external world. As Professor James remarks: "We do not first have a sensation or thought, and then have to add something to it to get a movement. Movement is the natural immediate effect of fecling, irrespective of what the quality of the feeling may be. It is so in reflex action, it is so in emotional expression, it is so in voluntary life."

The Freedom of the Will.— The vexed problem of the freedom of the will arises from the fact that there seems to be an antagonism between the demands of our intellect and those of our moral nature. On the one hand, there is the requirement that all phenomena of the inner life, like those of external nature, shall be capable of explanation according to the law of cause and effect. On the other hand, it is maintained that if morality is to have any meaning, the individual must be free and thus responsible for his acts. In favor of determinism, it is argued that the mental life is composed of a series of states or processes that are related to each other causally just as are events in the external world; this is the necessary assumption of psychology and of all the sciences that attempt to explain the mental life. "Whenever determination by necessary laws ceases, there ceases also the possibility of any explanation." Moreover, determinists point out

that the individual is moved to act by certain motives and that these motives are the resultant of certain external influences as modified by his character. This character again is the product of previous acts, either of his own or of his ancestors; so that at any time the act performed is the necessary reaction of the individual in the given circumstances. Furthermore, it is maintained that there is an unbroken line between acts that are performed from instinct or impulse, and where consequently there can be no claim made for freedom, and the most complicated and deliberate acts of will. On the other side, those who contend for freedom argue that we have no right to consider the mind of man as simply a part of nature and subject like it to necessary laws of causation. They urge in support of their position that personality, the principle of intelligence itself, cannot properly be represented as one factor on a level with others, but that it is the centre from which the very conception of law springs, and on another side is the determining ground of all motives and furnishes the standard by which they are evaluated. Appeal is also made to the immediate conviction of freedom that is present in all genuine cases of willing. Further, it is said that it is only on the assumption of freedom that such terms as "responsibility," "duty," "obligation" and "remorse" have any meaning. He who denies freedom, then, declares the experiences denoted by these words to be illusory.

It is impossible to give in the present article a detailed examination of these arguments. A few remarks may, however, be added regarding the general nature of the problem and the lines along which a reconciliation may be effected. In the first place, it is obvious that this controversy is a special phase of the general problem of mechanism (q.v.) and teleology (q.v.). Is everything to be explained according to necessary laws of cause and effect, or is it possible without doing violence to this principle to maintain a determination according to ends? If it is possible for the individual to set before himself the ends of his life, and to work for their realization, he is free in the only sense in which the word has any meaning. If, however, his acts are determined by some force that acts independently of him, he cannot be held responsible. Again, determinism is the only standpoint from which psychology as a natural science can proceed. For this science views the mental life as made up of a series of processes or mental phenomena. Its task, therefore, is to discover how these various elements are linked together according to causal laws. From the very nature of its postulates it is impossible to admit that there is any break in the line of causes and effects; every "state of mind" must be explained by showing that it stands in necessary relations to some other phenomena belonging to the same series. But this is to look at the mind from the outside, as composed of a number of phenomena, or mere occurrences in time. It is, however, possible to describe mind in a way that is truer to the direct experience of life, as a system of conscious functions or acts in which purposes are being realized and ends attained through the self-directed activity of the subject. As soon as this point of view is taken the causal and deterministic position is left behind, and the only possible assumption is that of self-determination or freedom. The conclusion we have reached then is that, so long as we regard mind from the standpoint of psychology as a science, everything must be explained causally, and that there is no possibility of introducing here the conception of freedom. But we have also seen that this standpoint is not final, but that experience can be more adequately interpreted as a process in which a conscious subject realizes ends that he himself sets, and that this view necessarily regards mind as something more than a series of causally determined phenomena.

Bibliography.— Schopenhauer, A., 'The World as Will and Idea'; Mill, J. S., 'Examination of Sir W. Hamilton's Philosophy'; 'System of Logic' (Bk. VI); Bain, 'Emotions and Will' (1888); Münsterberg, 'Die Willenshandlung' (1888); Ladd, G. T., 'Psychology Descriptive and Explanatory' (1894); Kant, 'Metaphysic of Morals'; Baldwin, J. M., 'Feeling and Will' (1891); James, W., 'Principles of Psychology'; Schneider, 'Der menschliche Wille' (1882); Wundt, W., 'Ethik'; and 'Essays'; Martineau, J., 'Types of Ethical Theory.'

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WILL, *in law,* is a disposition made by a competent person known as the testator, in a form more or less prescribed by law, of property over which he has the legal power of disposition, to take effect at death. Technically, the term "will" is used to describe a document which disposes of real property, while "testament" is used to describe one that disposes of personal property, "will and testament" including both. Broadly, and by common use, the term "will" covers both meanings and is accepted as describing a written instrument that disposes of both realty and personalty. Any person of legal age, being of sound mind and memory and not under duress, may make a will disposing of whatever interest he has at his death in either real or personal property. All wills to be valid in the United States, with the exception of a favored class known as "nuncupative wills" which are oral, must be written and signed by the testator and witnessed by at least two (or in several of the United States three) persons, who must sign in the presence of the testator and of each other, and are not beneficiaries under the will. The maker of a will must be 21 years of age in most of the States, but a few allow women of 18 to thus legally dispose of their property. Oral wills are permitted in the case of soldiers and sailors in actual service, and these "nuncupative" wills are definite statements of the will of the maker with two or more witnesses, who shall within a reasonable time thereafter reduce the statement to writing and sign as witnesses. A beneficiary cannot be a competent witness to a nuncupative will. A will may be altered or amended by the addition of the further wish of the testator, the amendment being known as a "codicil," which must be signed by the testator and witnessed with the same formality as the original will. A will may be revoked by the testator by destroying it, as by canceling, tearing, burning or otherwise mutilat-

ing it, or by making a new will, which later document invalidates all preceding wills. The destruction of a later will revives a former will if still in existence, which will then have full effect. In some States the subsequent marriage of the testator invalidates a will. The laws of the different States vary as to the provisions for the heirs and next of kin.

A will may be written in any form of language that expresses the intention of the testator. A very common form of beginning a will is: «In the name of God, amen. I, John Smith, being of sound mind,» etc. It need not be written in any prescribed form, but must show the intention. It may be written in any sort of writing material or on several pieces of paper if their sense shows them to be connected each to the other. Separate documents may be included in the will if the will speaks of their incorporation in the will as a part of it, and in such a way as to identify the documents. Publication is the act of making known in the presence of witnesses that the instrument executed is the will of the testator. It is not necessary for the witnesses to know the contents of the will, but the fact that it is a will. Publication is not necessary in all States. A will usually names one or more persons who shall carry out the will of the testator. This person is known as the executor or executrix. When no person is named in the will the court appoints such person, who is known as the administrator or administratrix. At the death of the testator the will is placed on file for probate in the Probate or Surrogate Court. A will is construed liberally, the words taken in their plain and usual sense, and the intention of the testator allowed to prevail wherever possible to understand such intention. Effect is given to every part of a will. Rules of construction are valuable only in case the will is contested. Favor is shown in case of contest to natural heirs and next of kin. Conditions may be made, and trust estates created, and whatever interest the testator may have at death may be disposed of by will during his lifetime to take effect at death. When a testator has a large estate it is customary to have his will drawn up by an attorney who is familiar with rules of construction and of evidence. This is not necessary to the validity of a will, which may be written by any one so long as it is properly signed and witnessed.

WILL-O'-THE-WISP. See IGNIS FATUUS.

WILLAMETTE, wĭl-lăm'et, a river in Oregon which has its rise in Lane County, flows nearly north and enters the Columbia River in Columbia County, in the northwestern part of the State. The total length is about 225 miles. It was originally navigable only for small steamers to Portland (q.v.), 15 miles from its mouth, but the canal around the Willamette Falls permits river traffic 100 miles or more.

WILLAMETTE UNIVERSITY, a co-educational institution of higher learning at Salem, Ore. It was founded as an Indian mission school in 1834 and became a school for white children in 1842; while it was established as the present university in 1853. Its school of medicine was organized in 1867 and that of law in 1884. Its other courses include liberal arts, and music. The School of Theology was discontinued in 1930, and some time before that the medical college was merged with that of the University of Oregon. The A.B. is the principal degree, while the LL.B. is given in the law school. Annual enrolment is about 834.

WILLARD, Archibald M., American painter and illustrator, son of a Baptist clergyman: b. Bedford, Ohio, 1836; d. Cleveland, Ohio, 11 Oct. 1918. The family settled later at Wellington, where the boy developed a marked interest in sketching, but opportunity for training in artistic lines being wanting, he worked for some years at decorative painting and continued his efforts in sketches and portraits. At the outbreak of the Civil War he enlisted with the 88th Ohio regiment and served as color-bearer. After the war he made battle sketches but at length found his forte in sketches showing humor and intensity of action and emotion. His better known subjects are 'Pluck'; 'The Nursery'; 'The Drummer's Last Yarn'; 'Deacon Jones's Experience'; and 'Pitching the Tune.' His more serious work includes 'Minute Men of the Revolution' and 'Spirit of '76.' The last named was originally entitled 'Yankee Doodle,' and was produced for Centennial year. The models used were Hugh Mosher, a local fifer, and his father, and Harry, son of Gen. J. W. Devereux, as the drummers. The picture was received with popular enthusiasm and exhibited at the Philadelphia Centennial and the larger cities of the United States. It was finally purchased and presented by General Devereux to his native town, Marblehead, Mass., where it hangs in Abbott Hall. The artist lived for some years in New York but passed his earlier and later years in Cleveland.

WILLARD, Ashton Rollins, American art critic: b. Montpelier, Vt., 14 April 1858; d. 3 Oct. 1918. He was graduated from Dartmouth in 1879, removed to Boston in 1887 and afterward spent much time in Europe. In 1902 was made chevalier of the Order of the Crown of Italy. His writings include 'Life and Work of Painter Domenico Morelli' (1895); 'History of Modern Italian Art' (1898); 'Land of the Latins' (1902).

WILLARD, Edward S., English actor: b. Brighton, Sussex, 1853; d. 9 Nov. 1915. His first appearance on the stage was made at Weymouth in 1869, but his London début was not made until 1881. He became manager of the Shaftesbury Theatre in 1889 and in 1890 came to the United States, where he played successfully for three years. He leased the Comedy and Garrick Theatres in London in 1894 and later made several tours of the United States, playing various leading parts under his own management.

WILLARD, Emma Hart, American educator: b. Berlin, Conn., 23 Feb. 1787; d. Troy, N. Y., 15 April 1870. She began her career as a teacher in 1803, subsequently became principal of a girls' academy at Middlebury, Vt., and in 1809 was married to Dr. John Willard. She opened at her home in Middlebury, Vt., in 1814, a boarding school for girls in which she introduced various improvements in methods of instruction and also taught subjects hitherto not included in the curriculum of girls' schools

Wishing to extend her ideas of education into wider fields, she addressed to the New York legislature in 1819 a treatise entitled *Proposing a Plan for Improving Female Education*, which found favor with Governor DeWitt Clinton and led to the incorporation of a seminary for girls at Waterford, N Y. Since no state funds were available, she moved in 1821 to Troy, N. Y., where the citizens presented her with a building for her school, to be known as the Troy Female Seminary, afterward called the Emma Willard School. She traveled in Europe in 1830, helping to found a training school for women teachers in Greece, and published *Journal and Letters from France and Great Britain* (1833).

After Dr. Willard died in 1825, she conducted the business management of her school until 1838 when she turned affairs over to her son and married Dr. Christopher Yates. But in 1843 she was granted a divorce by act of the Connecticut legislature and resumed her former name. She traveled through New York State, the South, and the West, lecturing to teachers, always promoting the cause of higher education for women.

Her textbooks were widely used and translated and she wrote some verse, of which the best known is *The Cradle of the Deep*. In 1895 a statue was unveiled to her memory in Troy, and in 1905 she was elected to the Hall of Fame for Great Americans at New York University.

Consult Lutz, A., *Emma Willard, Daughter of Democracy* (New York 1929); Goodsell, W., ed., *Pioneers of Women's Education in the United States* (New York 1931).

WILLARD, Frances Elizabeth Caroline, American educator and temperance reformer: b. Churchville, N Y., Sept. 28, 1839; d. New York City, Feb 18, 1898. She lived a pioneer life in her early years and was taught by her mother. Her conflicts with her father's strict training, as told in her book *Glimpses of Fifty Years* (1889), show her determination to lead a full life in spite of her sex. Graduating from the Northwestern Female College, Evanston, Ill., in 1859, she engaged in teaching and wrote articles for papers and magazines

After a trip to Europe in 1868, she was invited to lecture on her experiences and discovered she was an excellent speaker. When she joined the temperance movement in 1874 she devoted her talents to the crusade. She became, in 1879, president of the National Woman's Christian Temperance Union, and in 1891 of the World's W.C.T.U. Believing in temperance as a moral issue, she supported woman's suffrage, confident that when women had the vote they would use it for her cause. She did not live to know that the Prohibition Amendment would precede woman's suffrage and would be later repealed.

She visited every state in the Union. On her arrival in a village unannounced, a small boy would run through the streets with a dinner bell crying out "Lecture at the depot!" England also knew her well. In 1890 she was elected president of the National Council of Women. In 1950 the state of Illinois placed a statue in her honor in the Capitol at Washington, D.C., and in 1910 she was elected to the American Hall of Fame.

Consult Trowbridge, L. J., *Frances Willard of Evanston* (Chicago 1938); Earhart, M., *Frances Willard* (Chicago 1944).

WILLARD, Joseph, American clergyman and university president. b. Biddeford, Me., Dec 29, 1738; d New Bedford, Mass., Sept. 25, 1804. Graduating from Harvard in 1765, he became a tutor there in Greek in 1766, but after taking the pulpit in Beverly, Mass. in 1772, was ordained in the ministry As secretary of the American Academy of Arts and Sciences he corresponded with many famous scientists at home and abroad and became very well known as a man of learning. In 1780 he was chosen for the Harvard presidency, which he retained until his death. He was able to restore finances, obtain gifts from abroad, and improve the scholastic standing of the University.

WILLARD, Joseph Edward, American lawyer and diplomat: b. Washington, D.C., May 1, 1865; d. New York City, April 4, 1924. He was graduated from the Virginia Military Institute in 1886, took a summer course in law at the University of Virginia, and afterward practiced with great financial success at the Richmond bar. He served as a captain of United States Volunteers in the Spanish American War; was a member of the Virginia legislature from 1893–1902; lieutenant governor of Virginia from 1902–1906; and state corporation commissioner from 1906–1910. Appointed United States minister to Spain by President Woodrow Wilson in July 1913, his rank was raised to that of ambassador in September of that year. He spent the years of World War I in difficult negotiations with Spain and in 1921 returned to his law practice in New York.

WILLARD, Josiah Flynt (pen name JOSIAH FLYNT), American author and sociologist: b. Appleton, Wis., Jan. 23, 1869; d. Chicago, Ill., Jan. 20, 1907. He began a vagrant life at an early age, working as a casual laborer until he joined his mother in Germany, where he studied political economy at the University of Berlin. Besides working in Germany he spent some time on Tolstoy's estate in Russia in 1896. His interest in the problems of tramps in the United States led him to publish from his first-hand information articles and books such as *Tramping with Tramps* (1899). Pennsylvania Railroad officials asked him to report on their efforts to rid their roads of tramps, and he wrote *Notes of an Itinerant Policeman* (1900) based on his findings.

Other sociological books were *The Powers That Prey*, with Francis Walton (1900); *The World of Graft* (1901), which introduced the term "graft" to popular usage; *The Little Brother: a Story of Tramp Life* (1902), his only work of fiction; and *The Rise of Ruderick Clowd* (1903). His autobiography, *My Life* was published in 1908 after his death.

WILLARD, Samuel, American clergyman and educator: b. Concord, Mass., Jan. 31, 1640; d. Boston, Mass., Sept. 12, 1707. Graduated from Harvard in 1659, he studied theology, and in 1664 was ordained minister at Groton, Mass. Following the destruction of this village by the Indians during King Philip's War in 1676, he became a colleague of Thomas Thacher, pastor of Old South Church, Boston, and upon the latter's death in 1678, succeeded to the pastorate. Although named vice president of Harvard University in 1700, when he became acting president on the resignation of Increase Mather in 1701, the General Court would not permit him to assume

the title of president while still pastor of the church. He kept his pastorate until his death.

Firmly opposed to the persecutions of the courts in cases of witchcraft, he investigated and recorded his findings of court cases. For details consult *Massachusetts Historical Society Collections* (4th series, VIII, 1868). The series of Tuesday afternoon lectures he gave from 1688 until his death were printed in 1726 in a folio of 914 double columned pages under the title *Compleat Body of Divinity.*

WILLARD, Simon, American clockmaker: b. Grafton, Mass., April 3, 1753; d. Roxbury, Mass., Aug. 30, 1848. Apprenticed at the age of 12 to a clockmaker in Grafton, Simon soon became a master of his craft. Clocks marked "Simon Willard, Grafton," are known to collectors. During the Revolutionary War he paid for a substitute in the army and continued making clocks. From about 1780 to 1839 he made clocks at the factory he set up in Roxbury He patented a clock mechanism attached to a jack for roasting meat, but his most famous invention (1801) was the Willard Patent Timepiece or "banjo clock" as it came to be called much later.

Consult Willard, J. W., *A History of Simon Willard, Inventor and Clockmaker* (1911).

WILLARD, Simon, American colonist: bap. Horsmonden, Kent, England, April 7, 1605 (Old Style); d. Charlestown, Mass., April 24, 1676. Emigrating to Massachusetts in 1634, he settled at Cambridge, where he became a fur trader. He helped to establish the town of Concord in 1635, serving there as a magistrate, and commanding the militia. In 1641 he was made chief of a committee to regulate the fur trade. Assisting John Eliot in work among the Merrimac Indians, he was, however, forced to defend the settlers against them in King Philip's War. In 1671 he had moved to Groton, but after the destruction of his home during the Indian War (1676), he moved to Charlestown in March, where he died. He had 17 children by three marriages, and his descendants include these famous Willards: Frances, Joseph, Joseph Edward, Josiah Flynt, Samuel, and Simon (qq.v.).

WILLARD, village, Ohio, in Huron County, is 26 miles south of Sandusky, on the Baltimore and Ohio Railroad. It is also served by an airport. Located in a fruit, truck garden, and grain area it supplies food and dairy products for shipping, and its manufactures include rubber goods, lumber, and burial vaults. Pop. (1950) 4,744.

WILLCOCKS, wĭl'kŏks, Sir **William,** British engineer and irrigationist: b. India, 1852; d. July 28, 1932. Educated at Roorkee College, India, he was employed on Indian public works from 1872 to 1883, and on Egyptian works and reservoirs from 1883 to 1897. He designed and supervised the building of the Aswân (Assouan) Dam from 1898 to 1902, for which he was knighted in 1902. His irrigation projects in Mesopotamia in 1911 were equally important. He wrote: *Egyptian Irrigation* (1889); *The Irrigation of Mesopotamia* (1905); *From the Garden of Eden to the Crossing of the Jordan* (1918); and an autobiography, *Sixty Years in the East* (1935) published posthumously.

WILLCOX, wĭl'kŏks, **Cornélis DeWitt,** American army officer: b. Geneva, Switzerland, Feb. 26, 1861; d. Naples, Italy, Jan. 19, 1938. He came to the United States, graduated from the University of Georgia in 1880, from the United States Military Academy in 1885, and the Artillery School in 1892. During the Spanish-American War he was a captain of volunteers and from 1908 to 1910 he was chief of the military information division at Manila, Philippine Islands.

In 1910 he was appointed professor of modern languages at the Military Academy, studied at the University of Grenoble, France, in 1913, and was promoted colonel in 1914. In World War I he served in France as chief of the American Military Mission at French General Headquarters. Besides translating works from the Spanish, he was co-editor in 1915 of the *International Military Digest;* published *The Head-Hunters of Northern Luzon* (1912); *A Reader of Scientific and Technical Spanish . .* (1914); *War French* (1917).

WILLCOX, Orlando Bolivar, American soldier: b. Detroit, Mich., April 16, 1823; d. Cobourg, Ontario, Canada, May 10, 1907. He was graduated from the United States Military Academy in 1847, and after serving in the Mexican War and in Indian campaigns, resigned from the army and practiced law in Detroit until the outbreak of the Civil War when he re-entered the army as colonel of volunteers. Wounded and taken prisoner at the first Battle of Bull Run, he was exchanged in 1862 and fought in many battles. Mustered out of service in 1866, he re-entered the Regular Army and became a full brigadier general in 1886, with command of the Department of the Missouri. After his retirement in 1887 he was made governor of the Soldiers' Home in Washington, D.C. In 1905 he moved to Cobourg, Ontario.

Using the pen name Walter March he wrote *Shoepac Recollections: A Way-side Glimpse of American Life* (1856) and *Faca, an Army Memoir* (1857).

WILLCOX, Walter Francis, American statistician: b. Reading, Mass., March 22, 1861. Graduating from Amherst College in 1884, and from the Columbia Law School in 1887, he later studied at the universities of Yale and of Berlin, Germany, receiving a Ph.D. at Columbia University in 1891. From 1891–1931 he was professor of statistics and economics at Cornell University and thereafter professor emeritus. He was chief statistician of the 12th United States census in 1899–1901 and a special agent of the United States Census Bureau from 1902–1931. President of the American Statistical Association in 1912 and vice president of the International Statistical Association in 1923, he was a delegate to many foreign sessions of the latter.

His studies on divorce statistics in the 1890's were valuable, as was his *Introduction to the Vital Statistics of the U.S., 1900–1930* (1933). In 1939 he edited for the National Bureau of Economic Research, *International Migrations,* and in 1940 published *Studies in American Demography.*

WILLEBRANDT, wĭl'ĕ-brănt, **Mabel** (nee Walker), American lawyer and public official: b. Woodsdale, Kans., May 23, 1889. Her early education was obtained under the difficulties of a family constantly on the move, and she acquired

her college education by teaching school and studying at the State Normal School, Tempe, Ariz., where she took her B.A. degree in 1911. In Los Angeles she was principal of a grammar school while taking evening courses in law at the University of Southern California. After seven years of combining teaching and studying, she began to practice law in Los Angeles in the year 1915.

Her life and work had taught her the need of poor men's lawyers, and she organized the women's department of the Public Defender's Office while chairman of the Legal Advisory Board, District No. 11, Los Angeles. In 1921, with the support of the legal profession and the women of California, she was appointed assistant attorney general of the United States. Mrs. Willebrandt's chief cases had to do with prohibition, the violation of the liquor laws, and the criminal cases resulting from the 18th Amendment. She had charge of the Bureau of Prisons, including three federal penitentiaries, an institution for male first offenders, and one for women. In 1929 she resigned and published *Inside of Prohibition.*

WILLEMITE, wĭl'ĕm-īt, a mineral named for Willem (William) I of the Netherlands when found near Liége, Belgium. It is an orthosilicate of zinc Zn_2SiO_4. In Franklin Furnace, N. J., it is obtained in sufficient quantities to be mined as an ore of lead. In its pure form it is an opaque or transparent white, but when mixed with iron or manganese, it may be green, yellow, red, or brown. A variety known as troosite is zinc partly replaced by manganese. The crystals are commonly hexagonal prisms ending in obtuse rhombohedrons, but a granular form is also found mixed with franklinite. Crystals from Belgium differ from the New Jersey type in having an easy basal cleavage. The mineral has a hardness of 5.5 and a specific gravity of 3.84-4.19. Sometimes appearing phosphorescent, under ultraviolet rays it shows a bright yellow fluorescence.

WILLEMS, vĭl'ĕms, **Florent,** Belgian artist: b. Liége, Belgium, Jan. 8, 1823; d. Neuilly, France, Oct. 23, 1905. He studied at the Academy of Mechlin, where his style was influenced by the old Dutch masters of the 17th century. About 1840 he moved to Paris, winning some success. His *Preparing for the Promenade* may be seen at the Metropolitan Museum of Art in New York City.

WILLEMS, Jan Frans, Flemish philologist: b. Bouchout, near Antwerp, Belgium, March 11, 1793; d. Ghent, June 24, 1846. At the age of 14 he wrote a satirical verse in Flemish and in 1812 won a prize for a poem celebrating the Peace of Tilsit. All his life he was a leader of the movement to preserve the ancient Flemish language and his *Over de Nederduitsche Taal en Letterkunde* (1819–1824) won him admission to the Royal Academy of Amsterdam. He obtained a position as archivist at Antwerp, but after the separation of Holland and Belgium in 1830 he went to Encloo where he worked on Flemish translations of the *Rymkronyk van Jan van Heelu* and *Reinaert de Vos* (*Reynard the Fox*). In 1835 he became archivist at Ghent, where he founded a society to encourage Flemish. After his death there was published a collection of old Flemish songs which he had compiled.

WILLESDEN, wĭlz'dĕn, municipal borough, England, in Middlesex County, 6 miles northwest of London. Just outside the boundary of the County of London, it includes large residential areas and has a Post Office Engineering research laboratory Railway works form one of its largest industries. A method of waterproofing paper, canvas, and cellulose material which leaves a green varnish-like surface, was originated there and called the Willesden process.

Its history goes back to the time of the Norman Conquest, when its name appeared in Domesday Book, and it had a shrine that made it a place of pilgrimage until the 16th century. It was incorporated in 1933 and returns two members to Parliament. Pop. (1951) 179,647

WILLET, wĭl'ĕt, a large American snipe, *Catoptrophorus semipalmatus semipalmatus,* is easily recognizable when alighting, as its wings are held raised showing the wide white and black patches on both wing surfaces. Its thick, straight bill, longer than its head, is useful in obtaining its food while swimming in shallow waters, or stalking with its half-webbed feet along the shores.

Once widely found in the eastern states and prized by sportsmen for its eggs and the flesh of the young birds, it has now become extremely rare on the North Atlantic shore and it breeds in Nova Scotia. The birds are easily alarmed and take great care to protect their young.

There is also a western willet (*C. semipalmatus inornatus*), hard to distinguish from the eastern variety. Some come to the eastern shores, but are found mainly west of the Mississippi.

WILLETT, Marinus, American revolutionary soldier: b. Jamaica, N. Y., July 31, 1740; d. Corlears Hook, N. Y., Aug. 22, 1830. He was a student at King's College (now Columbia University), New York City. In 1758 he served in the French and Indian Wars. As a Son of Liberty, in 1775 he and his associates seized arms from the British forces in New York to prevent their being sent to Boston. In 1777 he was second in command at Fort Stanwix, holding it against Col. Barry St. Leger until relieved by Benedict Arnold. He was with the Sullivan expedition against the Iroquois and commanded the forces in the Mohawk Valley where, on Oct. 25, 1781, he checked the British at the Battle of Johnstown. At the last hostile movement against the enemy at Oswego, in 1783, he was in command.

From 1784 to 1788 he was sheriff of the County of New York. Two years later he was sent by President George Washington to sign a treaty of peace with the Creek Indians at Monmouth (August 1790). In 1807 he was appointed to serve as mayor of New York City.

When he died he was buried in a coffin made of wood he himself had collected on various battlefields, and was dressed in an old colonial suit. From his manuscript journals his son published *A Narrative of the Military Actions of Colonel Marinus Willett* (1831).

WILLETT or **WILLET, Thomas,** first mayor of New York City: b. Leiden, Holland, 1610; d. Rehoboth, Seekonk, Mass., Aug. 4, 1674. He was buried in Riverside, R. I., then part of Plymouth Colony, where in 1913 the City Club of New York unveiled a monument to his memory.

His family were Puritan refugees in Holland,

and Thomas emigrated to the Plymouth Colony in 1629 or 1632. He became a prominent trader, his ships going to New Amsterdam, where he acquired considerable property. His knowledge of Dutch made him the choice of Governor Peter Stuyvesant to serve on a committee settling boundaries with the English. Although he warned the governor of the impending attack by the British, he helped negotiate the surrender of the Dutch. In 1664, New Amsterdam became New York.

On June 12, 1665, Governor Richard Nicolls recalled Willett from his farm in Reboboth and made him the first mayor of New York City. In the same year he went to Albania (now Albany) to treat with the Iroquois. Again mayor in 1667, he was thereafter on the councils of successive governors. After the confiscation of his property when the Dutch briefly recaptured New York, he retired to Rehoboth. He was a founder of Swansea, Mass., which was set off from Rehoboth in 1668.

WILLETTE, vē'lĕt, **Adolph Léon,** French painter and illustrator: b. Châlons-sur-Marne, France, July 31, 1857; d. Paris, Feb. 4, 1926. As a pupil of Alexandre Cabanel, he made his debut in the Paris salon in 1881 with *The Temptation of St. Anthony* and had other paintings hung, but he turned from salon painting to illustration, contributing under a pen name as well as his own to *Chat Noir, Rire, Triboulet, Boulevard,* and founding *Pierrot* and *Pied-de-Nez.* He worked in lithograph and pastel as well as black and white, and his style was always pleasing and colorful even when gruesome. He carried on the tradition of the 18th century and his Pierrots and Columbines were Montmartre versions of Jean Antoine Watteau.

In 1904 he published *Cent Dessins de Willette* and in 1925 *Au clair de la lune, le Temps des Cerises.*

WILLETT'S POINT, New York, now called Fort Totten (q.v.).

WILLEY, Waitman Thomas, American statesman: b. Monongalia County, Va. (now W. Va.), Oct. 18, 1811; d. Morgantown, W. Va., May 2, 1900. Graduated from Madison College (now Allegheny College), Pennsylvania, in 1831, he studied law and was admitted to the Virginia bar, practicing at Morgantown. He was a Whig delegate to the Virginia Constitutional Convention in 1850, where he supported white manhood suffrage. In 1861 when again a member of the Virginia Convention, he voted against secession, but worked for the eventual division of the state to form the new West Virginia. He was elected to the United States Senate to fill the vacancy caused by the resignation of James M. Mason and secured the passing of the Willey Amendment to bring about the gradual abolition of Negro slavery in the new state.

As he had become a Republican and a supporter of Abraham Lincoln, a Democratic victory in West Virginia ended his public career in 1870.

WILLIAM (full name Friedrich Wilhelm Viktor August Ernst), crown prince of Germany and eldest son of William II, emperor of Germany: b. Potsdam, Germany, May 6, 1882; d. Hechingen, Württemberg-Hohenzollern, July 20, 1951. He had the customary military training of a German prince and attended the University of Bonn. Before his marriage in 1905 his escapades were notorious, but after his alliance with Cecilie Auguste Marie of Mecklenburg-Schwerin, he and his wife became popular social leaders and influential in public affairs. William was often opposed to the kaiser. He liked the English way of life and wrote a book, *From My Hunting Diary,* which showed his taste for sport. However, when World War I broke out he supported his father and was given a position on the general staff with the rank of lieutenant general. In a purely nominal command he failed to carry the victory over the French at Verdun in 1915. After his father's abdication (1918), he renounced the succession and followed him into exile in Holland.

He wrote *Memoirs of the Crown Prince of Germany* (1922) and *Ich suche die Wahrheit* (1925; Eng. tr. by R. Butler, *I Seek the Truth,* 1926), the latter an attempt to refute the accusations of war guilt against Germany.

Allowed to return to his native land in 1923, he took up the Nazi cause with the rise of Adolf Hitler and joined the Nazi motor corps. Although he was not allowed to enlist in the army in 1939, three of his sons did so. At the end of World War II he fled to Austria, where he was captured by the French and allowed to return to Hechingen, living in a villa within sight of his ancient castle.

His second son, Louis Ferdinand, became head of the Hohenzollern family, the eldest son, Wilhelm, having been killed in World War II.

WILLIAM I (called William the Conqueror), king of England and duke of Normandy: b. Falaise, Normandy, 1027 or 1028; d. Rouen, Sept. 9, 1087. Although he was the bastard son of Robert I, duke of Normandy, and Arletta, daughter of a tanner of Falaise, his father, having no legitimate heirs, acknowledged him as his successor. After his father's death (1035), while on crusade, William soon showed his power in defeating the French king, reforming the church, and consolidating his realm of Normandy. The historian John Richard Green says of him, "There never was a moment from his boyhood when he was not among the greatest of men."

Pursuing his claim to the throne of England, he visited England in 1051, where he probably obtained the promise of support from his cousin, King Edward the Confessor, to assure his succession to the crown. About 1053 he married Matilda of Flanders, a direct descendant of Alfred the Great. He also forced Harold, Godwin's son and favorite of the Saxons, to acknowledge his claim (1064). This was not binding without the consent of the national assembly or *witenagemot,* but when Harold was hastily crowned on Edward's death (1066) regardless of William's claims, William began to prepare for the Norman Conquest. A full pictorial account of his preparations may be seen in reproductions of the Bayeux tapestry.

After his victory over Harold at the Battle of Hastings (1066), on a spot now called Battle, he obtained a form of election from the London nobles and was crowned at Westminster Abbey on Christmas Day. See also Great Britain—*History* (Norman Conquest).

He began his rule with mild measures, but returned to Normandy, leaving the land in charge of less politic leaders, and the resultant uprisings led to his return, when he began by

repressing the encroachment of his followers; but on reviving the Danegelt, which had been abolished by Edward the Confessor, the discontents were renewed. These he repressed with his usual vigor, and a temporary calm succeeded. The resistance of two powerful Saxon nobles, Edwin and Morcar, who had formed an alliance with the kings of Scotland and Denmark, and with the prince of North Wales, soon after drew William to the north, where he obliged Malcolm, king of Scotland, to do homage for Cumberland. From this time he treated the English like a conquered people, multiplied confiscations in every quarter, and forced the native nobility to desert the country in great numbers. In 1069 another formidable insurrection broke out in the north, and at the same time the English resumed arms in the eastern and southern counties. William first opposed the storm in the north, and executed such merciless vengeance in his progress that the whole country between York and Durham was turned into a desert; and above 100,000 of both sexes and all ages are said to have perished. There being now scarcely a landed proprietor who had not incurred the forfeiture of rebellion, he put into execution his plan of introducing a total alteration of the state of English law and property, by dividing all the lands into baronies and adopting the feudal system in regard to land tenure and services. He also reduced the ecclesiastical property to a similar system, and, to prevent resistance from the clergy, expelled most of the English church dignitaries, and placed Normans or other foreigners in their stead, Lanfranc being made archbishop. Still further to humble the English, he caused French to be used in the courts of justice and in law proceedings, and ordered it to form a leading part of instruction in all the schools throughout the realm. In 1076 he received a demand from Pope Gregory VII, requiring him to do homage for his kingdom, and to pay the accustomed tribute from England to the Holy See. William denied the homage; nor would he allow the English prelates to attend a general council summoned by Gregory, but consented to the levy of Peter's pence. Toward the end of his reign he instituted that general survey of the landed property of the kingdom, the record of which still exists under the title of 'Domesday Book.' The manner in which he laid waste a large district in Hampshire, where he demolished villages, churches and convents, and expelled the inhabitants for 30 miles round, merely to form the New Forest for hunting, exhibits his indifference to the suffering of his subjects, as well as his love of the chase, which he further protected by a most severe code of game laws. In 1087 he went to war with France, whose king had encouraged a rebellion of Norman nobles, entered the French territory, and committed great ravages, but, by the starting of his horse at Nantes, received an injury which caused his death, at the Abbey of Saint Gervais, near Rouen (1087). He left three sons — Robert, to whom he bequeathed Normandy; William, who inherited England; Henry, who received only his mother's property, and five daughters. William the Conqueror was the most powerful sovereign of his time. He possessed superior talents, both political and martial, and employed them with remarkable vigor and industry. His passions were, however, strong; his ambition severe and merciless; and his love of sway often led him to disregard all restraints of justice and humanity. Consult Lappenberg, 'England under the Anglo-Norman Kings,' translated by Thorpe (1857); Palgrave, 'Normandy and England,' Vol. III (1864); Freeman, 'History of the Norman Conquest of England' (1867–71); Stubbs, 'Constitutional History of England' (1874); Green, 'Conquest of England' (1884); Freeman, 'William the Conqueror' (1888); Round, 'Feudal England' (1895).

WILLIAM II, surnamed Rufus, from his red face, king of England: b. Normandy, 1056; d. New Forest, Hampshire, 2 Aug. 1100. He was the third son of William I and was sent to England by his father the day before the death of the latter with a recommendation to the barons and bishops that he should be the Conqueror's successor. His wishes were respected and William Rufus was crowned at Westminster 26 Sept. 1087. The division of England and Normandy did not, however, please the great barons, who possessed territories in both; and a conspiracy was formed for effecting the deposition of William in favor of his brother Robert; but the conspiracy was repressed with great vigor; the confederate nobles were forced to withdraw to Normandy, and their English estates were confiscated. It is worthy of notice that in this instance a Norman ruler was supported by his English subjects against his Norman ones. Once firmly seated on his throne, William forgot his promises to the English; and the death of Lanfranc, archbishop of Canterbury, freeing him from an authority which he respected, he extended his rapacity to the church, and seized the temporalities of vacant bishoprics and abbeys, to which he delayed appointing successors. In 1090 he made an incursion into Normandy, to retaliate on his brother Robert; but a reconciliation was effected between them. In 1096 Robert mortgaged his dukedom to William for the sum of 10,000 marks to enable him to fit out an expedition and join the crusaders in the Holy Land. William accordingly took possession of Normandy and Maine, although in the case of the latter he was not allowed to do so without a struggle. William Rufus met his death while hunting in the New Forest. His body was found pierced by an arrow, which is generally believed to have been shot, whether accidentally or purposely cannot be said, by a French gentleman named Walter Tyrrel. Tyrrel immediately galloped to the coast, and embarked for France, where he joined the crusaders. The body was interred without ceremony at Winchester. This event took place when the king was in the 44th year of his age, and 13th of his reign. William Rufus possessed vigor, decision and policy, but was violent, perfidious and rapacious. Consult Freeman, 'Norman Conquest of England,' Vol. V (1876), and his 'Reign of William Rufus' (1882).

WILLIAM III, king of England and hereditary stadtholder of Holland: b. The Hague, 4 Nov. 1650; d. Kensington, England, 8 March 1702. He was the son of William II of Nassau, prince of Orange, and his mother was Henrietta Mary Stuart, daughter of Charles I of Eng-

land. Educated by the grand pensionary, John De Witt, he gained the love of the people, who in 1672, when Louis XIV invaded the republic, appointed him at once captain-general, grand-admiral and stadtholder of the United Provinces, after enforcing the abrogation of a resolution which De Witt had got passed in 1667, and which declared that in future no captain-general should at the same time be stadtholder. William's management of the war against France was masterly. In the campaign of 1673 he opened the sluices in the dikes around Amsterdam, inundating the whole of the neighboring district and forcing the French to retire. He was able to keep the enemy in check, and by his policy engaged the empire, Spain and Brandenburg to take part with Holland, so that at the Peace of Nijmegen in 1678 the integrity of Holland was respected. William's whole policy was directed against Louis XIV, for whom he entertained a personal hatred, and to curb the ambition of the French monarch he instituted the league of Augsburg, July 1686, between the emperor, Spain, Sweden and Holland, to which Denmark and some German princes also acceded. His wife, Mary, whom he had married in 1677, was the daughter of James II of England, and presumptive heiress to the throne. Unexpectedly James' second wife gave birth to a son, 10 June 1688, and the greater part of the Parliament and of the nation now feared that the bigoted James would introduce Roman Catholicism as the state religion and subvert the constitution. Rumor also asserted that the prince was supposititious. The Episcopalians and Presbyterians in England, under these circumstances, united, in order, by the aid of Holland, to give Mary the succession to the throne. William foreseeing that England, by the policy of his father-in-law, would become more and more closely connected with France, joined with the great majority of the British nation; and the pensionary Fagel persuaded the States-General to support him with ships and troops for the preservation of British freedom and the Protestant religion. William arrived suddenly at Torbay, 5 Nov. 1688, with a fleet of 500 sail, ostensibly equipped against France, and with 14,000 troops. Upon his landing a great part of the nobility immediately declared for him; and James' soldiers by degrees went over to him. In December the king fled with his family to France, after which William made his entry into London. The two houses of Parliament in convention now declared that James II had broken the fundamental compact between the king and the people, and by withdrawing from the kingdom had abdicated the government. On 13 Feb. 1689 Mary was proclaimed queen, and William, her husband, who had meanwhile gone over to the English Church, was proclaimed king. At the same time the declaration or bill of rights settled the limits of the royal power and the order of succession. Scotland followed England's example; but in Ireland, whither Louis XIV sent James with an army, the majority of the Roman Catholics maintained the cause of the deposed king. But William's victories over the army of James on the Boyne, 1 July 1690, and at Aughrim, 13 July 1691, assisted by the clemency with which he treated the vanquished party, made him master of Ireland. In the war on the Continent he was less successful. At Steinkirk he was defeated by Marshal Luxembourg in 1692 and at Neerwinden by the same general in 1693; but always succeeded in wresting from the French the fruits of their victories by skilful retreats and marches. Louis was finally compelled to acknowledge him as king of England at the Peace of Ryswick in 1697. The Parliament insisted at that time on the disbanding of nearly the whole army, deeming a standing army incompatible with the security of the constitution. Soon after, the will of Charles II of Spain, who had made the grandson of Louis XIV his heir, induced William to arm all Europe against Louis in the great alliance of The Hague 7 Sept. 1701. But in the midst of these projects he broke his collar-bone by a fall from his horse between Kensington and Hampton Court, 21 Feb. 1702, and died in consequence of the accident. His wife, Mary, had already died childless in 1694. William's manners were too cold and ungracious to allow him to be popular with the English people. Under a reserved exterior he concealed a strong love of renown and power, and to obtain the majority of votes in Parliament made use of bribery. Immersed in politics and war, he had neither leisure nor inclination for literature and art. In conversation he was grave and unattractive; but in business, penetrating, quick and decided; in danger, undaunted; in difficulties, unshaken; in war, bold without ostentation. Consult Burnet, 'History of His Own Times'; Trevor, 'Life and Times of William III' (1835); Macaulay, 'History of England'; Hallam, 'Constitutional History'; Ranke, 'History of England' (1875); Traill, 'William III' (1888); Hippold, 'William III, Prince von Oranien, Erbstatthalter von Holland, König von England' (1900); Lodge, R., 'History of England' (1910).

WILLIAM IV, king of Great Britain and Ireland, third son of George III; b. 21 Aug. 1765; d. Windsor, 20 June 1837. From 1779 to 1790 he served in the navy, and after quitting active service was raised successively to all the higher grades of naval command, becoming in 1801 admiral of the fleet. In 1789 he was raised to the peerage with the title of Duke of Clarence. He frequently spoke in the House of Lords, and held the office of lord high-admiral (1827–28). He became heir presumptive to the throne in 1827 and succeeded his brother George IV as king 26 June 1830. On his accession he retained the ministers then in office with assurances of his confidence in their zeal and ability. In the new Parliament, which met in November, the ministry, being left in a minority on a motion of Sir H. Parnell for referring the civil list to a select committee, immediately sent in their resignation; and a Whig administration was formed with Earl Grey at its head. The great events which render his reign memorable are the passage of the reform act, the abolition of slavery in the colonies and the reform of the poor laws. William IV married in July 1818 Adelaide, sister of the Duke of Saxe-Meiningen, by whom he had no surviving children. He had, however, a large family by Mrs. Jordan, the celebrated actress, who was for many years his mistress, while Duke of Clarence. Her liaison with the duke lasted from about 1790 till 1811, when an arrangement was

made by which she and her family were provided for. William IV was succeeded by his niece Victoria. Consult Fitzgerald, 'Life and Times of William IV' (1884); Walpole, 'History of England from the Conclusion of the Great War in 1815' (1878–86); Malloy, J. F., 'The Sailor King, William IV' (1903).

WILLIAM I, or **WILHELM I,** emperor of Germany and 7th king of Prussia: b. Berlin, 22 March 1797; d. there, 9 March 1888. He was the second son of Frederick William III and Louisa of Mecklenburg Strelitz, and from his earliest years was trained in military exercises. In the campaign of 1813–14 he joined the Prussian forces as captain, receiving then, for his bravery in the field, the «Cross of Saint George» from the Tsar Alexander. On the death of his father in 1840 he became heir presumptive to the throne, and received the title of Prince of Prussia. On the outbreak of the revolution in 1848 he left Berlin for England, but was soon recalled and in the following year proceeded against the insurgents with military vigor and suppressed the insurrection in Baden and the Palatinate. His brother having become incapable of ruling William (1857) was appointed regent, and in January 1861 became king, being crowned at Königsberg in October of the same year. With the assistance of Otto von Bismarck (q.v.) as president of the Cabinet and Von Roon as War Minister, he demanded from the nation a large scheme of army reform, and his foresight in this matter was justified by the Prussian success in the war with Denmark (1864) and the complete overthrow of Austria at Sadowa (1866). The latter war had been brought about by the diplomacy of Bismarck, who now proceeded to form a North-German Confederation with King William as its head, and to conclude a treaty of alliance, offensive and defensive, with the South German States. This growing power of Prussia provoked the jealousy of France, and a crisis was reached in the negotiations concerning the Spanish crown. War was proclaimed between Prussia and France (1870), and the South-German States having declared in favor of the former, King William led the combined German forces through the campaign, which resulted in the defeat of Napoleon at Sedan, and finally in the siege and capitulation of Paris. Meanwhile the North-German Parliament, uniting with the German princes, desired the king to become German emperor. This honor he accepted, and he was crowned as Emperor William I at Versailles on 18 Jan. 1871. After the conclusion of peace with France, and having entered Paris with his army, the emperor returned to Berlin amid great enthusiasm. The latter part of his reign was passed in consolidating the power of the new German empire, and in parliamentary and political conflicts with the Catholic, Liberal and Socialist parties in the state. (See GERMANY). His life was attempted several times. Among biographies are those of Forbes (1888); Smith, G. B., (1887); Strauss (1887); Simon (French, 1887, Eng. trans.); Marcks, 'Kaiser Wilhelm I' (1899). Consult also Von Sybel, 'Die Begründung des Deutschen Reichs' (1889–94; Eng. trans. 1890–92); Malleson, 'Refounding of the German Empire' (1892); Krause, 'Growth of German Unity' (1892); Oncken, 'Das Zeitalter des Kaisers Wilhelm' (1890–92); Blume, 'Kaiser Wilhelm' (Berlin 1906); Delbruech, F., 'Die Jugend William I' (Berlin 1907).

WILLIAM II (Friedrich Wilhelm Victor Albert), ex-German emperor and king of Prussia, commonly called Kaiser Wilhelm, son of Frederick III and Victoria, Princess Royal of Great Britain: b. Berlin, 27 Jan. 1859; d. Doorn, Netherlands, 4 June 1941. At birth he suffered an injury of the left arm which would have disqualified a private person for the army, but nevertheless he received a thorough military education. In 1869 he was enrolled in the army as second lieutenant, in 1874 entered the gymnasium at Cassel, and three years later, as first lieutenant, was admitted to the University of Bonn, where he remained until 1879, his principal studies being political science and law. He married (27 Feb. 1881) Princess Victoria of Schleswig-Holstein-Sonderburg-Augustenburg, and they had issue: six sons and a daughter.

In 1880 William entered the army to which he devoted himself with all earnestness, and in 1885 became colonel of the Hussars of the Guard. In spite of his physical defect he was soon one of the most capable and dashing officers in the army. He also dabbled in literature and art, which he pursued in various directions. Strengthened by physical culture and the diversions of hunting and other sports in which he excelled, he came to the throne (15 June 1888) well trained in mind, inured to exacting labors and filled with self-reliance and enthusiasm. Statecraft he had learned in the school of Bismarck (q.v.), and his political and personal ideals were imbued with veneration for his grandfather, whose conviction of «divine right» he embodied in his own view of the imperial office. His personal aggressiveness and military methods gave rise to popular fear of indiscretions whereby he might endanger the peace of Germany and of the world, but he vigorously repelled those suspicions of his motives which led to his designation as the «War-lord.» Quite early in his reign Gladstone expressed a fear of what might happen through the young kaiser's indiscretions, but the warning was largely unheeded. During the mortal illness of his father when crown prince, William was called upon to repudiate a charge of conspiracy to keep him from the throne; his own behavior in the three months of his father's reign betrayed no want of filial devotion. Upon his father's death his attitude toward his mother was the subject of much criticism, but on his accession William at once asserted his ideas of personal rulership, which he maintained in theory, and in practice relaxed only in submission to demands of policy. After he had been on the throne two or three years, there were 1,800 Germans in confinement for *lèse majesté,* many of whom had been guilty of most trifling indiscretions in speaking of the young kaiser. This created scandal, and William became aware that it was a bad policy and the law was relaxed. The kaiser soon actively concerned himself with every department of German life, and his personal sway was qualified only by the limitations of the constitution and of public opinion. By travel, in which he visited all the principal capitals of Europe, he familiarized himself with inter-

national affairs and became an expert in world-politics. When Moltke died the emperor declared that he had «lost an army,» but when he quarreled with Bismarck he showed no misgivings at the loss of the masterful chancellor and reputed creator of the empire, whose retirement he virtually compelled in March 1890. By this act, cleverly characterized by his critics as «dropping the pilot,» he made himself more distinctly master of the ship of state. He had evidently begun to have confidence in his own powers and judgment. His able chancellors—Caprivi, Hohenlohe, Bulow—were compliant to the imperial will. Shortly before Bismarck's death the emperor sought reconciliation, and their friendship was partially restored. In some things, notably in maintaining the Triple Alliance, the emperor followed the policy of Bismarck. William measured his strength against all liberalizing parties, and his early solicitude for the laboring classes latterly seemed lost in his bitter antagonism to socialistic elements. Bismarck's *kulturkampf* legacy William sagaciously disposed of through concessions which he turned to profit by making an implicit alliance of the Vatican and the German schools in his anti-revolutionary policies and by remodeling the schools themselves.

With all his alleged autocratic tendencies William undoubtedly sought the aggrandizement of Germany, her industrial and commercial supremacy, colonial expansion and primacy among the great powers. He extended the imperial influence to Turkey and Asia Minor, and strengthened German interests in the Far East and in Africa and South America. He held the press to a strict account; the army and navy, which he would make superior to all others, he kept in strong control. For many years his attitude indicated no menace, rather a promise of protection to the cause of peace, which on more than one occasion he doubtless aided in preserving. Herein his conduct was less aggressive than many of the speeches in which he addressed himself through Germany to the world. The sending of his brother, Prince Henry of Prussia, to the United States, in 1902, did much to promote friendly sentiment and to cover up the unpleasantness aroused in America over the suspicious conduct of the German naval vessels at Manila Bay when Admiral Dewey opened the battle there with the forces of Spain in May 1898.

Notwithstanding William's general good conduct, his occasional outbursts of ambition, and his persistence in building up the army and navy, constantly aroused suspicions of his intentions. From 1895 to 1908 he was continually at war with the Reichstag over the development of naval power. He kept demanding and he got larger and larger appropriations for battleships. He developed the Heligoland stronghold and the Kiel Canal, and managed things so that the Baltic was virtually a German lake. He developed what up to that time was the greatest war machine the world had ever known, but when it was defeated in the World War, he abdicated the throne on 9 Nov. 1918, took refuge in Holland, and bought an estate at Doorn. The death of his wife occurred 11 April 1921 and on 5 Nov. 1922 he married Hermine Schoenaish-Carolath, Princess of Reuss.

To dismiss William II as at one time «the most hated man in the world» is to ignore the fact that he was for a generation one of the most powerful figures in Europe, and that he owed his power largely to the force of his own personality. On his shoulders was placed the blame for World War I. We know better now—that he was an accomplice rather than a war instigator, that he was not the architect of the war that many of his enemies charged. The concentration of blame and hate on him was in a sense the personalization of Germany's role. More nearly accurate is the estimate of his one-time chancellor and close friend, Prince Bernhardt von Bulow, that in peace the Kaiser was a war lord, in war he evaded making decisions, and in defeat he fled. His failure was greater by far than the failure of his country. His was a career marred by blunders. Beginning with the dismissal of the Iron Chancellor, Prince von Bismarck, the greatest statesman of modern Germany, it ended with the flight to Holland in November 1918. The years that intervened until his death in exile in June 1941 were in effect so many years in prison. History is unlikely to add much to the picture of his true character beyond what was known at the time of his death. The late Theodore Roosevelt, in a letter to Sir George Trevelyan, the English historian, referred to William's «curious combination of power, energy, egotism and restless desire to do, and to seem to do, things.» Count Eulenberg, an intimate of the Emperor, warned Prince von Bulow when first the prince became closely associated with the Kaiser, that William «wants to shine and to do and decide everything himself. He loves glory, and is ambitious and jealous.» Von Bulow himself stressed the Emperor's impulsiveness, restlessness and love of posing. He described him as a «highly gifted, likable man, who as a ruler was so inclined to false logic, exaggeration and illusion.» And again, he spoke of him as having «an open mind, but one who would never concentrate; a quick, but superficial intelligence; a natural manner, but no tact, with, at times, a lack of dignity.»

As an emperor William failed. It would be interesting to know what he thought of Hitler, the man who succeeded beyond even the wildest dreams of William and his military advisers. In the first World War only the maddest pan-Germans conjured up a picture of all Europe under the German heel. If William II learned in exile to divorce his ego from world events, he may have died happy in the knowledge that another man had had better luck than he in making Germany the master of Europe. But there must have been bitterness in the knowledge that it was an upstart—a «nobody»—who led Germany to victory, whereas the all-highest, the Emperor, the King who looked upon himself as greater than all other kings, had fled when his defeated troops threatened to revolt. The war lord saved his skin, but lost his honor. For this, as much as anything else, he goes down in history as one of the least, if not the last, of the Hohenzollerns.

Bibliography.—Consult Bigelow, 'The German Emperor' (1889); Meister, 'Kaiser Wilhelm II' (1894); Gauss, 'The German Emperor, His Public Utterances' (1915); Davis, 'The Kaiser as I Knew Him' (1916); Bentinck, 'The Ex-Kaiser in Exile' (1921); the Kaiser's

Memoirs, by himself (1922); Beaumont, M., 'Fall of the Kaiser' (1931); Ludwig, E., 'Wilhelm **Hohenzollern**, the Last of Kaisers' (1932); **Nowak, K.** F., 'Kaiser and Chancellor' (1930); Viereck, G. S., 'Kaiser on Trial' (1937); Waters, W. H. H., 'Potsdam and Doorn' (1935); and Zedlitz-Trutzchler, R., 'Twelve Years at the Imperial German Court' (1924). See GERMANY; WAR, EUROPEAN.

WILLIAM I, prince of Orange, count of Nassau, surnamed the SILENT: b. Castle of Dillenburg, Nassau, 16 April 1533; d. Delft, Holland, 10 July 1584. He was the eldest son of William, count of Nassau, and Juliana, countess of Stolberg, and was educated in the Roman Catholic faith by Maria, queen of Hungary, sister of Charles V. He spent nine years in attendance on the person of the emperor, who had so high an esteem for his spirit, prudence and intelligence that he asked his opinion respecting the most important matters, and when he was but 22 entrusted him with the chief command of the army in the Netherlands, in the absence of Philibert, duke of Savoy. He also recommended him to his successor, Philip II, who regarded him with distrust. As Cardinal Granvella had now the entire confidence of Philip, and Margaret of Parma, who was charged with the government of the Netherlands, was obliged to do whatever Granvella suggested, especially with respect to the introduction of the Spanish inquisition, and the erection of new bishoprics, the Count of Egmont, the Prince of Orange and the Count of Horn represented to the king in writing, that unless the cardinal were speedily recalled his violence would drive the country to rebellion. Though Philip looked on this step as treason, he concealed his anger, and recalled the cardinal (1564). After the remonstrance offered in 1566 by 300 noblemen (the Gueux), with Count Louis of Nassau, the brother of William, at their head, against the introduction of the Inquisition and the establishment of new bishoprics, had been rejected and the Duke of Alva had been appointed governor of the Netherlands, William had a meeting with Egmont, Horn, his brother Louis and others at Dendermond, to deliberate on the means of averting the threatening danger. The majority advised an armed resistance, but this proposal came to nothing on account of the opposition of the Count of Egmont. The prince with his family now went to his castle at Dillenburg. Alva arrived in the Netherlands in 1567 and many men of consequence, including Egmont and Horn, were immediately arrested. In the beginning of 1568 he caused the prince and others, who had retired from the country, to be summoned before the Council of Twelve. The prince did not appear, in consequence of which Alva declared him an outlaw, confiscated his property and removed his son Philip William, from the University of Louvain, and sent him as a hostage to Spain. The Prince of Orange now determined on waging war against Alva. In a document issued in the summer of 1568, and called his «justification,» he gave the reasons for his conduct and publicly professed the Protestant religion. In consequence of this he received aid in money and troops from several Protestant princes. William now raised an army of 24,000 Germans, who were joined by 4,000 French soldiers, conducted his forces with great skill across the Rhine and Meuse, entered Brabant and defeated a division of the hostile army but was unable to bring the Duke of Alva, who threw himself into the fortresses, to an engagement, or to excite the people, who feared the Spaniards, to a general insurrection. His army now dispersed. He then took part in an expedition to France against the Catholic party of the Guises (1569). In France Admiral Coligny had advised him to fit out privateers against the Spanish, and establish himself particularly in Zealand and Holland, from which the Spaniards would hardly be able to drive him. The prince followed this advice, and the privateers made themselves masters, in 1572, of the town and harbor of Briel, on the island of Voorn and also took Flushing. As Alva's tyranny became more intolerable and the people were exasperated by new exactions, several cities of Holland, Zealand, Overijssel and Gelderland publicly declared for the Prince of Orange. Relying on the assistance of France, which Admiral Coligny had promised to obtain for him, William crossed the Rhine, but the news of the massacre of Saint Bartholomew deprived him for the time of all hope of French aid. He then retired into the province of Holland, which steadfastly supported him. He now resumed negotiations with France and obtained a treaty in which France promised to support him, provided that it should receive the protectorate over all the provinces of the Netherlands, which he succeeded in wresting from the Spaniards. At the end of 1573 Alva was recalled and replaced by Requesens. In 1574 Louis and Henry of Nassau, William's brothers, made an effort to join him, but were totally defeated by Requesens at Mookerheide, near Nijmegen. Both of William's brothers fell on the field of battle. This blow was compensated by the relief of Leyden, at that time hard pressed by the enemy. The raising of the siege of Leyden saved the province of Holland for the time, but the Spanish were still formidable, and Holland might have been completely crushed had it not been for the death of Requesens, which took place in March 1576. After this event William succeeded in bringing about the so-called pacification of Ghent (8 Nov. 1576), in which nearly all the provinces of the Low Countries united to expel the foreign troops, and promised mutual toleration in matters of religion. The new stadtholder, John of Austria, sought to break the force of the union by granting, in the perpetual edict, almost all the demands of the people (1577), but his conduct soon manifested his insincerity and the states of Antwerp then called the Prince of Orange to their aid. The people received him with acclamations in Brussels, and he was appointed to the rank of lieutenant-general. The war was now renewed and by the victory at Gemblours in the end of January 1578, the Spaniards recovered their superiority in the Walloon provinces, which were zealously Catholic. In 1579 Don John of Austria died, and the king appointed Alexander Farnese of Parma as his successor. The policy of Farnese

succeeded in gaining over to the king the southern provinces and the prince, therefore, brought the five northern provinces, Holland, Zealand, Utrecht, Gelderland and Friesland, into closer connection by the union of Utrecht, 23 Jan. 1579 and thus laid the foundation of the republic of the United Netherlands. In 1580 the king, finding it impossible to triumph over William by fair means, put a price upon his head. This step induced the united provinces to renounce their allegiance to Philip, and William was offered the dignity of sovereign count of Holland and Zealand, which he accepted. But the edict of Philip proclaiming a reward for his life was not without effect. In 1582 an attempt was made by a Spaniard named Jaureguy to assassinate him at Antwerp, and a second attempt made at Delft on 10 July 1584, by a Burgundian fanatic, Balthasar Gerard, succeeded. William of Nassau was four times married. Maurice of Nassau, who distinguished himself as a general in the Thirty Years' War, was one of his sons and William III of England, a grandson. Consult Gachard, 'Correspondance de Guillaume le Taciturne' (1847–66); Motley, 'The Rise of the Dutch Republic' (1856); Klose, 'William I von Oranien' (1864); Juste, 'Guillaume le Taciturne d'après sa Correspondance et ses Papiers d'Etat' (1873); Putnam, 'William the Silent, Founder of the Dutch Republic' (1895); Frederic Harrison 'William the Silent' (1897); and 'Cambridge Modern History' (Vol. III).

WILLIAM I, Frederick, king of the Netherlands, grand duke of Luxemburg, prince of Orange and duke of Nassau: b. The Hague, 24 Aug. 1772; d. Berlin, 12 Dec. 1843. He was the eldest son of William V, Prince of Orange-Nassau, and was married to Frederike Luise Wilhelmine, daughter of Frederick William II of Prussia in 1791. He distinguished himself in the wars with the French republic, and became an exile with his father, the hereditary stadtholder of the Dutch republic, in 1795, and for several years lived at Fulda. After his father's death, in 1806, he succeeded to the duchy of Nassau and joining the Prussian army against Napoleon was captured at Jena and his possessions confiscated. Released soon afterward he fought against the French at Wagram. At the Congress of Vienna the kingdom of the Netherlands was formed composed of Holland and Belgium and 16 March 1815 William I was proclaimed king. His hereditary estates having been given to Prussia and Nassau, he received in exchange the grand duchy of Luxemburg. Belgium was, however, separated from Holland by the revolution of 1830, and as William was unwilling to recognize its existence as an independent state, he became unpopular. He continued to protest up to 1839, and the next year abdicated in favor of his son, retiring to Berlin at the same time with an immense fortune.

WILLIAM II, Frederick George Louis, king of the Netherlands: b. The Hague, 2 Dec. 1792; d. 17 March 1849. He was the eldest son of the preceding monarch; distinguished himself in the Peninsular War under Lord Wellington, and also commanded the army of the Netherlands at the battle of Waterloo. In 1816 he was married to the grand duchess Anna Paulovna, sister of Alexander I of Russia. His reign began at his father's abdication in 1840, but although he brought order out of the financial chaos caused by his father, he was by nature opposed to political reform. In 1848 events obliged him to consent to an entire reorganization of the government, but his death took place before the new constitution could go into effect.

WILLIAM III, Alexander Paul Frederick, king of the Netherlands: b. The Hague, 19 Feb. 1817; d. Loo, 23 Nov. 1890. He was the eldest son of the preceding monarch and his reign was chiefly distinguished by undertakings for internal improvement. Under his rule, the kingdom enjoyed uninterrupted peace and material prosperity. He carried out the parliamentary reforms instituted in 1848 and in 1862 decreed the abolition of slavery in the Dutch West Indies. In 1866 the Dutch province of Limburg, a member of the Germanic Confederation from 1815, was restored to the Netherlands and by the treaty of 11 May 1867, the grand duchy of Luxemburg was declared neutral territory under the sovereignty of the house of Orange-Nassau. While Prince of Orange, he married in 1839, the Princess Sophia Frederica Matilda, daughter of the late King William I, of Würtemberg. They had two sons, William Nicholas Alexander Frederick Charles Henry, Prince of Orange (b. 4 Sept. 1840; d. 11 June 1879), and William Alexander Charles Henry Frederick (b. 25 Aug. 1851; d. 21 June 1884), the last male heir of the house of Orange. In 1879 King William was married to Emma, Princess of Waldeck-Pyrmont, their daughter Wilhelmina becoming heir to the throne.

WILLIAM I, surnamed The Lion, king of Scotland: b. 1143; d. Stirling, 1214. He was a grandson of David I and brother of Malcolm IV, whom he succeeded in 1165. The source of his designation is one of the mysteries of history. His predecessors had long contested with the kings of England the sovereignty of Northumberland and other districts of the north of England, but under Malcolm these claims were virtually abandoned and the king of Scots received, as an equivalent for them, the earldom of Huntingdon and other valuable estates. William still coveted the Northumbrian region and while attending Henry II of England in his wars upon the Continent, is supposed to have asked for a portion of the disputed territory. On being refused he invaded the district after the example of his ancestors, but on 13 July 1174 fell into the hands of the English. For security he was conveyed to Normandy, and there consented, as the price of his liberation, to perform that homage for his kingdom which the English kings so long vainly required from the government of Scotland. The treaty of Falaise, as the arrangement was termed, from the place of its adjustment, was revoked in 1189 by Richard I of England in consideration of a payment of 10,000 marks, needed for his expedition to Palestine. William had several disputes with the Church, but was one of the early benefactors of the regular ecclesiastics,

and founded in 1178 the great abbey of Arbroath, which he dedicated to Saint Thomas a Becket.

WILLIAM IX, Duke of Aquitaine and Count of Poitou, the first great Provençal poet: b. 1071; d. 1127. He appears to have led a very licentious life, which is constantly reflected in his poems. His poetical work is of special interest as it stands at the beginning of the Classical period in Provençal literature, and marks the transition from the popular minstrel ballads to the more Classical and arbitrary literature of the courts of the several Provençal principalities. Much of the work of William of Aquitaine is very close to the popular poetry that he must have found existing in the south of France when he began to write. One of his poems — a romance of licentious adventure, probably quite in the style of the approved poetry of his time — shows special signs of being close, not only to the popular ballad, but bears imprinted upon it the stamp of the loose manners and customs of the age in which it was written. In his poetry there is already developed the stereotyped poem describing the devotion of the knight to his lady. So assured is this form even at this early day, in the mouth of one who, on his own confession, was true to no lady, that it would seem as if it must have already existed long enough to have acquired a set form and character. But the disappearance of practically all the Provençal poetry of the time preceding the practical activity of William of Aquitaine, has obliterated the record of the past upon which he undoubtedly builded. William of Aquitaine led a very active life, most of which was taken up with wars against the neighboring rulers. He led a plundering expedition into Normandy and conquered Toulouse. But his greatest exploit was the crusade of the year 1100, on which he started out for Palestine with an army of 60,000. He reached Jerusalem, but was finally defeated and forced to flee with a handful of followers. On the way back he was shipwrecked; so that it was over three years before he reached home. Notwithstanding this religious expedition William quarreled with the Church, defied the papal authority and was twice excommunicated. A poem written toward the close of his life, however, expresses repentance for his sins and his ecclesiastical attitude and repentance. In it he vows the renunciation of all worldly pleasures and the dedication of himself to the service of God. It seems probable, in view of what is known of his life, that his execution was not equal to the facility of his poetical expression. Consult Holland and Kellar for an incomplete edition of his works (1850); Sachse, 'Uber das Leben und die Lieder des Troubadours Wilhelm IX Graf von Poitou' (Leipzig 1882).

WILLIAM OF LORRIS, French poet: b. about 1212. His chief fame rests on the 'Romance of the Rose' of which he wrote the first 4,000 verses. This is a long allegorical poem written in 1237, but left unfinished by the author who is supposed to have died young. It has been said that the 'Romance of the Rose' is a sort of art of love. At any rate it was the forerunner of a kind of literature which became very popular in France and continued to exercise its influence for a considerable length of time there and in most of the Latin and Germanic countries of Europe. His work is among the best and most original of his age; but the rhetorical figures and allegories which were its most distinguishing feature were seized upon by subsequent writers, imitators of the 'Romance of the Rose,' and the result was a very extensive and popular literature which tended to grow more and more untrue to nature, art and correct literary expression. See 'Romance of the Rose.' Consult Jarry, L., 'Guillaume de Lorris et le testament d'Alphonse de Poitiers' (Orleans 1881); Langlois, E., 'Origines et Sources du Roman de la Rose' (Paris 1891); Paulin, 'Histoire Littéraire de la France' (Paris).

WILLIAM OF MALMSBURY, mämz'bër'ĭ, English historian: b. probably in Somersetshire, about 1070; d. Malmsbury, Wiltshire, about 1143. He was educated at the Benedictine Abbey of Malmsbury of which he subsequently became librarian and precentor, and from which his name is derived. His works are in Latin and are of great historical value. They include 'De Gestis Regum Anglorum,' a general history of the kings of England from 449 to 1128; 'Historia Novella,' containing the narration to 1142; 'De Gestis Pontificum Anglorum,' an ecclesiastical history of England down to 1123; 'Vita S. Dunstani'; 'Vita S. Wulfstani,' etc. The best edition of his English and Church histories is that of Stubbs in the Rolls Series (1887–88). Consult Birch, 'Life and Writings of William of Malmsbury' (1874); Stubbs' Prefaces in the Rolls Series; Norgate, 'England Under the Angevin Kings,' Vol. I (1887).

WILLIAM OF NEWBURGH, English chronicler: b. Bridlington, Yorkshire, about 1136; d. Newburgh, near Coxwold, Yorkshire, about 1198. He was educated, lived all his life, and died in the Augustinian Abbey of Newburgh. He is one of the chief authorities for the reign of Henry II. His 'Historia Rerum Anglicarum' covers the period from 1066–98, is written in five books, and is highly valuable as a broadminded, just and clear presentation of the happenings of the times, though his statements are not always accurate. His other works consist of three sermons. Consult Howlett in the Rolls Series, 'Chronicles of Stephen, Henry II and Richard I' (1884).

WILLIAM OF NORMANDY (The Clerc), a French poet of the first half of the 13th century. He wrote principally moral poems and religious legends and traditions. There has been much strife among critics as to just what poems of those attributed to him were really written by him. Among his surviving poems about which there does not seem to be any reasonable doubt, are 'Le Bestiaire divin' (edited by Hippeau in 1852; and by Reinsch 1890); 'Le Besant de Dieu' (edited by Hippeau, 1852; by Martin, 1879); 'Les Joies Notre-Dame' (edited by Reinsch, 1879); 'Sainte Madeleine' (edited by Schmidt, 1880); 'Tobie' (edited by Schmidt, 1880), and 'Le Roman des Romans.' Among the poems which have been attributed to him by some critics and editors, a verdict strongly contested by others, are cer-

tain fables and 'Fergus.' Consult Mann, 'Der Bestiaire divin des Guillaume le Clerc' (in 'Französische Studien,' 1889); Schmidt, 'Guillaume le Clerc de Normandie im besondere seine Magdalenenlegende' (in Romanische Studien, 1880); Seeger, 'Ueber die Sprache des Guillaume le Clerc de Normandie' (Halle 1881).

WILLIAM OF TYRE, Syrian historian and archbishop: b. probably in Syria, about 1137; d. about 1184. He was educated at Antioch and Jerusalem, and in 1175 was made archbishop of Tyre. He was one of the six bishops who represented the Latin Church of the East at the Lateran Council in 1179. His 'Historia Rerum in Partibus Transmarines Gestarum' is one of the best histories of mediæval times, and is the principal authority for the history of the Latin kingdom in the East from 1127–84. He also wrote 'Historia de Orientalibus Principibus.'

WILLIAM OF WYKEHAM, wĭk'ăm, English prelate, architect and statesman: b. Wykeham, Hampshire, 1324: d. South Waltham, Hampshire, 24 Sept. 1404. He received a liberal education from the lord of the manor of Wykeham, and was afterward recommended by him to the notice of Edward III, who made him chief keeper and surveyor of the several of the royal castles. He built Windsor Castle, and afterward, taking orders, held various ecclesiastical posts, becoming bishop of Winchester in 1367. He was lord chancellor of England 1367–71, founded in 1373 a grammar school at Winchester, which still exists as Winchester College, and New College, Oxford, which he completed in 1386. He was lord chancellor for the second time 1389–91 and rebuilt the nave of Winchester Cathedral in the Third Pointed manner 1395–1405. He is buried in a magnificent chantry chapel in the south arcade of the nave at Winchester. Consult 'Three Chancellors' (1860); and 'Lives,' by Lowth (1758), and Moberly (1887).

WILLIAM HENRY, Fort, in the town of Caldwell, N. Y., at the head of Lake George (q.v.). In August 1757, it was taken from the English by a force of French and Indians under Montcalm.

WILLIAM JEWELL COLLEGE, located in Liberty, a suburb of Kansas City, Mo. It was founded in 1849 by the Baptists of Missouri; Dr. William Jewell of Columbia, Mo., was one of the leaders in the movement for the establishment of the college, and contributed $10,000 in lands toward the endowment, hence the college was named for him. It was opened to students in 1850, and on account of financial difficulties was closed in 1855–57; just as the college was becoming prosperous, the Civil War again forced the work to suspend from 1861 to 1868; for a part of that time the building was occupied by the Federal troops. Since 1877 the plant value has been raised to over $900,000. The college offers four courses or groups, leading to the degree of A.B. Some studies are required in all groups, and some are free electives. The curriculum includes several thelogical courses, completion of which by arrangement with the Southern Baptist Theological Seminary at Louisville, Ky., entitles the student to credit at that seminary. The degree of A.M. is no longer conferred. There are two-year pre-medical, pre-legal, pre-engineering, and also pre-commerce special courses. A college band and a college orchestra are maintained. There are 44 scholarships. The student organizations include four literary societies, Philharmonic (a musical society), a Young Men's Christian Association and missionary societies. The buildings include Jewell (the original building), Vardeman, Brown, Wornall, Ely, Gano (chapel) and Melrose Halls, the Cottages, and the gymnasium. The library contains 40,000 volumes; the students average 400, and the faculty 27, while the productive funds total $1,242,000.

WILLIAM AND MARY COLLEGE, located at Williamsburg, Va., the second oldest college in the United States. Established in 1693, it successfully concluded the third attempt to found a college in Virginia. Rev. James Blair was commissioned in 1691 by the general assembly of Virginia to go to England to petition for a charter for a college from Their Majesties, William and Mary, for whom the college was named. Its purpose, as stated in the charter signed 8 Feb. 1693, was to furnish the church of Virginia with a seminary of ministers, to educate youth piously in good letters and manners, and to propagate Christian faith among the Indians. The college was granted a coat of arms by the college of heralds. Certain lands, a duty on exports of tobacco, and other funds were liberally appropriated for its use. Blair was appointed its first president and he held office 50 years; during this time the college organized all departments required in its charter and secured a full faculty consisting of president, six professors, usher, and writing-master. Through a bequest in the will of the scientist, Hon. Robert Boyle, Blair realized funds with which the college conducted an Indian school. Under Jefferson's guidance the college became a university in 1779 by discontinuing its grammar and divinity schools and creating schools of medicine, law, and modern languages. Ther the elective system of study was introduced. During the Revolution, the college lost a large part of its endowment and its buildings were occupied by British, French, and American troops. Martial activity in the vicinity necessitated closing the college for a short time in 1781. Throughout the Civil War no classes were held, for the entire faculty and about 90 per cent of the students enlisted in the Confederate service. Occupancy by Federal troops did great and unnecessary damage to its property; Congress in 1893 partially reimbursed the college for this. Reopening in 1865 under extreme financial difficulties, the college was forced to close again in 1881. Seven years later it resumed operation by aid of an annual appropriation of $10,000 granted it by the Virginia legislature upon condition that the college include a course of normal instruction in its curriculum. In 1906 it was transferred to the State becoming an important unit of the Virginia educational system; in 1918 the college was made co-educational. It is now a liberal arts college of 1,300 students; its faculty numbers 100 regular professors and instructors and 20 special lecturers and supervisors; its library has 140,000 vols. and 260,000 Virginia historical manuscripts; its physical property is valued at $4,500,000; and the state grant is now $230,000 annually. In 1925 the college took over the Richmond School of Social Work and Public Health, the oldest

school of its kind in the South, which it now directs as the Richmond Professional Institute of the college. In 1930 the Norfolk division of the college was opened as a day school offering two years of academic work. Each of these schools has about 400 students. The college also offers extension classes in several nearby Virginia cities. Although the original college structure, called the Sir Christopher Wren building in honor of its architect, has suffered three fires, its walls have always remained standing. The general assembly met in it from 1700 to 1705, before the Williamsburg capitol was completed, and again, for a few years, after the capitol burned in 1747. This, the oldest academic building in the United States, together with the president's house and Brafferton hall, the Indian school, have been restored to their colonial appearance through the munificence of John D. Rockefeller, Jr. The influence of William and Mary has always been felt in State and national history. Its alumni include three presidents of the United States: Jefferson, Monroe, and Tyler; and other great men: Richard Bland, George Wythe; Peyton, Edmund, and John Randolph; John Marshall, Carter Henry and Benjamin Harrison; Winfield Scott, Thomas R. Dew, Edmund Ruffin, and William B. Rogers. George Washington served as college chancellor from 1788 until his death. F.H.C. society, a secret fraternity, and Phi Beta Kappa, the intercollegiate honorary fraternity, were founded at the college in 1750 and 1776 respectively. The college was the first in the United States to use the honor system and to confer medallic prizes for scholarship. Julian Alvin Carroll Chandler was president of the college from 1919 until his death in 1934.

JOHN STEWART BRYAN,
President.

WILLIAM PENN CHARTER SCHOOL, a secondary day school for boys, located at Philadelphia. In 1683 the governor and council of the province engaged a schoolmaster (Enoch Flower) for "the instruction of the youth" of Philadelphia; from this grew the Charter School, founded in 1689 and incorporated in 1698 by the council and lieutenant-governor as "the public school founded in Philadelphia at the request, costs and charges of the people of God called Quakers." Although supported by the Quakers, it was open to all, and for more than 60 years continued to be the only public place for instruction in the province. In 1701 Penn was asked to confirm the lieutenant-governor's charter by one under his own hand and seal. This he did on the same day that he chartered the city itself. The school therefore enjoys, in this regard, a unique distinction. The two subsequent charters issued by Penn, one in 1708 and the other in 1711 (the last the legal one under which the board now works) rendered broader and more far-reaching the measures for the school's future development. The school was entirely emancipated from denominational control, and the title of the corporation changed by omitting the words "at the request, costs and charges of the people of God called Quakers," the title in the final charter standing: "The Overseers of the Public School founded by Charter in the Town and County of Philadelphia in Pennsylvania" (the word "public" being used in the English sense, open to all willing to pay the fees). The school premises are now located in the heart of the city and, taken with the beautiful playing fields in the suburbs presented to the school in 1903, are valued at $250,000; and the scholarship funds amount to about $50,000. It is purely a day college preparatory school for boys, and has for years been famed for both its high standard of scholarship and the intelligent care devoted to physical training. The students have long numbered over 500, it being the largest boys' day school of its class in the United States. Its attendance is not confined to residents of Philadelphia.

WILLIAM TELL. See WILHELM TELL.

WILLIAMS, Alpheus Starkey, American soldier: b. Saybrook, Conn., 20 Sept. 1810; d. Washington, D. C., 21 Dec. 1878. Graduated from Yale in 1831, he studied in the law school there in 1831–33, and in 1836 began legal practice in Detroit, Mich. There he held local offices, and in 1840–44 was probate judge of Wayne County. He became proprietor of the *Daily Advertiser* of Detroit in 1843, and remained its editor until 1848. During the Mexican War he was lieutenant-colonel of the First Michigan volunteers. In May 1861 he received the commission of brigadier-general of volunteers. Later he was a division commander in the Shenandoah, and in 1862 became temporary commander of the 12th corps, which he directed until April 1863, leading it at South Mountain and Antietam. He was also in command of a corps at Gettysburg and, after his transfer to Tennessee, at Lookout Mountain. After commanding a division of the 20th corps in Sherman's Atlanta campaign, he was appointed in November to command that corps, and led it in the "March to the Sea" and the campaign in the Carolinas. Upon the capture of Savannah he was brevetted brigadier-general of volunteers. Mustered out in January 1866, he was Minister to San Salvador in 1866–69 and member of Congress in 1875–78. In 1870 he was Democratic candidate for the governorship of Michigan.

WILLIAMS, Anna Bolles, American writer of juvenile tales: b. New London, Conn., 1840. She published, under the nom-de-plume J. A. K., 'Birchwood' (1885); 'The Fitch Club'; 'Professor Johnny' (1887); 'Rolf and His Friends'; 'Who Saved the Ship'; 'The Giant Dwarf'; 'The Riverside Museum'; 'History of the Rogerenes.'

WILLIAMS, Arthur Llewellyn, American Protestant Episcopal bishop: b. Owen Sound, Ontario, 30 Jan. 1856; d. 27 Jan. 1919. He received an academic education and engaged in the railroad business in Colorado for several years. He then studied theology and was graduated at the Western Theological Seminary, Chicago, in 1888. Admitted to the diaconate in 1888 and to the priesthood in 1889, he served as missionary in White River Valley, Colo., 1888–89, was rector of Saint Paul's Church, Denver, 1891–92 and of Christ Church, Chicago, 1892–99. In October 1899 he was consecrated bishop-coadjutor of Nebraska.

WILLIAMS, Benjamin, American statesman: b. North Carolina, 1754; d. Moore County,

N. C., 1814. He served in the revolutionary army, and was promoted colonel for service at Guilford. He was member of Congress 1793–95; governor of North Carolina 1799–1802, and again 1807–08.

WILLIAMS, Channing Moore, American Protestant Episcopal bishop: b. Richmond, Va., 18 July 1829; d. 2 Dec. 1910. He was graduated from William and Mary College in 1853 and from the Theological Seminary at Alexandria, Va., in 1855. He took deacon's orders in 1853 and was ordained to the priesthood in 1857. He served as a missionary in China in 1857–66, and in the last-mentioned year was consecrated bishop of Yeddo, Japan, resigning his bishopric in 1889, when he retired from episcopal duties, but continuing his missionary labors for some years.

WILLIAMS, Edward (bardic name, IOLO MORGANWG), Welsh poet and Celtic scholar: b. Llancarvan, Glamorganshire, 1745: d. Flemingstone, Glamorganshire, 17 Dec. 1820. With Owen Jones and Pughe, he edited the 'Myvyrian Archæology' (1801–07), and himself published 'The Fair Pilgrim, a Poem Translated from the Welsh' (1792); 'Poems Lyric and Pastoral' (1794); 'Psalms of the Church in the Desert' (1812) in Welsh. To the 'Fair Pilgrim' he appended specimens of Druidical 'Triads,' which, after a long protracted controversy and on the non-production of their manuscripts, are commonly looked on as a literary forgery. Williams was a friend of Southey and ranked foremost among Welsh poets of his time. His posthumous Welsh work, 'Secrets of the Bards of the Isle of Britain' (1829) was edited by his son, Taliessin Williams. Consult Warring, 'Recollections and Anecdotes of Edward Williams' (1850).

WILLIAMS, Eleazer, American missionary to the Indians: b. about 1788; d. Hogansburg, Franklin County, N. Y., 28 Aug. 1858. After obtaining a secondary education in Massachusetts, upon the outbreak of the War of 1812 he became a United States government agent among the northern Indians, and later fought in several actions and was severely wounded at Plattsburg (14 Sept. 1814). After the war he became a clergyman of the Protestant Episcopal Church, and for many years labored as a missionary among the Indians of the northern Wisconsin region. By many he was identified with Louis XVII of France (q.v.), and on this subject much has been written, from J. H. Hanson's article in *Putnam's* for February 1853 to M. H. Catherwood's 'Lazarre' (1901). Among his writings were 'Caution against Our Common Enemy' (1815) and a translation into Mohawk of the 'Book of Common Prayer' (1853).

WILLIAMS, Ephraim, American soldier: b. Newton, Mass., 24 Feb. 1715; killed near Lake George, N. Y., 8 Sept. 1755. In early life he was a sailor, but in the war with France, 1740–48, served as captain of a New England company in Canada. He received from Massachusetts in return for his services a grant of 200 acres of land in the present township of Adams and Williamstown and was made commander of all the frontier posts west of the Connecticut River. When hostilities broke out afresh he was put in command of a regiment and ordered to join the New York forces under Sir William Johnson, who was marching northward to attack the French. He was proceeding with a large body of soldiers to attack Dieskau's advance force, when the whole party was entrapped in an ambuscade of French and Indians, and at the first fire Colonel Williams fell mortally wounded. While in camp at Albany he had made his will, bequeathing his property for the establishment of a free school in Massachusetts, which later became Williams College. In 1854 the alumni of Williams College erected a monument to his memory on the spot where he fell. See WILLIAMS COLLEGE.

WILLIAMS, Francis Churchill, American author, son of Francis Howard Williams: b. Philadelphia, Pa., 23 April 1869. He was graduated at the University of Pennsylvania in 1891 and until 1900 was engaged in journalism. His books include 'J. Devlin, Boss' (1901); 'Stories of the College' (joint author, 1902); 'The Captain' (1903). He was literary adviser to J. B. Lippincott Company, Philadelphia (1902–06). From 1907 to 1927 he was associate editor of *The Saturday Evening Post.* He is a contributor of biographical and critical articles and fiction to the magazines.

WILLIAMS, Frederick Ballard, American artist: b. Brooklyn, N. Y., 21 Oct. 1871. He studied at the Cooper Union Art School and at the National Academy of Design in New York, and specialized in landscape and figure paintings. He was elected to the National Academy in 1909. He was awarded a medal at the Panama-Pacific Exposition, San Francisco, in 1915. Among his works in public collections are 'Happy Valley' (Metropolitan Museum of Art, New York); 'Chant d'Amour' (Brooklyn Institute Museum); 'Vivacetto' (Albright Gallery, Buffalo); 'Conway Hills' (National Gallery, Washington), etc.

WILLIAMS, SIR George, English founder of the Young Men's Christian Association: b. Dulverton, Somerset, 11 Oct. 1821; d. London, 6 Nov. 1905. He became converted in 1837 and was active in attempts to promote the religious welfare of his associates. In 1841 he went to London, gathered together the young men employed in the same establishment as himself, and on 12 June 1844, organized, with others, a society called the "Young Men's Christian Association," which was designed to be "a society for improving the spiritual condition of young men engaged in the drapery and other trades." He was treasurer of the Young Men's Christian Association, 1863–85, and succeeded Lord Shaftesbury as its president in the last-named year. He was knighted in 1894. (See YOUNG MEN'S CHRISTIAN ASSOCIATION). Consult Stevenson, 'Historical Records of the Young Men's Christian Association from 1844 to 1884' (1884).

WILLIAMS, George Frederick, American politician: b. Dedham, Mass., 10 July 1852. He was graduated from Dartmouth in 1872, studied later at Heidelberg and Berlin, was admitted to the bar and thereafter practised his profession in Boston. He edited Williams' 'Citations of Massachusetts Cases' and the 'Annual Digest of the United States,' Vols. X to XVII. He was a member of the State legislature in 1889, of Congress 1891–93; ran for governor (1895, 1896, 1897); and was Minister to Greece (1913–July 1914). Died 11 July 1932.

WILLIAMS, George Henry, American senator, Cabinet officer and jurist: b. New Lebanon, N. Y., 23 March 1823; d. 4 April 1910. He was admitted to the bar in 1844 and removed to Iowa where he engaged in practice. He was judge of the First Judicial Court of Iowa in 1847–52; and in 1853–57 he was chief justice of the Oregon Territory. He was one of the framers of the constitution of the State of Oregon, and served as United States senator for that State in 1865–71. He was Attorney-General under President Grant in 1872–75. His nomination by President Grant for justice of the Supreme Court of the United States was not confirmed by the Senate. After his retirement as Attorney-General he practised law at Portland, Ore., and he was mayor of that city in 1902–05.

WILLIAMS, George Huntington, American geologist: b. Utica, N. Y., 28 Jan. 1856; d. there, 12 July 1894. He was graduated at Amherst College in 1878, later studied at Brunswick and Göttingen and took the degree of Ph.D. at Heidelberg in 1882. He was afterward connected with the faculty of Johns Hopkins University, and was appointed professor of inorganic chemistry there in 1892. He made special investigations of the geology of Maryland and materially assisted the United States Geological Survey of that State. He was editor of the department of mineralogy and petrography of the 'Standard Dictionary' (1893); was author of 72 papers on geology, and of 'Elements of Crystallography' (1890).

WILLIAMS, George Washington, American author: b. Bedford Springs, Pa., 16 Oct. 1849; d. 1891. He was of African descent, served in the Civil War, subsequently attended school and was for a time engaged as a preacher and then as a journalist. In 1877 he was graduated from the Cincinnati Law School and in 1879–81 served in the Ohio legislature. He was United States Minister to Haiti in 1885–86, and in 1888 was a delegate to the World's Conference of Foreign Missions at London. He was editor of the Cincinnati *Southwestern Review* and of the Washington *Commoner,* and published 'History of the Negro Race in America from 1619 to 1880' (1883); 'History of the Negro Troops in the War of the Rebellion' (1887); 'History of the Reconstruction of the Insurgent States' (2 vols., 1889), etc.

WILLIAMS, Gershom Mott, American bishop: b. Fort Hamilton, N. Y., 11 Feb. 1857; d. Paris, France, 14 April 1923. He studied at Cornell, 1875–77, was in mercantile business for several years and after studying law was admitted to the Michigan bar in 1879. The next year he was ordained to the Episcopal ministry and held rectorships at Detroit, Buffalo, Milwaukee and Marquette (1880–96). In 1896 he was consecrated bishop of Marquette.

WILLIAMS, Helen Maria, English author: b. London, 1762; d. Paris, 15 Dec. 1827. She was introduced to public notice by Dr. Andrew Kippis, who recommended very highly her first work, a legendary tale in verse, entitled 'Edwin and Eltruda,' which was published in 1782. Between this period and 1788 she published an 'Ode on Peace' (1783); 'Peru, a Poem' (1784); and a collection of miscellaneous poems (1786). In 1790 she settled in Paris, in the same year published a series of 'Letters Written in France,' and in 1792–96 a second series, 'Letters from France,' and in 1795 a third, 'Letters Containing a Sketch of the Politics of France.' These 'Letters' advocated the doctrines of the Girondists, on whose downfall she was in great danger, and for some time imprisoned. They are one-sided and replete with inaccuracies and misrepresentations. Among her remaining works are 'A Tour in Switzerland' (1798); 'Narrative of Events in France' (1815); 'Correspondence of Louis XVI' (1803); 'Letters on the Events Which Have Passed in France since the Restoration in 1815' (1819); an English translation of Humboldt's 'Personal Narrative' (1814); 'Julia,' a novel (1790); and the story, 'Perourou, the Bellows-mender' (1801), on which was based Lord Lytton's 'The Lady of Lyons.' Mention may be made of several well-known hymns by her, such as 'My God, all Nature owns Thy Sway' and 'While Thee I Seek, Protecting Power.'

WILLIAMS, Henry Shaler, American geologist and palæontologist: b. Ithaca, N. Y., 6 March 1847; d. 1 Aug. 1918. He was graduated from Yale in 1868, occupied the chair of geology at Cornell in 1879–92, resigning in the last-mentioned year to accept a similar chair at Yale, which he held until 1904, when he returned to Cornell. He was secretary of the International Congress of Geologists at Washington in 1891 and was chairman of the section of geology and geography of the American Association of Advanced Sciences in 1892. He made extensive studies of the Devonian and Carboniferous systems and published 'The Classification of the Upper Devonian' (1885); 'Fossil Faunas of the Upper Devonian' (1884–87); 'The Cubiodes Zone and Its Fauna' (1890); 'Correlation Papers, Devonian and Carboniferous' (1891); 'Shifting of Faunas as a Problem of Stratigraphic Geology' (1903); 'On the Theory of Organic Variation' (1911), etc.

WILLIAMS, Isaac, English theologian and author: b. near Aberiptwith, Cardiganshire, 12 Dec. 1802; d. Stinchcombe, Gloucestershire, 1 May 1865. He studied at Trinity College, Oxford, in 1831 became Fellow there and took priest's orders, and was known as one of the leading Tractarians (q.v.). He was Newman's curate at Saint Mary's and was later in charge of the church at Littlemore. With Newman, Froude and Keble he contributed to the *British Magazine* the verse later collected as 'Lyra Apostolica' (1836); and in the 'Tracts for the Times,' he wrote Tract 80, 'Reserve in Communicating Religious Knowledge,' the subject of much discussion. In 1842 he was an unsuccessful candidate for the Oxford chair of poetry, the defeat being regarded as also the first for the Tractarians as a party. From 1842 to 1848 he was curate at Dartington, and afterward resided at Stinchcombe, where he assisted somewhat in the clerical duties of the parish. Among his further publications are several books of poetry, such as 'The Cathedral' (1838; 8th ed., 1859; reprinted 1889 ed., Benham); 'Thoughts in Past Years' (1838; 6th ed, 1852); and 'The Baptistry, or the Ways of Eternal Life' (1842–44; 6th ed., 1863); and some

volumes of prose, chiefly sermons. 'Selections' from his writings appeared in 1890; his 'Autobiography' in 1892.

WILLIAMS, James Douglas, American politician: b. Pickaway County, Ohio, 16 Jan. 1808; d. Indianapolis, Ind., 20 Nov. 1880. After a common-school education, he became a farmer in Knox County, Ind., first held office in 1838 as justice of the peace for Harrison township in that county, and in 1843 was elected as a Democrat to the house of representatives in the general assembly. He sat in the house during seven sessions, and in the senate for 12. In 1874 he was chosen to Congress, where he served until 1876, resigning upon his nomination as governor of Indiana. He was elected to the office in October, after a vigorous contest, his Republican opponent being Gen. Benjamin Harrison. His administration was one of economy and stability. His chief interest was in connection with the development of the agriculture of Indiana, and he was an incorporator and president of the State Board of Agriculture. He was widely known by his sobriquet of «Blue Jeans.»

WILLIAMS, Jesse Lynch, American author: b. Sterling, Ill., 17 Aug. 1871; d. 14 Sept. 1929. Graduated, Princeton, 1892. Published 'History of Princeton University' with J. De Witt (1898); 'The Stolen Story and Other Newspaper Sketches' (1899); 'The Adventures of a Freshman' (1899); 'New York Sketches' (1902); 'The Day Dreamer' (1906); 'My Lost Duchess' (1908); 'Mr. Cleveland, a Personal Impression' (1909); and the plays 'And So They Were Married' (1915); 'Remaking Time' (1916); 'Why Marry?' (1917 Pulitzer Prize); 'Why Not?' (1922); 'Lovely Lady' (1925).

WILLIAMS, John, English ecclesiastic, archbishop of York: b. Aberconway, Carnarvonshire, Wales, March 25, 1582; d. Glodded, March 25, 1650. He was educated at Cambridge, took orders in the English Church in 1609, succeeded Bacon as keeper of the great seal in 1621, an office which he held till 1626, and was consecrated bishop of Lincoln in November 1621. Though a favorite with James I he incurred the dislike of Charles I, and having supported the Petition of Right in 1628, was prosecuted by Laud before the Star Chamber, charged with betraying the king's secrets. After eight years' legal proceedings he was suspended from his see, fined successively £10,000 and £8,000 and imprisoned in the Tower, 1636–40. Released by the Long Parliament and restored to his see, he was made archbishop of York, December 1641, but was again sent to the Tower with 11 other bishops on account of their protest against the validity of acts passed during their enforced absence from the House of Lords. He was released in 1642 and during the civil war supported the royal cause and fortified and held Conway Castle. Consult 'Scrinia Reserata,' a Latin life of the prelate, by Hacket and Philips (1700).

WILLIAMS, John, American clergyman, known as «the redeemed captive»: b. Roxbury, Mass., 10 Dec. 1664; d. Deerfield, Mass., 12 June 1729. He was graduated from Harvard in 1683, was settled in Deerfield in 1686, and ordained in 1688. On 29 Feb. 1704, a party of 200 French and 142 Indians surprised the town, and some of them, breaking open Williams' house, killed two of his children and his negro servant, and forced him with his wife and six of his surviving children (his son Eleazer was absent) to set out with other prisoners for Canada. On the second day's march Mrs. Williams fell from exhaustion, and was dispatched with a tomahawk. About 20 other prisoners were murdered under similar circumstances. On his arrival in Canada, after a journey attended by almost unexampled hardships, Williams was treated by the French with great humanity and even courtesy, and at length was redeemed, and arrived in Boston, 21 Nov. 1706, with 57 other captives, among whom were two of his children. His daughter Eunice, 10 years of age, was left behind, and married an Indian. Williams, soon after his return, resumed his pastoral charge at Deerfield and published a narrative of his captivity, entitled 'The Redeemed Captive Returning to Zion' (1707), a narrative of his adventures which furnishes a good picture of the frontier dangers of the time.

WILLIAMS, John, English missionary: b. Tottenham, Middlesex, 29 June 1796; d. Erromango, New Hebrides, 20 Nov. 1839. At 14 he was apprenticed to an ironmonger, but having offered himself to the London Missionary Society, was sent in 1816 to Eimeo, one of the Society Islands. Later he settled in Raiatea, the largest of the group, and labored here with marvelous success, his powers of organization being as conspicuous as his zeal. In 1823 he went to Raratonga, the chief of the Hervey Islands, where he met with continued success. He next built a boat with his own hands in which during the next four years he visited many of the South Sea Islands, extending his missionary labors to the Samoa Islands. In 1834 he returned to England, there superintending the printing by the Bible Society of his Raratongan New Testament, and raising $20,000 to equip a missionary ship for Polynesia. In 1838 he went out again, visited many of the stations he had already established, and sailed as far west as the New Hebrides, where he hoped to plant a mission, but was killed and eaten by the savages natives of Erromango. He published 'Narrative of Missionary Enterprises' (1837). Consult the biographies by Campbell (1842) and Prout (1843).

WILLIAMS, John, American Protestant Episcopal bishop: b. Deerfield, Mass., 30 Aug. 1817; d. Middletown, Conn., 7 Feb. 1899. He was graduated from Harvard in 1835, studied theology and was ordained deacon in 1838 and priest in 1841. From 1837 to 1840 he was tutor in Washington (now Trinity) College, then was for a time assistant minister of Christ Church, Middletown, Conn., and rector of Saint George's, Schenectady, N. Y., 1842–48. In 1848 he was elected president of Trinity College and professor of history and literature. He was consecrated assistant bishop of Connecticut in 1851, but retained the presidency of Trinity for two years longer, and then became vice-chancellor. Several students for holy orders having placed themselves under his direction, an informal theological department grew up, which was afterward incorporated as the Berkeley Divinity School at Middletown, Bishop Williams remaining the principal instructor. On

the death of Bishop Brownell in 1865, he assumed sole charge of the diocese, whose administration had for a long time been practically in his hands, and at the same time became chancellor of Trinity College. In the General Conventions of 1883 and 1886, he was chosen chairman of the House of Bishops, and in 1887 succeeded Bishop Lee as presiding bishop of the Episcopal Church. His published works include 'Thoughts on the Gospel Miracles' (1848) and 'Studies in the Book of Acts' (1888).

WILLIAMS, John Joseph, American Roman Catholic prelate: b. Boston, Mass., 22 April 1822; d. there, 30 Aug. 1907. His elementary education was obtained at the cathedral parochial school; in the Sulpician College, Montreal, Canada, he studied philosophy, and later theology with the Sulpicians in France. In 1845 he was ordained priest by Archbishop Affre and upon returning to Boston, Mass., was appointed assistant at the cathedral, in 1855 becoming its rector. Two years later he was made vicar-general of the diocese and rector of Saint James' Church, both of which positions he held for nine years, being then chosen coadjutor to Bishop Fitzpatrick, whose death, however, occurred before the arrival of the papal bulls for Father Williams' consecration. Therefore, on 11 March 1866, Father Williams was consecrated bishop of Boston. A vast territory was then under his jurisdiction, as his diocese included the entire State of Massachusetts, but when, in 1870, Bishop Williams went to Rome to attend the Vatican Council, he applied for the division of his diocese, the result being that Springfield, Mass., was erected into an episcopal see. In 1875 Pope Pius IX elevated Boston to a metropolitan see, Bishop Williams becoming its first archbishop, the pallium being conferred upon him 2 May 1875. Foremost among the monuments to his zeal and energy are the new Holy Cross Cathedral of Boston and Saint John's Theological Seminary.

WILLIAMS, John Sharp, United States senator: b. Memphis, Tenn., 30 July 1854. He was the descendant of one of the most distinguished of Southern families, whose founder was John Williams, member of the Continental Congress. John Sharp Williams studied at the Kentucky Military Academy, the University of the South, at Sewanee, Tenn., and at the University of Virginia. His general training was completed at the University of Heidelberg, Germany; but on his return home he studied law at the University of Virginia and privately at Memphis. In 1878 when he was only 24 years old he settled at Yazoo, Miss., where he arose immediately to eminence at the local bar. Following the bent of Southerners he also became a landowner and planter. In the early '90s he began to take an active interest in politics and was elected to the national House of Representatives where he remained from 1893 to 1909. He entered Congress in the midst of that trying period when all the agricultural interests of the country were sorely depressed and when laboring men were uniting with farmers' organizations in the hope of weakening the grip of financiers and industrial leaders upon the government. Williams was in full sympathy with their efforts. He was an ardent advocate of a low tariff, if not an advocate of actual free trade. He was a member of that group of earnest Democrats who opposed President Cleveland in 1895 when the so-called gold bonds were issued to a syndicate controlled by Messrs. Belmont and Morgan of New York, as a means of maintaining the credit of the treasury. Mr. William Jennings Bryan was the leader of these protesting Democrats. Early in 1895 Mr. Williams signed, with Bryan and 31 other leaders of Congress and newspapermen, an address to the people which had a great influence upon the history of the country. It proved to be the beginning of the campaign of Mr. Bryan for the control of the Democratic National Convention of 1896. It was not only a protest against the proposed gold standard, for which Eastern men, Democratic and Republican, were clamoring; it was an appeal to independent Democrats very much like that which Salmon P. Chase and others issued to the country against the famous Nebraska bill of 1854. It rallied the whole West, regardless of party, and when the Republicans met in convention in Saint Louis, it was with great difficulty that the party was prevented from declaring against the gold standard. But the Democratic National Convention which met in Chicago was entirely won and Mr. Bryan was made candidate for the Presidency. Mr. Williams was an earnest champion of free trade and free silver and as such had a large share in the extraordinary campaign in which both issues were lost. Williams continued an influential member of the House of Representatives and during the Roosevelt Presidency he was the leader of the minority, a witty, alert and forceful critic of governmental measures. Although he was never an organizer, nor a politician except in the better sense, he was twice the undisputed candidate of his party for speaker. The last time he offered for Congress in his district, he received every vote cast. But he had already made up his mind to enter the Senate. It was at the time of the growing Vardaman movement in Mississippi. Notwithstanding the popularity of Governor Vardaman, who opposed Williams, the latter easily won a seat in the Senate. The issue was mainly the question of the negro in the State, Williams taking the more moderate attitude that there would be no negro question if it were left out of party politics. In the Senate Williams fought persistently for a lower tariff, although he broke with Bryan and many of his earlier political friends, and in 1911 aided in the passage of the Underwood tariff which President Taft vetoed. When President Wilson entered office Williams became a warm supporter of the great reforms, tariff, finance and income tax laws, which were made effective in 1913 and 1914, after all realizing the purposes of the movement of 1896. He was almost from the beginning of the European War an advocate of American intervention, and when the country entered the war he was an earnest supporter of the Allied cause, while his colleague from Mississippi, Senator Vardaman, took the opposite view. Mr. Williams was in the Senate from 1911–23. In 1919 he voted alone against a resolution urging President Wilson to press the cause of Ireland, against the wishes of the British government, before the Paris Peace Conference. He declared that Congress should not interfere in the internal relations of a friendly power. D. 28 Sept. 1932

WILLIAMS, John Skelton, American financier, government official and railroad organizer: b. Powhatan County, Va., 6 July 1865; d. Richmond, Va., 4 Nov. 1926. Educated at the University of Virginia, he engaged in banking and other business at Richmond, gaining a large fortune. He organized the Seaboard Air Line under Southern control and capital, and was its president in 1894–1904. He was actively interested in the development of Southern resources. He was appointed Assistant Secretary of the Treasury in 1913 and Comptroller of the Currency in 1914 and again in 1919, resigning in 1921. He was also ex-officio member of the Federal Reserve Board and in 1918 a member of the advisory committee to the Director-General of Railroads and also director of the division of finances and purchases in the department of railroads.

WILLIAMS, John Stuart, American senator and Confederate soldier: b. Montgomery County, Ky., 1820; d. there, 17 July 1898. He was graduated at Miami (Ohio) University in 1838, and was admitted to the bar of Kentucky in 1840. He served in the Mexican War, was promoted to the rank of colonel and afterward resumed his law practice. He was a member of the Kentucky State legislature in 1851–52. He was opposed to the secession of the Southern States, but organized a brigade for service in the Confederate army and served as brigadier-general throughout the war. He later urged speedy renewal of allegiance to the United States. He served in the Kentucky legislature in 1873–74, and was United States senator in 1879–85.

WILLIAMS, Jonathan, American soldier: b. Boston, Mass., 20 May, 1750; d. Philadelphia, Pa., 16 May 1815. He was secretary to his granduncle, Benjamin Franklin, while the latter was Ambassador to France, and while abroad read widely concerning fortification and made an especial study of military science. He returned with Franklin in 1785 and was for some years a judge of Common Pleas at Philadelphia. In 1801 he entered the army, soon becoming inspector of fortifications and taking command of West Point in 1802–03. He resigned in the year last named, but returned to the army in 1805 as chief engineer and superintendent at West Point. While in charge of the fortifications of New York he built Fort Columbus and Castle William on Governor s Island, Castle Clinton (Castle Garden), and Fort Gansevoort. On the breaking out of the War of 1812, as senior officer at Castle William, he claimed command of that fort, and on his being assigned elsewhere, he resigned. He was elected to Congress in 1814, but did not take his seat. As the first person in the United States to apply the principles of scientific engineering he has often been called «the father of the corps of engineers.» He published 'The Use of the Thermometer in Navigation' (1799) and translated 'Elements of Fortification' (1801), and 'Kosciusko's Manœuvres for Horse Artillery' (1808).

WILLIAMS, Sir Monier Monier-. See Monier-Williams, Sir Monier.

WILLIAMS, Roger, pioneer of religious liberty and founder of Rhode Island: b. Wales, 1607; d. Providence, R. I., March 1684. There is considerable doubt as to the year of Williams' birth; authorities differ. Some of them claim he was born in 1601, others in 1603. The writer after a careful examination of all the records places the date at 1607. Consult Straus' 'Roger Williams, the Pioneer of Religious Liberty,' pp. 5–11.

The most recent investigations have shown that he was the son of James Williams, a merchant tailor of London, and of his wife, Alice Williams. While yet a mere boy, he attracted the attention of Sir Edward Coke, while taking shorthand notes of sermons and speeches in the Star Chamber, and Coke placed him (1621) in the Charter House School. From there (1623) he went to Pembroke College, Cambridge University, from which he took his degree in 1626. Williams soon developed into a decided opponent of the liturgy and ceremonies of the Church, thereby placing himself on the side of the most radical Puritans. On 1 Dec. 1630 he embarked from Bristol with his young wife in the ship *Lyon,* and arrived at Nantasket 5 Feb. 1631. No sooner had he set foot upon the shores of New England than he came in conflict with the ecclesiastical and civil authorities of the colony, whom he found arrayed against him, for asserting and maintaining with unwavering fidelity those principles which have immortalized his name as the champion of religious liberty.

The arrival of Williams in America was noted by Winthrop as that of a «Godly minister.» He was already known and esteemed by the leading men in the colony, and he was immediately invited to officiate in the place of John Wilson as teacher of the church at Boston, which, however, Williams declined on the ground that they of Boston were an unseparated people. It is well to note here a distinction between the Pilgrims and the Puritans. The former were Separatists, and were associated as a distinct church before they left Holland. A principle of their Church was, that the state had no right to punish for spiritual sins. The Puritans, on the other hand, though Nonconformists, were not separated from the Established Church. Their scruples were against conforming to many of the ceremonies of that Church. He was invited by the Pilgrim church at Salem to become an assistant or teacher in place of Higginson, who died a few months before. This call Williams accepted, but the civil authorities, the General Court of Boston, interfered and remonstrated with the Salem church for choosing him. He remained at Salem only a short while, and in August removed to Plymouth, where he was received with much respect. Here he remained for two years, supporting himself by manual labor and officiating as «teacher» in the church among the Pilgrim fathers. During his residence here he became intimately acquainted with various Indian chieftains in the neighborhood, which intimacy had an important bearing in his subsequent life in the founding of Rhode Island.

In August 1633 he returned to Salem and resumed his ministerial labors there, but at every turn he found himself in conflict with the clergy and the court of Massachusetts. He was frequently cited to appear before the court. In October 1635 he was tried before the General Court, consisting of the governor, the deputy

governor, eight assistants and some 25 deputies. The formal charges against him were four in number, but the basis of them may be summed up by the statement that he maintained that the civil power has no jurisdiction over the conscience, or, in other words, he maintained the absolute liberty of conscience. The court convicted him and sentenced him to banishment. In January 1636 he left Salem to escape arrest, and to seek a refuge from the tyranny of the church brethren. He went first to Seekonk, and afterward with four companions who joined him embarked in a canoe to seek a spot beyond the jurisdiction of the Massachusetts and Plymouth colonies. The site selected by him was Providence, so named by him in gratitude for «God's merciful providence to him in his distress.»

In March 1638 a large section of land was conveyed to him by deed from the Indians, which land he divided equally among his followers. Mrs. Williams and her two infant children joined him, and friends from Massachusetts and England soon joined the Rhode Island colony.

William Coddington, who had been a merchant in Boston, was elected as magistrate with the title of judge, and three elders were elected to assist him. This form of government continued until 1640. Meanwhile the antagonism of the Boston Colony to Williams continued, and a law was passed which practically excluded the inhabitants of Providence from entering Massachusetts. In March 1641 the government of Rhode Island was regularly organized.

The formation of the New England Confederacy, in 1643, which included the four colonies, Massachusetts, Connecticut, Plymouth and New Haven, was a matter of anxious concern to the Rhode Island and Providence settlements. The open hostility of the Confederacy, together with the claim made by Massachusetts that the Rhode Island and Providence colonies had no authority to set up civil government, induced these latter colonies to seek a charter from England. At an assembly held in Newport 19 Sept. 1642, a committee was appointed to procure a charter, and in July 1643 Williams set sail from New York for England. Here on 17 March 1644 he obtained a charter which gave to the towns of Providence, Portsmouth and Newport full power to rule themselves under the name «The Providence Plantations of Narragansett Bay.» This charter granted in the most friendly spirit everything that Williams prayed for.

Williams returned to America in 1644, landing in Boston 17 September. He ventured to tread on this forbidden ground by exhibiting a letter from 12 leading members of the Parliamentary party in England, addressed to the government of Massachusetts. He, therefore, proceeded without hindrance to Providence. In May 1647 a form of government was agreed upon after many delays; the office of president of the colony, which so naturally belonged to Williams, was bestowed upon John Coggeshall of Newport. Dissensions arose within and without the new colony; Williams was called upon to pacify the Indians and to settle numerous disputes, ecclesiastical and civil. In October 1652 Williams was again in England making efforts to secure a renewal of the colony's charter; this he secured and returned to America, landing in Boston in 1654. In this same year the reorganization of the Rhode Island government took place, and on 12 September Williams was elected president of the colony. He was again elected 20 May 1656. In this year the persecution of the Quakers in Boston soon made Rhode Island a Quaker refuge, and they were made welcome largely through the influence of Roger Williams. For many years, until 1677, Williams continued to hold various offices and to guide the affairs of the colony. In the Indian wars of 1675–76, when Providence was attacked, Williams was captain of militia and drilled companies in Providence. See Rhode Island.

The life of Roger Williams was now rapidly nearing its end. His Providence friends did not fully appreciate the life-work of this sturdy champion of soul liberty, which was destined to bring happiness to a continent. At his death the brief record was conveyed to the outer world in a letter dated 10 May 1684, stating «The Lord hath arrested by death our ancient and approved friend, Mr. Roger Williams, with divers others here.» He was buried in a spot which he himself had selected on his own land, near where, 47 years before, he had first landed within the colony he founded.

The principles of religious liberty had been proclaimed in all ages and under many climes, with more or less plenitude, but Roger Williams was the first to organize and build up a political community with absolute religious liberty as its chief cornerstone. To him the successful pioneer of these principles is due to a larger extent than to any man, the American system of a «free church in a free State.»

No portrait of him in bronze or in marble, or of any kind, has come down to us, and when in 1872 the State of Rhode Island presented a statue of her founder to the nation, which now stands in the rotunda of the Capitol at Washington, the artist had to make the memorial from an ideal conception.

Among the great men of his times with whom Williams stood in close personal relations, besides his early patron, Sir Edward Coke, were Cromwell, John Milton, Sir Henry Vane, the younger, Major-General Harrison of the Parliamentary army, Lawrence Lord, president of the Council of State, and others of distinction in England and America. (See United States — Civil and Religious Liberty). Consult 'Memoirs,' by James D. Knowles (Boston 1833); Gammell (Boston 1846); Elton (London 1842); Guild, R. A., 'Biographical Introduction, etc.' (Providence 1866); 'Works of Roger Williams,' published by the Narragansett Club of Providence (6 vols., Providence 1866–74); biographies by Oscar Straus (New York 1894) and Carpenter, E. J. (ib. 1910); Tyler, M. C., 'History of American Literature, 1607–1765' (New York 1878); Dexter, Henry M., 'As to Roger Williams and his «Banishment» from the Massachusetts Plantation' (Boston 1876).

WILLIAMS, Rowland, Anglican clergyman and educator: b. Halkyn, Wales, 16 Aug 1817; d. Broad Chalk, near Salisbury, Wiltshire, 18 Jan. 1870. He was graduated from King's College, Cambridge, in 1841, and was Fellow and

tutor there in 1839–50. He accepted the chair of Hebrew at the theological college of Saint David's in 1850, acting also as vice-president of that institution. In 1854 he became select preacher at Cambridge and became vicar of Broad Chalk in 1858, while still retaining his offices at the college. His views on inspiration brought him into disfavor with the Welsh clergy and in 1862 he was prosecuted and condemned for neresy in the Court of Arches. He resigned his professorship and retired to his vicarage at Broad Chalk, where he henceforth lived, though in 1864 he secured from the Privy Council a reversal of the judgment against him. His publications include 'Rational Godliness' (1855); 'The Hebrew Prophets' (1868–71); 'Psalms and Litanies' (1872), etc. Consult Williams, Ellen, 'Life and Letters of Rowland Williams' (1872).

WILLIAMS, Samuel Wells, American missionary and philologist: b. Utica, N. Y., 22 Sept. 1812; d. New Haven, Conn., 17 Feb. 1884. He was graduated from the Rensselaer Institute, Troy, N. Y., in 1832, and in 1833 went to Canton, China, as printer to the American Mission. He was compelled to remove to Macao in 1835, and in 1845–48 was in the United States, after which he resumed his work in Canton. He acted as interpreter to Commodore Perry on his Japanese mission in 1853–54, and in 1857 resigned his position in the mission and became secretary and interpreter to the United States legation. He assisted in the negotiation and ratification of the treaty of Tientsin in 1858–59. Upon the establishment of the United States legation at Peking under Burlingame in 1862 he became its secretary, occupying the post until 1876, when he returned to the United States and accepted the chair of Chinese at Yale, where he remained until his death. He was editor and contributor to the *Chinese Repository* during the time of its publication (1832–51), and was a leading authority on the Chinese and Japanese languages. He superintended the press work of Medhurst's 'Dictionary of the Hokkien Dialect' (1837) and with Bridgman issued 'Chinese Christomathy' (1841). His other works include 'Easy Lessons in Chinese' (1842); 'The Topography of China' (1844); 'The Middle Kingdom' (1848); 'A Syllabic Dictionary of the Chinese Language' (1874), etc. The two last mentioned are the greatest of his works and are still among the highest authorities in their field. Consult Williams, F. W., 'Life and Letters of Samuel Wells Williams' (1888).

WILLIAMS, Seth, American soldier: b. Augusta, Me., 22 March 1822; d. Boston, Mass., 23 March 1866. He was graduated at the United States Military Academy in 1842, and in the Mexican War served as aide-de-camp to Gen. Robert Patterson. He was adjutant of the United States Military Academy in 1850–53, and was thenceforth until his death connected with the adjutant-general's office. He was promoted brigadier-general of volunteers 23 Sept. 1861, and later served as adjutant-general on the staff of Generals McClellan, Burnside, Hooker and Meade. From 1864 until the close of the war he was inspector-general of the army on the staff of General Grant. He was brevetted major-general of volunteers 1 Aug. 1864 for conduct at Gettysburg, and major-general of regulars 13 March 1865 for his services in the war. His health was seriously undermined in the war but he remained on duty.

WILLIAMS, Talcott, American journalist: b. Abeih, Turkey, 20 July 1849; d. New York City, 24 Jan. 1928. His parents were Congregationalist missionaries. He was graduated at Amherst College in 1873. He was on the staff of the New York *World* in 1873–77; was Washington correspondent of the New York *Sun* and of the San Francisco *Chronicle* in 1877–79; and was editorial writer on the Springfield (Mass.) *Republican* in 1879–81. He was one of the editors of the Philadelphia *Press* in 1881–1912. In 1912–19 he was director of the School of Journalism founded at Columbia University by Joseph Pulitzer, becoming emeritus professor in the latter year. He was president of the American Conference of Teachers of Journalism in 1913. He was associate editor of 'New International Encyclopedia' (2d ed.) and published 'Turkey: a Problem of Today' (1921); 'The Newspaper Man' (1922).

WILLIAMS, Walter, American journalist and educator: b. Boonville, Mo., 2 July 1864. He was editor and part owner of the Boonville *Advertiser* in 1884–89; and edited the Columbia (Mo.) *Herald* in 1890–1908. He also edited the Saint Louis *Presbyterian* in 1897–98; the *Daily State Tribune,* Jefferson, Mo., in 1898–1902; and founded the *Country Editor* in 1895. He was dean of the School of Journalism, and professor of journalism, University of Missouri 1908–30; and in 1931 became president. He was the organizer and secretary of the World's Press Parliament held at Saint Louis in 1904; was elected the first president of the Press Conference of the world for 1916–25; and was the first president of the American Association of Schools and Departments of Journalism in 1916. Author of 'Some Saints and Some Sinners in the Holy Land' (1902); 'History of Missouri' (1908); 'From Missouri to the Isle of Mull' (1909); 'The Practice of Journalism' (1911); 'The World's Journalism' (1915); 'Journalism—The Newest Weapon for Democracy' (1919); 'The Press Congress in Hawaii' (1922). Died 29 July 1935.

WILLIAMS, William, American patriot and signer of the Declaration of Independence b. Lebanon, Windham County, Conn., 8 April 1731; d. there, 2 Aug. 1811. He was graduated at Harvard College in 1751, in 1755 served on the staff of Col. Ephraim Williams in the Lake George expedition, and after the revolutionary troubles began was an active member of the council of safety, and in October 1775 was chosen a representative in the Continental Congress. His property was nearly all expended in the war, and he was tireless in obtaining private donations to supply the army, going from house to house to collect articles that could relieve the destitution of the soldiery. He held nearly every office in the gift of his constituents, served nearly 50 years in the State legislature, and was a member of the convention of his State which adopted the Federal Constitution.

WILLIAMS, Sir William Fenwick, British soldier: b. Annapolis Royal, Nova Scotia, 4 Dec. 1800; d. London, 26 July 1883. He was

graduated from Woolwich in 1821, entered the Royal Artillery in 1825, and after serving in the East Indies several years, was appointed British commissioner to the conferences in Erzurum, Turkey. He was also British commissioner for the settlement of the boundary dispute between Persia and Turkey in Asia. During the Crimean War he was sent as commissioner to the relief of Kars, but on Nov. 28, 1855, was forced by famine to capitulate. On his return to England, he was created baronet, received the order of pasha of the highest order, the decoration of the Medjidie from the sultan, and was made a grand officer of the Legion of Honor of France. He sat in Parliament for the Borough of Calne, 1856–1859, and then assumed command of the forces of British North America from 1859 to 1865. He became governor of Nova Scotia in 1865, and was governor of Gibraltar from 1870 until 1876. In 1871 he was made a Grand Commander of the Bath.

WILLIAMS COLLEGE, an accredited privately controlled institution of arts and sciences for men, located at Williamstown, Mass., owes its origin to the bequest of Col. Ephraim Williams, for establishing a "Free School" in Williamstown The bequest was made in 1755; the property was sold, and the funds were allowed to accumulate until 1785 when a free school was incorporated by the legislature, and a lottery granted for raising funds to erect a new building. In 1790 the building (now West College) was completed, and the school was opened Oct. 20, 1791. In 1793 the institution was incorporated as a college; the property vested in the free school was transferred to the college, and a grant of $4,000 was made by the state to purchase a library and apparatus. Between 1796 and 1868 the college received various state appropriations, land grants, and tax allocations which added materially to its financial stability. In 1806 the first foreign missionary society in the United States was formed at Williams.

The curriculum prescribes the work of the freshman year, and organizes the courses of the last three years in 11 major groups arranged in three divisions. The aim is to secure the concentration of part of the student's work in one well-defined field, and the distribution of another part among different subjects. Only the degrees of A.B. and M.A. are conferred. Various scholarships are provided. In 1952 the student enrollment was 1,057.

WILLIAMSBURG, wĭl'yămz-bûrg, independent city, Virginia, located in James City and York counties; seat of James County; altitude 78 feet, on the peninsula between the York and James rivers, 45 miles southeast of Richmond. It is served by the Chesapeake and Ohio Railway, is on modern highways connecting with Newport News Airport, and has nationwide bus service. The city has no major industries.

Williamsburg was the first Virginia city to be incorporated (1722). It is interesting to note that the Virginia General Assembly meets in the old capitol building once in each session. Government is by city manager and council. Pop. (1950) 6,735.

HISTORIC WILLIAMSBURG

Williamsburg was so named in 1698 in honor of the reigning English king, William III. Owing to its rich historic associations and restoration features, it is a center of attraction for visitors from all parts of the United States and the world.

As a historic shrine, Williamsburg is included in the Colonial National Historical Park which also includes Jamestown and Yorktown, Va. Painstaking research and meticulous care have been taken in the restoration of old Williamsburg which city, through the subsidy of John D. Rockefeller, Jr., is now recognized as a national shrine.

Restoration was begun in 1927. Of the original buildings 80 still stand; more than 600 buildings were removed for the restoration or reconstruction of 325 colonial residences, public buildings, famous gardens, streets, and greens. Here great events of American history may be relived in true perspective. At one step the visitor enters a different way of life enhanced by hostesses in 18th century attire, attendants in colonial uniforms, and skilled craftsmen in reconstructed workshops using tools and implements of 200 years ago in the production of cloth, metal work, pewter, and cabinets.

The Capitol.—One of the chief exhibition buildings is the reconstructed capitol where the colonial government convened 1704–1780. Originally built under provisions of an act of 1699, it was twice destroyed by fire. The present pink brick building is a reconstruction of the first capitol. Its slender white tower carries the arms of Queen Anne, and flies the 18th century British Union Jack.

Raleigh Tavern.—Particularly noteworthy is this old tavern which in its pristine days was known for its arrack punch of unusual potency. The visionary tourist of today would have little trouble in forming a mental picture of the charter members of the Phi Beta Kappa Society who met here in 1776; or the graceful dancers of the minuet with their gallant partners; or young Thomas Jefferson, a student at the College of William and Mary, who confessed to "dancing with Belinda" in the Apollo Room (1763); or George Washington, whose diary carries frequent references to dining at the Raleigh. The old tavern also witnessed the buying and selling of slaves, and heard the protests of the burgesses who inveighed against the "repeated injuries and usurpations" of the king of Great Britain when they met here to arrange a boycott of British goods.

Ludwell-Paradise House.—Built sometime between 1700 and 1717 by Philip Ludwell, this is the oldest brick dwelling in Williamsburg. Its rooms today carry an interesting exhibition of American folk art of the middle 19th century, the gift of Mrs. John D. Rockefeller, Jr. Originally the family residence of Philip Ludwell II, it later became the home (but not the property) of Lucy, daughter of Philip Ludwell III. On a visit to London, she married John Paradise, a member of Dr. Samuel Johnson's intimate circle of writers and painters. Lucy spent so much time in London that her property was confiscated during the American Revolution.

Public Magazine or Powder House.—This octagonal brick structure, with its walled yard, was erected in 1715, to store the munitions sent from the Tower of London by Queen Anne to defend the colony. When the governor, John Murray, 4th earl of Dunmore, in 1775 confiscated the gunpowder stored here, he stirred the citizens

of Virginia, led by Patrick Henry, to their first act of revolution. The building had some importance during the French and Indian War (1755–1763), and was used for powder storage by Confederate troops during the Civil War.

The Old Court House.—This T-shaped, one-story structure with arched windows and an octagonal cupola stands at the center of Market Square. Erected in 1770 it now houses the Williamsburg Restoration Archaeological Museum. Here, with rolling drums and pealing bells, was proclaimed the Declaration of Independence.

Bruton Parish Church.—This church is one of the fine examples of colonial architecture. The rector, the late Reverend Dr. W. A. R. Goodwin, was the first to interest John D. Rockefeller, Jr. in the restoration of Williamsburg. The parish was formed in 1674, and the church was ordered built in 1677. Its stone front witnessed the baptism of 14 slaves for whom George Washington stood godfather. The first rector of the parish was the Reverend Rowland Jones, great-grandfather of Martha Washington. It is the oldest Episcopal Church in uninterrupted use in America.

Public Gaol.—This still has its pillory and stocks which are the center of attraction for visitors to Williamsburg. Here Blackbeard's Pirates, captured in 1718, were imprisoned before they were hanged. During the early days of the American Revolution the gaol was overcrowded with Tory sympathizers, traitors, spies, and British redcoats, many of whom died of gaol fever.

Governor's Palace.—This residence stands at the northern end of the Palace Green and is surrounded by several acres of formal gardens. Georgian in style, it has castellated walls in the forecourt and a stately cupola above its balustraded roof. The floor plan of the main building was drawn by Thomas Jefferson. A copperplate engraving found in the Bodleian Library at Oxford University, England, shows in detail the front elevation of the palace. A further aid in restoration is the so-called Frenchman's Map of 1782, by an unknown cartographer, which showed the general layout of the buildings and grounds. The rooms of the palace contain an outstanding collection of 18th century furnishings.

College of William and Mary.—At the end of Duke of Gloucester Street stands this, the second oldest college in the United States. Chartered in 1693, it served as the center of higher education throughout the colonial period. George Washington was its chancellor for 11 years; among its alumni are Thomas Jefferson, James Monroe, and John Marshall. The college became a university in 1779 when schools of medicine, law, and modern languages were created. William and Mary is now a coeducational liberal arts college and an important unit of the state educational system. See also WILLIAM AND MARY COLLEGE.

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WILLIAMSITE, wĭl'yămz-īt, an apple-green impure variety of the mineral serpentine (q.v.); sometimes mistaken for jade. It is used for ornamental purposes.

WILLIAMSON, Hugh, American physician, statesman and scientist: b. West Nottingham, Pa., Dec. 5, 1735; d New York, N. Y., May 22, 1819. While professor of mathematics at the College of Philadelphia (now the University of Pennsylvania) he took up the study of medicine In 1764, pursuing his medical studies, he went to Edinburgh, London, and at Utrecht, Netherlands, he received the degree of M.D. He returned to Philadelphia to practice medicine, but abandoned it for further study of mathematics and the sciences.

In 1773, while waiting to sail for Europe, he witnessed the Boston Tea Party, and was instrumental in carrying the first news of it to England where he predicted a revolution in America if British colonial policy was continued. In connection with this he was examined by the Privy Council.

In 1776 he returned to America to begin a mercantile career in the Carolinas, at the same time practicing medicine. He offered his services to Governor Richard Caswell, of North Carolina, and in due course was made surgeon general of the state troops, in which capacity he rendered signal service.

His political career began in 1782 when he was elected to the Continental Congress. He was re-elected in 1787, and remained a member until it went out of existence. In 1787 he was a North Carolina delegate to the Federal Convention and became a signatory witness to the Constitution of the United States. In 1789 he was elected to the First Congress, and was re-elected to the Second. On completion of his term as congressman, he moved to New York in 1793 and there devoted the rest of his life to literary and scientific pursuits. He wrote a number of books on medical and scientific subjects.

WILLIAMSON, city, West Virginia, seat of Mingo County, altitude 665 feet, on the Tug Fork River at the Kentucky state line, is served by the Norfolk and Western Railway, by federal highways, and is situated 60 miles southwest of Charleston. It is a trade and distribution center for a bituminous coal field which extends into east Kentucky. Its manufactures include gasoline, foundry products, wood products, and armatures. It has large railroad shops, and natural gas and oil wells. Williamson was incorporated in 1892. Government is by mayor and council. Pop. (1950) 8,624.

WILLIAMSPORT, wĭl'yămz-pōrt, city, Pennsylvania, seat of Lycoming County, altitude 528 feet, on the west branch of the Susquehanna River, 70 miles north of Harrisburg; served by the Pennsylvania, the Reading, and the New York Central railroads. It has an airport four miles from the center of the city and adequate bus service. It is claimed that the city was named, in 1795, for William Russell, a local boatman of that period.

Industries and Manufactures.—Formerly a great lumber center, the city's manufactures now include chemicals and allied products, clay, glass and stone products, food, leather, rubber goods, lumber and lumber products, metals and metal products, mine and quarry products, paper and printing, textiles, radio tubes and photo flash bulbs.

Educational and Cultural Facilities.—Williamsport's school system includes junior and

senior high schools, parochial schools, Dickinson Junior College, and the Williamsport Technical Institute. In the city is Lycoming College, a fully accredited and endowed coeducational liberal arts institution established in 1848 as a Methodist secondary school. The Historical Society Museum has impressive collections of curiosities and antiques. There are churches of all denominations, hospitals, and a public library. The city is the home of *Grit* (1882), an independent weekly newspaper with a net circulation of 600,000.

Recreational Facilities.—Little League baseball, which originated in Williamsport in 1938, has its national headquarters in the city which is the host annually to the State Little League Tournament and the Little League World Series for which teams from all over the United States gather. The game is also played in Canada, Hawaii, and Cuba. The city has golf courses, many baseball and softball diamonds, basketball courts, football fields, tennis courts, and swimming beaches.

History and Government.—First settled in 1756, Williamsport was chartered as a borough in 1806, and incorporated as a city in 1866. It has the commission form of government with five councilmen. Pop. (1950) 45,047.

WILLIAMSTON, wĭl'yăm-stŭn, town, North Carolina, seat of Martin County, on the navigable Roanoke River, is served by the Atlantic Coast Line Railroad. It is located on federal highways, 40 miles east of Rocky Mount. The town is named for Col. William Williams, a prominent citizen at the time of its incorporation. Situated in a tobacco, peanut, cotton, and corn region, it is an important tobacco market; its manufactures are peanut products, fertilizer, and lumber. The town has a modern public school system, churches of various denominations, a community hospital, a courthouse built in 1885, and several fraternal and social clubs.

Asa Biggs, United States senator and Confederate judge, was born here 1841. His son, Henry A. Biggs, was the last Confederate soldier to be killed at Appomattox. Madame Jumel, wife of Aaron Burr, vice president of the United States under Thomas Jefferson, lived in Williamston. The town was incorporated in 1779. Government is by a mayor and five commissioners. Pop. (1950) 4,975.

WILLIAMSTOWN, wĭl'yămz-toun, city in Australia, State of Victoria, on the southwest shore of Hobson's Bay, opposite Port Melbourne, and, since 1925, included within the limits of Greater Melbourne. Its chief business interests center in the shipping industry. The port has seven commodious piers, shipbuilding yards, patent slips, and a drydock. There are glass works, a woolen mill, and refrigeration plants. Basalt and brown coal are worked near the town, and several manufactures are carried on. Pop. (1947) 26,640, which includes 13,370 for the metropolitan area.

WILLIAMSTOWN, town, Massachusetts, in Berkshire County, on the Hoosic River; altitude 603 feet; 19 miles north of Pittsfield; served by the Boston and Maine Railroad. Its chief industry is wire manufacturing. The town has an excellent school system, and is the site of Williams College (q.v.). First settled in 1753, and named West Hoosac, the town was incorporated in 1765 when its name was changed to Williamstown in honor of Ephraim Williams by whose bequest Williams College was founded. Pop. (1950) 6,194.

WILLIAMSVILLE, wĭl'yămz-vĭl, village, New York, in Erie County, altitude 685 feet, is served by the Lehigh Valley Railroad and is situated 8 miles northeast of Buffalo. Manufactures include wood products, chemicals, gelatine, burial vaults, and concrete blocks. Originally known as Eleven Mile Creek, it later took the name of Williams Mills, or Williamsville, from Jonas Williams who in 1804 settled here as lumberer, grist miller, and tanner. The village was incorporated in 1850; it is governed by a mayor and four members of a board of trustees. Pop. (1950) 4,649.

WILLIMANTIC, wĭl-ĭ-măn'tĭk, city, Connecticut, at the junction of the Willimantic and Natchaug rivers, seat of Windham County, altitude 260 feet, is served by the Central Vermont, and the New York, New Haven and Hartford railroads. It is within the town limits of Windham and is located 28 miles east of Hartford. Known as the "Thread City," famed for cotton spinning since 1822, its chief manufactures are: thread, textiles, yarns, metal products, tools, machinery, hardware, rayon, airplane parts, and optical goods. Willimantic's educational facilities include a high school, Willimantic State Teachers College, grade schools, public and parochial, a public library, and the Durham Hall Library.

Incorporated as a borough in 1833 and as a city in 1893, Willimantic is governed by a mayor and board of aldermen. Pop. (1950) city, 13,586; town, 15,884.

WILLING, wĭl'ĭng, **Thomas,** American jurist, merchant, and financier: b. Philadelphia, Pa., Dec. 19, 1731; d. there, Jan. 19, 1821. In 1740 he was sent to England to be educated at schools in Bath and Wells. He entered the Inner Temple, London, in 1748, to read law. Returning to Philadelphia in May 1749, he became a partner in his father's mercantile business, and later entered into partnership with Robert Morris (signer of the Declaration of Independence), as Willing, Morris & Company, a firm which at that time became the leading mercantile house in Philadelphia. Willing also served in many public and political activities. In 1763 he was elected mayor of Philadelphia, and a year later to the Provincial Assembly from which he resigned in 1767 to accept an appointment as justice of the supreme court of the province. He became an active champion of colonial rights but was reluctant to break with the mother country. In 1775 he was elected to the Second Continental Congress, and voted against the Declaration of Independence because he "thought that America at that time was unequal to such a conflict."

During the Revolutionary War he remained in Philadelphia, refused to take the oath of allegiance to the king, but worked assiduously to support Robert Morris in his financial support of the war. In 1781, Willing was appointed president of the newly organized Bank of North America. He, with others, was appointed by President George Washington as commissioner to receive subscriptions to the first Bank of the

United States of which he was president (1791–1797). Having amassed a fortune of about one million dollars his health broke, and he retired to private life.

WILLIS, wĭl'ĭs, **Henry Parker,** American economist: b. Weymouth, Mass., Aug. 14, 1874; d. Oak Bluffs, Martha's Vineyard, Mass., July 18, 1937. He was graduated from the University of Chicago in 1894 (Ph.D. 1897), and later studied at Leipzig and Vienna. His subsequent appointments were: assistant to the Monetary Commission (1897–1898); professor of finance, George Washington University (1905–1906, and 1907–1910); expert for the Ways and Means Banking and Currency committees of the House of Representatives (1911–1913); secretary of the Federal Reserve Board (1914–1918); president of the Philippine Insular Bank, Manila, P. I. (1916–1917); professor of banking, Columbia University (from 1917); associate editor (1912–1914), and editor in chief (1919–1931) of the *New York Journal of Commerce.*

He was author of *Our Philippine Problem* (1905); *Principles and Problems of Modern Banking* (1910); *Business and Banking* (with G. W. Edwards, 1921); *Investment Banking* (with J. I. Bogan, 1929).

WILLIS, Nathaniel Parker, American editor and author: b. Portland, Me., Jan. 20, 1806; d. Cornwall-on-Hudson, N. Y., Jan. 20, 1867. While still a student at Yale from which he graduated in 1827 he became known as a poet. Two years after his graduation he established in Boston the *American Monthly Magazine.* His editorial audacity, however, alienated the sympathies of critics and subscribers, and after two and a half years it ceased publication. Leaving Boston, he was appointed foreign correspondent for the New York *Mirror* (1831–1836) and soon took rank among the leading American men of letters.

During extensive travels in Europe he visited England (1834) where his social gifts made him a popular member of London society. There in 1835 he married Mary, the daughter of Gen. William Stace. Returning to the United States in 1836, he continued his literary contributions to the *Mirror* and helped to establish a short-lived periodical, the *Corsair.* After another visit to England, where he induced William Makepeace Thackeray to write for the *Corsair,* he joined the *New Mirror,* a New York weekly which soon became the *Evening Mirror.*

After his wife's death (1845) he made his third and last visit to Europe accompanied by his young daughter. On his return home the following year he became associated with the *National Press,* later renamed the *Home Journal.* He remarried (1846), visited Bermuda and the West Indies in 1852, and a year later established a country seat, "Idlewild" at Cornwall-on-Hudson, where he continued his literary activities and exchanged amenities with his famous neighbor, Washington Irving, at "Sunnyside." Later, as correspondent in Washington for the *Home Journal,* he became a favorite of Mrs. Lincoln. Failing health sent him back to "Idlewild" where he died.

Among his principal works are: *Poetical Scripture Sketches* (1827); *Inklings of Adventure,* 3 vols. (1836); *Loiterings of Travel* (1840); *Pencillings by the Way* (1844); *Famous Persons and Places* (1854); *Paul Fane* (1856); *The Convalescent* (1859); and the play *Tortesa, or the Usurer Matched* (1839).

WILLISON, wĭl'ĭ-s'n, Sir **John Stephen,** Canadian journalist: b. Hills Green, Huron County, Ontario, Canada, Nov. 9, 1856; d. Toronto, May 27, 1927. He was parliamentary correspondent of the Toronto *Globe* and in 1890–1902 he was its editor. He then became editor of the Toronto *News,* from 1902, and in that capacity he contributed largely to the defeat of the Reciprocity Agreement with the United States (1911), and to the downfall of the Laurier administration. He was elected president of the Parliamentary Press Gallery in 1890; and of the Canadian Press Association in 1900. In 1910 he became Canadian correspondent of *The Times,* London. He was knighted in 1913.

He published *The Railway Question in Canada* (1897); *Sir Wilfred Laurier and the Liberal Party: a Political History,* 2 vols. (1903); *The United States and Canada* (1908); *The New Canada* (1912); *Reminiscences* (1919).

WILLIS'S ROOMS. See Almack's.

WILLISTON, wĭl'ĭs-tŭn, city, North Dakota, and seat of Williams County, on the Missouri River, 110 miles west of Minot; altitude 1,874 feet; served by the Great Northern Railroad. It is on two federal highways, and has a municipal airport. Located in an agricultural region, which produces small grain, sugar beets, beef and dairy cattle, Williston also has lignite coal mines. It was incorporated in 1904 and has the commission form of government. Pop. (1950) 7,378.

WILLISTON PARK, village, New York, on Long Island in Nassau County, 21 miles east of New York City; served by the Long Island Railroad and buslines. It is a residential community with a public school system and a free public library. Incorporated 1926, the village is governed by a board of five members appointed by a board of trustees. Pop. (1950) 7,505.

WILLKIE, wĭl'kĭ, **Wendell Lewis,** American lawyer, public utility executive, and Republican presidential candidate: b. Elwood, Indiana, Feb. 18, 1892; d. New York, N. Y., Oct. 8, 1944. His father, Herman, was a prosperous lawyer and landowner; his mother was the first woman ever admitted to the Indiana bar. He was third of a family of six children; attended Culver Military Academy and, in 1909, went to the University of Indiana. After receiving his B.A. degree (1913), and the degree of LL.B. (1916), he joined his father in the practice of law, but left to enlist in the army, soon to become a lieutenant in the field artillery. In January 1918 he married Edith Wilk, a librarian in Rushville, Indiana.

After the war he joined the legal department of the Firestone Rubber Company, and the law firm of Mather and Newbitt, and became one of the best known lawyers in Ohio. In 1929, Willkie was called to New York to an attorneyship for the Commonwealth and Southern, a utility holding company of which concern, in 1933, he was made president. During the business depression of that time his campaign to increase consumption and decrease costs greatly benefited his com-

pany and its customers. Eventually the Tennessee Valley Authority paid his company $78,600,000 for its Tennessee properties.

Willkie's nationwide activities in connection with his utilities crusade eventually brought to him recognition as presidential timber. By May 1940 he was recognized as the chief Republican dark horse for the nomination. His political beliefs were stated in a widely publicized article, "We, the People" At the Republican National Convention in Philadelphia in 1940 his political skill brought him the presidential nomination. His following campaign resulted in his receiving over 22,000,000 votes but he did not succeed in winning the election.

His entire lack of affectation, his forthrightness, and his engaging personality assured for him continued public acclaim. After his defeat he urged in a radio address that his supporters' "function during the next four years [should be] that of the loyal opposition." The Willkie Memorial Building in New York City, financed by voluntary contributions at a cost of $250,000 has a plaque on which is inscribed: "We Carry on in the Spirit of his Service to All Men and One World." He wrote *One World* (1943), a strong argument against isolationism.

WILLMAR, wĭl'mär, city, Minnesota, seat of Kandiyohi County, altitude 1,123 feet, on Foot Lake, is served by the Great Northern Railroad. It is located 52 miles southwest of St. Cloud, and was named for Leon Willmar, a railroad agent. It is a railroad division point; the chief industries are turkey processing, dairying, and farming; the principal crops are corn and small grains. It is also a livestock buying center. The city's educational facilities include a junior-senior high school, a public library, and the Willmar Memorial Auditorium which contains the curio and book collection of the late Col. Cushman Rice. The village was founded in 1869 and incorporated as a village in 1874, and as a city in 1901. Government is by a mayor and council. Pop. (1950) 9,410.

WILLOUGHBY, wĭl'ō-bĭ, Sir **Hugh,** English Arctic explorer: b. probably, Risby, Derbyshire, England, about 1500; d. about 1554. In 1553 he was appointed to command an expedition fitted out by London merchants "for the discovery of regions, dominions, islands, and places unknown," and on May 10 sailed from Deptford with three vessels, the *Bona Esperanza,* his own ship, with 35 persons; the *Edward Bonaventure,* carrying 50 men; and the *Bona Confidentia,* with 28 men. They sighted the coast of Norway about the middle of July and during a storm in the middle of September the *Edward Bonaventure,* at Senja, parted company with the two other vessels, which reached Russian Lapland, where they found a good harbor at the mouth of the river Arzina. Here Willoughby and his 62 companions perished during the course of the winter. The following year Russian fishermen found the ships with the dead bodies of the crews, together with the commander's journal, and a will witnessed by Willoughby, showing that some of the mariners were alive in January 1554.

Richard Chancellor, in the remaining vessel, after being separated from his comrades, finally reached Archangel, near the mouth of the river Dvina, in the White Sea. News of his arrival was immediately dispatched to the czar, Ivan IV, who invited the mariners to the court of Moscow. A direct trade with Russia resulted from Chancellor's discovery.

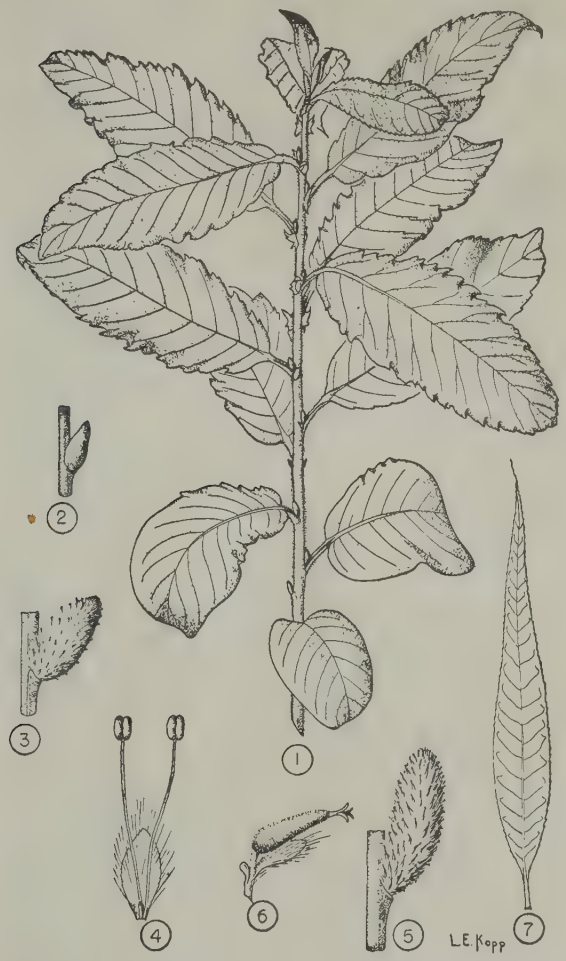
WILLOUGHBY, Westel Woodbury, American political scientist: b. Alexandria, Va., July 20, 1867; d. Washington, D.C., March 26, 1945. After graduating from Johns Hopkins University in 1888, he practiced law for several years. In 1894–1895 he was assistant in political science at Leland Stanford Jr. University (Stanford University), and from 1897 to 1933 was professor of political science at Johns Hopkins. He was adviser to the Chinese delegations at the Washington Conference, 1921–1922, at the International Opium Conference, 1924–1925, and at the Assembly of the League of Nations, 1931. He was the author of numerous books on constitutional law and similar subjects, also on opium; in 1935 he wrote *The Sino-Japanese Controversy and the League of Nations.*

WILLOUGHBY, William Franklin, American economist, twin brother of Westel Willoughby (q.v.): b. Alexandria, Va., July 20, 1867. After graduating at Johns Hopkins University in 1888, he was an expert in the United States Department of Labor (1890–1900); professor of jurisprudence and politics at Princeton (1912–1917); served as director of the Institute for Government Research (1916–1932); and consultant of the political science and publishing administration, Library of Congress, from 1937. He was the author of various books on the principles of administration.

WILLOUGHBY, wĭl'ō-bĭ, village, Ohio, in Lake County, altitude 625 feet, is served by the New York Central, and the New York, Chicago, and St. Louis railroads. It is located on the Chagrin River, 17 miles northeast of Cleveland, near Lake Erie. The principal manufactures are auto parts, rubber products, furniture, machinery, metal products, chemicals, and heating apparatus. The village has a public library and a medical college. The first settlement centered around a grist and sawmill erected in 1797; the first town meeting was held 1815. Government is by a mayor and council. Pop. (1950) 5,602.

WILLOW, a genus, *Salix,* of some 300 species of trees and shrubs in the family Salicaceae; over 100 are in North America. Mostly north temperate, they extend from the Arctic to the Gulf of Mexico, Central America, the West Indies, into the Andes in Chile; they also grow in Eurasia, South Africa, Madagascar, Java and Sumatra. Willows vary from less than an inch in height under arctic and alpine conditions (*Salix herbacea,* dwarf willow) to trees of a hundred feet or more. The alternate, simple leaves may be narrow as in weeping willow, or rather broad as in the pussy and shining willows. The leaf-stalks are short, and stipules are often present. One large scale covers each bud. The flowers are in elongated clusters, aments or catkins, of two types, staminate and pistillate; these are normally on different trees. However, exceptions occur, and both types may be on the same tree, or staminate and pistillate flowers may develop in the same catkin, or in rare instances, the flowers are bisexual. A staminate catkin has an axis bearing numerous bracts which

are more or less hairy on the outer surface, each subtending 2 or several stamens and a yellow nectar gland. In the pistillate ament each bract encloses a gland and a single pistil with a



Figs. 1-6—Pussy willow. Fig. 1—Shoot showing leaves variously toothed or entire, axillary buds and stipules, x ½. Fig. 2—Bud covered with single scale, x ½. Fig. 3—Young staminate catkin, x ½. Fig. 4—Single staminate flower showing hairy bract, 2 stamens and nectar gland. Fig. 5—Young pistillate catkin, x ½. Fig. 6—Pistillate flower showing hairy bract, single pistil and gland. Fig. 7—Leaf of weeping willow, x ½.

divided stigma and an ovary containing 8 or more ovules. The seeds are minute and have a tuft of soft hairs which serve for wind dissemination. Pussy willow catkins appear well before the leaves, and as the staminate ament elongates the backs of the bracts become visible, exposing their silky grayish hairs and giving rise to the "pussy" stage. Later the stamens with their golden pollen are seen. Willow catkins are visited by insects which gather nectar and pollen and effect pollination. In certain northern and Arctic species the pollen is less sticky, and wind pollination apparently occurs, as in catkin-bearing plants generally. Since the sexes are normally on separate plants, cross pollination is the rule; hybridization is thus facilitated and many intermediate forms exist. In various species diploid chromosome numbers of 38, 76, 114 and 152 are found, so that they constitute a polyploid series, as is often the case in hybridization. The perpetuation of these forms is facilitated by natural and artificial propagation by cuttings. In the temperate zone willows thrive along stream banks, and twigs naturally root in the muddy shores. They also reproduce by seeds. Among flowering plants willow is ancient, fossils extending back to the Cretaceous.

Largest of the willows of eastern North America is the black willow, *Salix nigra.* With its dark brown, ridged bark, reddish to orange twigs, and long, narrow leaves, it is a striking stream-bank tree, ranging from the east westward across Texas to California. Although its light, reddish brown wood is soft and not strong, this is the common willow wood of North America. It is used for artificial limbs, boxes, crates, barrels for produce, cores for veneers, furniture, and somewhat for paper pulp. By destructive distillation it yields charcoal and black powder, a constituent of black gunpowder. The peach-leaved willow, *S. amygdaloides,* extends from Washington across Canada to western New York, and south to Oklahoma and Texas; it flourishes along the streams flowing eastward from the Rockies. This shrub or fairly tall tree with leaves suggestive of those of the peach finds limited use for lumber and charcoal. Other conspicuous American species are the shining willow, *S. lucida,* a shrub or tree of the northeast, identified by its leaves which are a deep, rich, shiny green above, paler beneath, and the pussy willow, *S. discolor,* a shrub or small tree, distributed along waterways from Nova Scotia to Manitoba, and southward to Missouri and Delaware. Its "precocious" staminate catkins are ornamental. Similar are the florists' willows, *S. caprea* and *S. cinerea,* introduced from Europe, and sold as pussy willows at Eastertime. In central Europe they are used in churches on Palm Sunday. Numerous other cultivated willows have frequently "escaped." Although native of Europe, Asia and Africa, the white willow, *S. alba,* is planted and grows wild in North America. It is a tall riparian tree with spreading branches often drooping, and small, narrow, silky leaves. There are forms with bright yellow and others with bright red branches. White willow and crack willow, *S. fragilis,* a similar tall tree but with somewhat larger leaves, and greenish to reddish twigs that snap off in the wind, furnish important European wood. The weeping willow, *S. babylonica,* with pendulous branches and narrow falcate leaves, is native of China; the trees by the rivers of Babylon, upon which the Jews hung their harps as they wept, according to the Psalms, were probably aspens, not weeping willows as often supposed. Willow "rods" or twigs are cut in winter or spring, and the bark is removed. They are then dried and woven into baskets and wicker furniture; osier willow (*S. viminalis*), almond-leaved willow (*S. amygdalina*), and purple osier (*S. purpurea*) are preferred. Pollarded willows are trees which have been cut back to produce a dense head of shoots, such as are employed in basketry. Willow is also a source of tannin, of salicin, and of honey, and the trees are used as windbreaks, shelterbelts, to prevent erosion, and in riverbank revetments.

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EDWIN B. MATZKE.

WILLOW GROUSE or **WILLOW PTARMIGAN.** See PTARMIGAN.

WILLOW HERB. See EPILOBIUM.

WILLOW RUN, wĭl'ō rŭn, village, Michigan, in Washtenaw County, is served by the Michigan Central Railroad. At its airport the University of Michigan has an aeronautical research center. It is a residential and industrial suburb located four miles east-northeast of Ypsilanti. The huge bomber plant which was built here during World War II, operated by Henry Ford, was converted for the manufacture of automobiles and farm machinery following the war. The village has a housing project administered by the Public Housing Administration. Politically it is a part of Ypsilanti and Superior townships. Pop. (1950) 11,365.

WILLOW WARE. All porcelain and earthenware dishes decorated with this transfer printed scenic pattern are known collectively as willow ware. Adapted from the Chinese decoration on much of the blue and white china imported to England in the 17th and 18th centuries, this design originated in 1780 at the Caughley pottery and the copper plate for it was engraved by Thomas Minton, who later founded his own famous pottery. This pattern was so popular that soon others like Wedgwood, Spode, Turner, and Davenport were using it and by about 1800 it had become a stock pattern with most English potteries for both porcelain and earthenware dishes. From this, it became the most widely used decoration for inexpensive earthenware dishes which were quantity-produced by the English potteries for home use and export. It was also copied by some of the Continental potteries, especially those of the Netherlands.

The willow pattern never went out of style and is still a standard one with pottery manufacturers in England, Holland, the United States and even Japan for export to Occidental markets. At first, it was printed in cobalt blue and later in a medium green and the reddish shade known as mulberry. The design of this pattern perpetuates the legendary Chinese love story of the scribe, Chang, and Li-chi, daughter of a mandarin. They eloped to an island tea house surrounded by willow trees on a small lake. Pursued by her father, the lovers were changed by approving gods into a pair of turtle doves. These are shown in the design flying away to safety above the willow trees.

THOMAS H. ORMSBEE.

WILLOW WREN or **WILLOW WARBLER,** a European singing bird (*Phylloscopus trochilus*), dull olive-green on the upper part of the body, yellowish white on the breast and below, and about five inches in length. The nest is placed on the ground, most commonly against a bank, in long grass or weeds, but often at the foot of a bush; like that of the wood wren, it is covered with a dome having a rather wide hole in the side, whence this species and its congeners are called oven birds. The willow wren is a graceful, active bird, flitting restlessly from twig to twig. Its song is loud and sweet.

WILLOWS, wĭl'ōz, city, California, and seat of Glenn County, altitude 139 feet, is served by the Southern Pacific Railroad and has an airport. It is on the Pacific Highway, 90 miles north of Sacramento, and is the trading center for an irrigated dairy, poultry, and sheep area which also raises barley, rice, wheat, flax, clover, sugar beets, and citrus fruits. Wool and the cultivating of Ladino clover are the main industries. The city's educational facilities include public schools, a high school, churches, and a free public library. It was incorporated as a town in 1886, and as a city in 1935. Government is by mayor and council. Pop. (1950) 3,019.

WILLS, Helen Newington, American tennis player: b. Centerville, Calif., Oct. 6, 1906. Educated at the Anna Head School and the University of California, she later studied art and exhibited in New York City. As a champion tennis player she won the United States women's singles championship in 1923, 1924, 1925, 1927, 1928, 1929, and 1931; the Wimbledon singles eight times; the French singles four times, and the Wightman Cup singles 18 times, and retired from major tournament play in 1938. She wrote and illustrated *Tennis* (1928) and *Fifteen-Thirty* (1937).

WILLS, wĭlz, **William Gorman,** Irish playwright and poet: b. Kilmurry, Ireland, Jan. 28, 1828; d. London, England, Dec. 13, 1891. Educated at Trinity College, Dublin, he studied art at the Royal Hibernian Academy and, for a time, engaged in portrait painting. After 1862 he devoted himself to literature, but resumed portrait painting in 1868.

He was the author of *Notice to Quit* (1863); *The Wife's Evidence* (1864); and the dramas *Charles I* (1872, played by Henry Irving); *Medea in Corinth* (1872); *Olivia* (1873; based on Goldsmith's *Vicar of Wakefield*); *Eugene Aram* (1873); *Marie Stuart* (1874); *Jane Shore* (1876); *Sedgmoor* (1881); *Claudian* (1883); *A Royal Divorce* (1891), and, with Sydney Grundy, *Madame Pompadour* (1888). He was also the author of ballads, including the well-known *I'll Sing Thee Songs of Araby.*

WILLS, William Henry, English writer: b. Plymouth, England, Jan. 13, 1810; d. Welwyn, Hertfordshire, Sept. 1, 1880. He was a member of the original staff of *Punch,* acting as dramatic critic and also contributing both prose and verse. His contributions included *Punch's Natural History of Courtship; Punch's Comic Mythology;* and *Information for the People.* In 1846 he became associated with Charles Dickens, with whom he formed a lifelong friendship, as subeditor of the *Daily News.* In 1849 he became assistant editor of *Household Words,* and in 1859 of *All the Year Round.* He published *Old Leaves Gathered from Household Words* (1860).

WILLS, William John, Australian explorer: b. Totnes, England, Jan. 5, 1834; d. Cooper's Creek, Australia, about June 30, 1861. Having studied medicine in London, he emigrated to Australia in 1852 where he was joined in the following year by his father, and together they practiced medicine at Ballarat. In 1855 he became a surveyor of Crown lands, and in 1858 he was appointed to the staff of the magnetic and meteorological observatory at Melbourne. In 1860 he joined the expedition under Robert O'Hara Burke as third in command, later be-

coming second, and crossed the continent northward, reaching the Gulf of Carpentaria, but on the return journey both Burke and Wills died of starvation. Wills' journal was recovered and published as *A Successful Exploration from Melbourne to the Gulf of Carpentaria from the Letters and Journals of William John Wills (1863)*.

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WILLSTATTER, wĭl'shtĕt-ĕr, **Richard,** German chemist: b. Karlsruhe, Aug. 13, 1872; d. Locarno, Switzerland, Aug. 3, 1942. Professor of organic chemistry at the University of Munich in 1902, he taught at the Federal High School in Zurich (1905–1912), the Kaiser Wilhelm Institute, Berlin (1912–1915), and again at Munich (1916–1925). Willstätter's work on chlorophyll and on anthocyanins (red, blue, and violet plant pigments) earned him the 1915 Nobel Prize in chemistry. He later worked on the chemical composition of enzymes and the assimilation of carbonic acid in plants.

WILLUGHBY, wĭl'ŭ-bĭ, **Francis,** English ornithologist and ichthyologist: b. Middleton, Warwickshire, England, 1635; d. there, July 3, 1672. After completing his studies at Cambridge University (1653–1659) he spent some time at Oxford University and traveled extensively in England. Thereafter, in the company of John Ray, often called the "father of English natural history," he made an extensive Continental tour to gather collections in the furtherance of their studies.

Ray edited and translated Willughby's Latin *Ornithologia* (which Willughby did not live to publish) and in 1678 he published it in English as *The Ornithology of Francis Willughby.* Ray also edited Willughby's *History of Fishes* (1686). Both George Louis Buffon and Linnaeus were much indebted to the *Ornithologia,* and it is claimed that Willughby originated the Linnaean system of zoological classification.

WILMERDING, wĭl'mĕr-dĭng, borough, Pennsylvania, in Allegheny County, served by the Pennsylvania Railroad, is located 11 miles east of Pittsburgh. It is an air brake manufacturing center. The borough has public and parochial schools and a high school library. Settled and incorporated in 1890, it is governed by mayor and council. Pop. (1950) 5,325.

WILMETTE, wĭl-mĕt', village, Illinois, in Cook County, on Lake Michigan, altitude 614 feet, is served by the Chicago and North Western Railway and is situated 15 miles north of Chicago. It is a residential community. At its Baha'i temple is held the annual convention of the United States branch of the Bahai faith. Incorporated in 1872, the village is governed by a manager. Pop. (1950) 18,162.

WILMINGTON, wĭl'mĭng-tŭn, city, Delaware, seat of New Castle County, altitude from 33 to 260 feet; served by the Pennsylvania; the Baltimore and Ohio; and the Reading railroads. The New Castle County Airport, 6 miles distant, is served by four major airlines; the city, on federal and state highways, has good bus connections with all parts of the country. It is the largest city in the state, a port of entry with deepwater docks; is located on the Delaware River at the influx of Brandywine Creek and the Christina River, and is 25 miles southwest of Philadelphia.

Industries.—Wilmington is called the "chemical capital of the world," for it is the home of factories and laboratories of large chemical manufacturing interests including the world-renowned E. I. duPont de Nemours & Co., Inc. Other industries and products include braided rubber hose, cotton dyeing and finishing works, railroad equipment, leather, fiber, iron and steel products, cork products, rayon, automobile assembling, oil refining, meat packing, and the building of ships and yachts.

Educational and Cultural Facilities.—The city has a modern public school system with junior and senior high schools, private and parochial schools, and institutions teaching business subjects. At Newark, 14 miles distant, is the University of Delaware. The Wilmington Institute Free Library has over 200,000 volumes. The city has over 150 churches of all denominations; many fraternal organizations and social clubs; public and private hospitals; a number of theaters, and a flourishing art center and artist colony.

Places of Interest.—Particularly noteworthy are such historical points as the statue before the duPont Building, commemorating Caesar Rodney who rode to Philadelphia in July 1776, to sign the Declaration of Independence; the first powder mill in the United States (1802) which used the waterpower of the Brandywine; the Robinson House, an old Swedish blockhouse, eight miles north of the city, showing portholes used in Indian warfare; the old city hall, built in 1798, now occupied by the Delaware Historical Society; the monument in Fort Christina State Park, commemorating the landing of the first Swedish settlers; and the Old Swedes Church (1698), rebuilt and restored, used continuously since its erection as a place of worship.

Of outstanding interest is the Experimental Station of the duPont Company which has about 800 technically trained research workers representing a wide range of sciences. In addition it has about 1,500 nontechnical employees. Here was carried on the research which resulted in nylon and many other new products of service to the world. Approximately five miles south of Wilmington is the Delaware Memorial Bridge, a suspension structure connecting the states of Delaware and New Jersey, constructed at a cost of over $40 million.

History and Government. — Adventurous Swedish voyagers under the leadership of Peter Minuit (q.v.) landed on the site of Wilmington in 1638 to found a colony. They erected a fort, a church and homes, and named the settlement Christinahamn and the river Christina, in honor of the queen of Sweden. The little colony prospered, but in 1655 it was annexed by Peter Stuyvesant to become part of Holland's growing empire. Thereafter it became a commercial and trading center until it was taken by the British in 1664 and allowed to go to ruin. Thomas Willing, who foresaw the possibilities of the site in 1731, laid out streets and named the place Willington, later changed to Wilmington after Spencer Compton, the English earl of Wilmington. It was incorporated as a city in 1832 and is governed by a mayor and council elected by popular vote. Pop. (1950) 110,356.

WILMINGTON, city, Illinois, in Will County, altitude 619 feet, on the Kankakee River (bridged here), is served by the Gulf, Mobile and Ohio Railroad, and is situated 15 miles south-southwest of Joliet. It is the trade center for an agricultural and bituminous coal-mining area. Farm products include corn, oats, soybeans, livestock, poultry, and dairy products; the chief manufactures are felt, clothing, and fireworks. The city has good schools, a public library, and theaters. Island Park is a favorite resort. Settled about 1839, it was incorporated 1875. Pop. (1950) 3,354.

WILMINGTON, town, Massachusetts, in Middlesex County, is served by the Boston and Maine Railroad. It is 15 miles north-northwest of Boston, on three highways, and has an airport. The principal activities are dairying, poultry raising, fruit growing, and leather manufacturing. The town has a complete public school system, churches of all denominations, a public library, and social and fraternal clubs.

It was first settled in 1639 and incorporated in 1730; the town meetinghouse was erected in 1733. Wilmington took an active part in the Revolutionary War. In 1803 the Middlesex Canal, which passed through Wilmington, was opened and greatly facilitated the transportation of merchandise and passengers. Pop. (1950) 7,039.

WILMINGTON, city and port of entry, North Carolina, seat of New Hanover County, on Cape Fear River, 30 miles from its mouth, altitude 30 feet; served by the Atlantic Coast Line and the Seaboard Air Line railroads, and five federal highways. It has two airports with freight and passenger service to all parts of the United States, and is located 115 miles south-southeast of Raleigh. An important deepwater port, its waterfront is lined with piers and warehouses affording wharfage facilities for ocean-going vessels.

Industries and Manufactures.—The agricultural products of the region are lettuce, peanuts, corn, tobacco, farm truck, flowers and bulbs; cut flowers are shipped by air to all parts of the country. Dairy cattle raising also is important. As well as being an important petroleum distributing point, the city exports cotton, tobacco, lumber, naval stores, and superphosphates. Local industries include the manufacture of clothing, textiles, bromine, fertilizer, lumber, metal products, creosoting, and meat packing. Shipbuilding is also carried on.

Educational, Cultural, and Recreational Facilities.—Wilmington has a complete school system with senior high schools, parochial schools, and a junior college. It has a public library with bookmobile, churches of many denominations, and four hospitals. The Community Concert Association, and the Symphony Orchestra contribute to the cultural development of the community. The four-day program of the Azalea Festival in April attracts visitors from a wide area.

Places of Interest.—The city hall, built in 1857, is of classic design and houses the public library. The New Hanover County Historical Museum has among its exhibits many time-honored documents; Lord Cornwallis' house, now a historical shrine owned by the North Carolina Society of Colonial Dames, was the headquarters of Lord Cornwallis during the Revolutionary War; the Bellamy Mansion, completed in 1857, was headquarters of Federal occupation troops in the Civil War; and in the national cemetery, with other war dead, lie the Union soldiers who died in the assault on Fort Fisher (q.v.) in 1865.

History and Government.—The first settlement was made by English yeomen in 1730 and was called New Liverpool, later renamed New Town. Governor Gabriel Johnston, in 1734, changed the name to honor his patron, Spencer Compton, the English earl of Wilmington. Thereafter the town assumed commercial importance. Cornwallis occupied Wilmington before starting on his march to Yorktown. During the War Between the States the port was used by Confederate blockade runners. After the bombardment of Fort Fisher, 18 miles south of the city, Wilmington surrendered to the Federal forces. It was rechartered as a city in 1866. It has the city manager form of government, instituted in 1941, with five city councilmen. Pop. (1940) 33,407; (1950) 45,043.

WILMINGTON, city, Ohio, and seat of Clinton County, altitude 1,033 feet, served by the Baltimore and Ohio, and the Pennsylvania railroads. It is situated 30 miles southeast of Dayton. The trading center for an agricultural area, it also manufactures tools, metal products, electrical goods, machinery, furnaces, and food products. It is the seat of Wilmington College (q.v.). A few miles north of the city is the John Bryant State Park. Settled in 1810, the city was incorporated in 1928. Government is by mayor and council. Pop. (1950) 7,387.

WILMINGTON, Capture of, in the American Civil War. After Gen. Alfred H. Terry's capture of Fort Fisher (q.v.) in North Carolina, Jan. 15, 1865, Terry posted his troops on an intrenched line across the peninsula, about two miles above the fort. An advance on Wilmington was delayed until he could be reinforced, as Maj. Gen. Robert F. Hoke, the Confederate commander, was holding Fort Anderson, on the west bank of Cape Fear River, about midway between Fort Fisher and Wilmington, and on the opposite bank had thrown up a line of intrenchments across the peninsula in Terry's front, defended by 4,500 men. Fort Anderson was an extensive earthwork, mounting 10 heavy guns, commanding the approaches by land and water, and held by Brig. Gen. Johnson Hagood's brigade of 2,000 men. Gen. Ulysses Simpson Grant ordered Gen. John McA. Schofield, with the 23d Corps, from Tennessee to the coast of North Carolina to cooperate with Gen. William T. Sherman.

Schofield's troops arriving at Alexandria and Washington late in January were detained some days by the ice in the Potomac. Gen. Jacob D. Cox's division of 4,400 men went by steamer from Alexandria and landed on the peninsula, in rear of Terry, February 9, raising Terry's command to 8,000 men. Schofield now took command; the fleet under Admiral David D. Porter occupied positions in Cape Fear River and off the coast, covering both flanks of Terry's line.

On February 11, Terry pushed forward, supported by Cox, drove in Hoke's pickets, and intrenched within 500 yards of his main line. An attempt on the 12th to turn Hoke's left by a cooperation of the army and navy was foiled by high winds and a violent storm. On the night of the 14th an unsuccessful attempt was made to

move the pontoons upon their wagons along the beach with the troops.

On February 16, General Cox's and Gen. Adelbert Ames' divisions crossed by steamboat to Smithville, on the right bank of the river, where they were joined by Col. O. H. Moore's brigade, of Gen. Darius N. Couch's division, and a battery; on the 17th, Cox with four bridgades and the battery advanced along the main Wilmington road, driving the Confederate pickets and bivouacking near Fort Anderson, with his right resting on the river.

Next morning the advance was resumed and the enemy driven within the works. Moore's and Henderson's brigades were intrenched on the south side of the fort, while Cox, with his other two brigades, followed later by Ames' division, started around Orton Pond, covering the Confederate right, to gain the Wilmington road in rear of the fort, the distance to be traveled being about 15 miles. The guns of Fort Anderson opened fire on the two brigades confronting the fort, and the gunboats opened heavily on the fort, the monitor *Montauk* lying close to it and the others enfilading its parapet. General Hagood, warned by his cavalry of Cox's movement around his right, hastily abandoned Fort Anderson during the night, taking with him six light guns and falling back behind Town Creek, eight miles above the fort. Hoke also retreated from his lines opposite Fort Anderson to within four miles of Wilmington. By these movements Schofield gained possession of the main defenses of Cape Fear River and of Wilmington, with several pieces of heavy ordnance and a large amount of ammunition, and with but small loss.

On February 19, Cox pursued Hagood to Town Creek, behind which and near its mouth he was found intrenched, having destroyed the only bridge. The creek was not fordable and could not be bridged. Terry also advanced on the east side of the river, following Hoke, and found him in force, and Ames' division was recrossed to the east bank and joined Terry in the night.

Terry again advanced on the morning of the 20th and after some sharp skirmishing came upon Hoke well intrenched with artillery in position. On the same day Cox crossed Town Creek below Hagood's position, attacked on the flank and rear and routed his brigade. He captured two guns, three battle flags and 375 prisoners, including Col. C. H. Simonton, temporarily commanding the brigade, and nearly all the officers.

On February 21, Cox secured a portion of the Confederate pontoon bridge across Brunswick River, which Hoke had endeavored to destroy, put the 16th Kentucky Regiment upon Eagle Island abreast Wilmington, and threatened to cross Cape Fear River above the town. Hoke at once set fire to steamers, boats, cotton and naval stores, and abandoned the place, retreating in the direction of Goldsboro. General Terry entered the place without opposition early in the morning of February 22, and pursued Hoke across Northeast River.

The Union loss from Feb. 11, 1865 to the capture of Wilmington on February 22 was about 200 killed and wounded. Schofield estimated the Confederate loss at not less than 1,000 killed, wounded, and prisoners.

Consult Cox, J. D., *March to the Sea* in *Campaigns of the Civil War Series* (1882); id., *Military Reminiscences of the Civil War*, vol. 2 (1900).

WILMINGTON COLLEGE, located at Wilmington, Ohio, is a four-year fully accredited liberal arts coeducational institution established in 1871 and sponsored by the Society of Friends (Quakers). Three degrees are conferred: bachelor of arts, bachelor of science, and bachelor of science in education. Particular stress is placed on liberal arts, fine arts, preprofessional training, and industrial management; various scholarships and loan funds are available. The campus covers 300 acres. In addition to dormitories, classrooms, and lecture halls, buildings include a fine arts center, a gymnasium, a library, an observatory, and an athletic field and stadium. The library has a Quaker collection. The normal student body for fall and winter terms is 500. An average summer school enrollment is 300.

WILMOT, David, American jurist and politician: b. Bethany, Pa., Jan. 20, 1814; d. Towanda, Pa., March 16, 1868. Admitted to the bar in 1834, he practiced law in Towanda, and served as a member of Congress from 1845 to 1851. He favored the Mexican War and other party measures, but opposed the extension of slavery in any territory acquired by the United States. On Aug. 8, 1846, when a bill was introduced appropriating funds to be used in the negotiation of peace with Mexico, Wilmot introduced an amendment which provided that "neither slavery nor involuntary servitude" shall be allowed in territory so acquired. This amendment, known as the Wilmot Proviso (q.v.) became famous in American history.

Wilmot supported Martin Van Buren in 1848 against Gen. Lewis Cass, the Democratic candidate for president, and later joined the Republican Party at the time of its formation, and was a delegate to the national conventions of 1856 and 1860. From 1851 to 1861 he served as president judge of the 13th judicial district of Pennsylvania. In 1857 he was the unsuccessful Republican candidate for governor of the state. From 1861 to 1863 he was United States senator, and served as judge of the United States Court of Appeals from the time of his appointment in 1863 until his death.

WILMOT, John. See ROCHESTER, 2D EARL OF (JOHN WILMOT).

WILMOT, Robert Duncan, Canadian statesman: b. Fredericktown, New Brunswick, Canada, Oct. 16, 1809; d. Orimocto, New Brunswick, Feb. 11, 1891. He was educated in St. John and engaged for a time in shipping. He entered the Legislative Assembly in 1846 where he sat for St. John until 1861, and again in 1865–1867. He was mayor of St. John in 1849, surveyor general of New Brunswick and member of the executive council of the province 1851–1854, provincial secretary in 1856–1857, and a delegate to the colonial conference in London 1866–1867. He became a member of the Canadian Senate in 1865, of the Privy Council in 1878, was speaker of the Senate in 1878–1880, and in 1880–1885 served as lieutenant governor of New Brunswick.

WILMOT PROVISO, an amendment offered in the United States Congress by David Wilmot (q.v.), Aug. 8, 1846, pending the consideration of a bill placing $2,000,000 at the disposal of President James K. Polk to negotiate a peace with Mexico. The amendment was as follows:

Provided, that, as an express and fundamental condition to the acquisition of any territory from the republic of Mexico by the United States, by virtue of any treaty which may be negotiated between them, and to the use by the executive of the moneys herein appropriated, neither slavery nor involuntary servitude shall ever exist in any part of said territory, except for crime, whereof the party shall first be duly convicted.

It was adopted in the House, and was under debate in the Senate when the hour arrived previously fixed for adjournment of the session. At the next session (Feb. 8, 1847), Wilmot again introduced it, and a fierce and angry contest began. The House remained firm in favor of the amendment, and it was passed February 15 by a decided majority, but was not acted on by the Senate. It caused great agitation throughout the country, the principle involved being essentially the one over which the Civil War was fought. The efforts of both the major parties at the time—the Whigs and the Democrats—to subordinate the issue led to formation of the Republican Party which accepted the proviso's principle. It may be said finally to have triumphed through the act of June 19, 1862, forbidding slavery in "any part of the Territories of the United States now existing, or which may at any time hereafter be acquired."

WILSON, Alexander, American ornithologist: b. Paisley, Scotland, July 6, 1766; d. Philadelphia, Pa., Aug. 23, 1813. From 1779 to 1789 he was a weaver's apprentice and from 1789 to 1794 a peddler. During this period he wrote numerous dialect poems on folk life as he observed it in his travels, and a volume of his work appeared in 1790. In 1792 he published *Watty and Meg* anonymously. It had a sale of over 100,000 copies within a few weeks.

Having written a satire on a person in Paisley, Wilson was imprisoned for libel. Upon his release he came to America, arriving at New Castle, Del., in 1794. He soon turned to teaching, acting as a schoolmaster in several places in Pennsylvania and New Jersey.

While thus engaged he met William Bertram, the naturalist, who encouraged him to continue drawing North American birds, and Alexander Lawson, the engraver, whose tastes and instructions stimulated his own talents. In 1807 he began to prepare for the publication of *American Ornithology.* Seven volumes of this work appeared between 1808 and 1813, and two more posthumously in 1814. Four supplementary volumes, containing American birds not described by Wilson, were published by Charles Lucien Bonaparte from 1825 to 1833.

Wilson continued to write poetry after leaving Scotland, one of his chief productions being *The Foresters* (1805), a poem describing a walking trip made by Wilson to Niagara Falls.

WILSON, Allen Benjamin, American inventor: b. Willet, N. Y., Oct. 16, 1824; d. Woodmont, Conn., April 29, 1888. A cabinetmaker by trade, he invented in 1849 a sewing machine which made a stitch on both the forward movement of the shuttle and on the return movement. This was patented on Nov. 12, 1850. On Aug. 12, 1851, he patented the rotary hook, a substitute for the shuttle. Further improvements which Wilson devised were the stationary bobbin and four-motion feed, the latter making it possible to sew a curved line on the sewing machine. He patented these on Dec. 19, 1854.

The manufacture of Wilson's machine was taken over by Nathaniel Wheeler (q.v.) in 1850 with Wilson engaged as factory supervisor. He withdrew from the business in 1854 and settled in Waterbury, Conn., where he undertook other enterprises. See also SEWING MACHINES.

WILSON, SIR Archdale, English soldier: b. Kirby Cane, Norfolk, England, Aug. 3, 1803; d. London, May 9, 1874. He entered the Bengal Artillery in 1819, distinguished himself at the siege of Bharatpur in 1825–1826, and took part in the Sikh War, 1848–1849. At the outset of the Sepoy Mutiny in May 1857, he was the first officer to encounter the Sepoys in battle, defeating them on May 30 and 31. He succeeded to command of the force before Delhi in July, holding his position until September 14, when the city was taken. He was rewarded for his services with a baronetcy.

In March 1858, he participated in the siege of Lucknow and capture of the city on March 17. In April he went to England on furlough and did not return to India. On March 6, 1868, he was promoted to the rank of lieutenant general.

WILSON, Charles Edward, American industrialist and government official: b. New York, N. Y., Nov. 18, 1886. In September 1899 he began his career in the shipping department of the Sprague Electrical Works, New York City. This organization became a subsidiary of the General Electric Company in 1903, Wilson continuing with the company and rising through various departments to become merchandising manager and vice president in 1930–1937. He was executive vice president from 1937 to 1939 and president in 1940–1942 and 1944–1950.

From 1942 to 1944 he served first as vice chairman and then as executive vice chairman of the War Production Board. He had charge of production scheduling for the war effort and procured materials for the atom bomb project. He resigned because he felt reconversion policies were being carried out too rapidly.

From December 1950 to March 1952 he was director of the Office of Defense Mobilization. As head of the defense program of the United States he urged adoption of price and wage controls to achieve economic stabilization. He resigned this post because of disagreement with President Harry S. Truman over settlement of a wage dispute in the steel industry.

WILSON, Charles Erwin, American industrialist and public official: b. Minerva, Ohio, July 18, 1890. He was graduated from Carnegie Institute of Technology in 1909 as an electrical engineer. In the same year he began his career as an engineer with the Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa. In 1912 he designed the company's first automobile starting motor. From 1919 to 1926 he was chief engineer and factory manager for the Remy Electric Company, a General Motors subsidiary. Upon the reorganization of this company as the Delco-Remy Corporation, he became president and general manager, serving until 1929.

From 1929 to 1939 he was vice president of General Motors Corporation, concentrating on labor relations and production planning. He became a director in 1934 and served as executive vice president in 1939–1940. Becoming president of the organization in 1941, he was one of the United States defense production leaders during World War II. He subsequently evolved a mo-

bilization plan for dual-purpose factories which might turn out either civilian or defense goods, or both simultaneously. In 1947 he was author of the so-called "escalator" wage formula, a cost-of-living pay plan, which was accepted by the automobile workers' union in 1948 as part of a five-year contract.

On Nov. 20, 1952, he was appointed by president-elect Dwight D. Eisenhower as secretary of defense, the appointment to take effect with the new administration's assumption of office. He was sworn into office on Jan. 28, 1953.

WILSON, Charles Thomson Rees, Scottish physicist: b. Glencorse, Midlothian, Feb. 14, 1869. A graduate of Cambridge University, from 1895 he devoted himself to research in physics, concerned principally with the condensation of nuclei, ions, and atmospheric electricity. He was Jacksonian professor of natural philosophy at Cambridge from 1925 till 1934. By use of a container filled with water vapor, named for him the "Wilson cloud chamber," he developed a method of photographing ionized particles which condensation of the water vapor about them made visible to the camera. He shared the Nobel Prize for physics with Arthur Holly Compton (q.v.) in 1927, and in 1935 the Royal Society awarded him its Copley Medal. In 1937 he was made a Companion of Honour.

WILSON, Clarence True, American clergyman and prohibitionist: b. Milton, Del., April 24, 1872; d. Portland, Ore., Feb. 16, 1939. He graduated at the University of Southern California in 1894 and at McClay College of Theology, Los Angeles, the next year. For several years he occupied pastorates of the Methodist Episcopal Church in California and New Jersey; in 1905–1910 he was pastor of Grace Church, Portland, Ore. Most of his life was devoted to the support of government prohibition of the manufacture and sale of intoxicating beverages. He was a founder in 1910 of the board of temperance, prohibition, and public morals of the Methodist Episcopal Church, and as general secretary of that body from 1916 till 1936, he exercised nationwide influence. Besides conducting a vigorous campaign against intoxicating beverages, he also warred on users of tobacco in any form. His numerous books in support of the causes he espoused included *A World Vision of Temperance Reform; Dry or Die; That Flame of Living Fire.*

WILSON, Sir Daniel, Canadian archaeologist and educational reformer: b. Edinburgh, Scotland, Jan. 5, 1816; d. Toronto, Ontario, Aug. 7, 1892. In 1837, after graduating at Edinburgh University, he adopted a literary career in London. Returning to Edinburgh in 1842, he devoted himself to antiquarian pursuits. Among the works which he published during this phase of his career were *Memorials of Edinburgh in the Olden Time* (1846–1848; new ed., 1892); *Oliver Cromwell and the Protectorate* (1848); *The Archaeology and Prehistoric Annals of Scotland* (1851; 2nd ed., 1863). At this period he was secretary of the Scottish Society of Antiquaries, but in 1853, he went to Canada to become professor of history and English literature at the University of Toronto; he became president of the university in 1881, and in this post, which he continued to occupy until his death, he was an outspoken advocate of undenominational university education. His books written after arrival in Canada included *Prehistoric Man* (1862; rev. ed., 1876); *Caliban, the Missing Link* (1873); *Reminiscences of old Edinburgh* (1878); *Anthropology* (1885); *The Right Hand: Lefthandedness* (1891); *The Lost Atlantis* (1892).

WILSON, Edmund, American critic and miscellaneous writer: b. Red Bank, N. J., May 8, 1895. After graduating at Princeton in 1916, he became a reporter on the New York *Evening Sun,* and with the entry of the United States into World War I in 1917, he enlisted in the army. Following demobilization, he returned to New York City. During 1920–1921, he was managing editor of *Vanity Fair,* and in 1926, he became book review editor of the *New Republic.* When he resigned in 1931 to devote more time to his own writing, he was associate editor of the latter weekly. Until his appointment as literary critic of the *New Yorker* in 1944, he published numerous volumes, including poetry, fiction, and plays, but he was primarily a critic. *Axel's Castle* (1931), a book of literary criticism, and *To the Finland Station* (1940), a study of the revolutionary movement in Europe, were outstanding in their respective fields. While *Travels in Two Democracies* (1936) was a favorable report on a trip to Soviet Russia, subsequently he modified some of his views on the regime in the concluding essay in *The Triple Thinkers* (1938). A volume of essays interpreting the dualism of certain writers entitled *The Wound and the Bow* (1941) was widely acclaimed; and other works at this period included *The Boys in the Back Room* (1941), which discussed the California group of American writers, *Notebooks of Night* (1942), a miscellany of prose and verse, and *The Shock of Recognition* (1943), an anthology of selected American literature. Soon after the appearance of *Memoirs of Hecate County* (1946), a collection of short stories, the book was banned for obscenity in some parts of the United States. *Shores of Light* (1952) was a collection of essays written between 1920 and 1940.

WILSON, Edmund Beecher, American zoologist: b. Geneva, Ill., Oct. 19, 1856; d. New York City, March 3, 1939. After graduating in philosophy at Yale in 1877, he studied at Johns Hopkins University and, in Europe, at Cambridge and Leipzig. He lectured on biology at Williams College, 1883–1884, and the Massachusetts Institute of Technology, 1884–1885, and for the next six years occupied the chair of zoology at Bryn Mawr. In 1891, he went to Columbia University as professor of invertebrate zoology, and in 1897, he was made full professor. From 1909 until 1928 he was Da Costa professor of zoology, and thereafter he was emeritus professor in residence. He was a pioneer in research on heredity, doing notable work in embryology and morphology. His principal book was *The Cell in Development and Inheritance* (1896; 3rd ed., 1925), and others included *The Physical Basis of Life* (1923). During 1913 he was president of the American Association for the Advancement of Science.

WILSON, Francis, American actor and playwright: b. Philadelphia, Pa., Feb. 7, 1854; d. New York City, Oct. 7, 1935. His first appearance in legitimate comedy was as Cool in *London Assurance,* which played in Philadelphia in 1878–

1879. Turning to comic opera, as Sir Joseph Porter in *Pinafore,* played in New York City in 1885, he was an outstanding success, and for four years he was leading comedian of the McCaull Opera Company. His finest role was that of Cadeaux in *Ermine,* which he played for the first time at the New York Casino in 1889. Forming his own company, he took leading comedy roles in plays which included *The Oolah, The Merry Monarch, The Chieftain, The Little Corporal,* and *Cyrano de Bergerac.* Thereafter, for a time he engaged in legitimate comedy in such plays as *Cousin Billy, The Mountain Climber, When Knights Were Bold,* and *The Bachelor's Baby* (this last written by him). Other plays in which he appeared included *The Rivals, The School for Scandal, She Stoops to Conquer,* and *Rip Van Winkle.* His own plays included *The Magic Ring, The Spiritualist,* and *The Dancing Master.*

WILSON, Harry Leon, American fiction writer: b. Oregon, Ill., May 1, 1867; d. Monterey, Calif., June 28, 1939. In 1887, while employed as stenographer by the Union Pacific Railroad, his first humorous sketch was accepted by *Puck,* at that period the foremost American comic weekly. He joined the staff of the magazine in New York City in 1892, and from 1896 until 1902 he was *Puck's* editor. Meanwhile he had published two books, *Zig Zag Tales* (1896) and *The Spenders* (1902). They were followed by *The Lions of the Lord* (1903), a serious novel having the Mormon trek to Salt Lake for setting. He wrote a number of plays in collaboration with Booth Tarkington (q.v.), one of the most successful being *The Man from Home* (1908); and a series of humorous novels which included *Bunker Bean* (1912), *Ruggles of Red Gap* (1915), and *Merton of the Movies* (1922). Many of his stories were adapted for motion pictures. Among later books were *The Wrong Twin* (1921), *Oh, Doctor!* (1923), *Professor, How Could You!* (1925), *Lone Tree* (1929), and *Two Black Sheep* (1931).

WILSON, Henry, American statesman: b. Farmington, N. H., Feb. 16, 1812; d. Washington, Nov. 22, 1875. His name was originally Jeremiah Jones Colbaith, legally changed to Henry Wilson on his reaching manhood. He was a farm apprentice in his native town till the age of 21, when he moved to Natick and learned the shoemaker's trade. After two years' work at this business he had accumulated a small sum of money, which enabled him to attend the academies at Stafford, Wolfsborough, and Concord. But the loss of some of his money forced him to cut short his plan for an education, and he returned to his work at Natick in 1838, and finally built up a prosperous shoe factory. In 1840, he took an active part in the presidential campaign in behalf of the Whig party, and in the same year was elected to the lower house of the Massachusetts legislature; in 1844–1845 he was a member of the State senate. At this time he became known as an active opponent of slavery and in 1845, was selected with John Greenleaf Whittier (q.v.) to present to Congress the anti-slavery petition from Massachusetts against the annexation of Texas. In 1848, he withdrew from the Whig party because of its rejection of anti-slavery resolutions, and took a prominent part in organizing the Free Soil party, purchasing and editing the Boston *Republican* in the interests of that party. In 1850 and 1851, he again served in the State senate, and was president of that body during both terms. He was president of the Free Soil National Convention in 1852, and chairman of the national committee; and in 1853 he was a member of the Massachusetts Constitutional Convention. In 1855, he was elected to the United States Senate, and shortly after taking his seat made a speech advocating the repeal of the fugitive slave law and the abolition of slavery in the District of Columbia and in the Territories. For a time in 1855 he was associated with the American (Know-Nothing) party; however, he withdrew when it adopted a pro-slavery platform and took an active share in organizing the Republican party on the basis of opposition to extension of slavery. He refused the challenge to a duel made by Preston Smith Brooks (q.v.), whose assault on Charles Sumner (q.v.) in 1856 he had denounced, but asserted his right to defend himself if attacked. In January 1859, he was re-elected to the Senate by an almost unanimous vote of the Massachusetts legislature; and on the assembling of the Senate in 1861, he was made chairman of the committee on military affairs, a post which the Civil War rendered one of great responsibility. In this capacity he introduced and carried through Congress, during the extra session of 1861, the acts to authorize the employment of 500,000 volunteers, to increase the regular army, and to reorganize the military system. In 1865, he was a third time elected to the Senate, and took a prominent part in all the reconstruction measures, favoring the granting of full civil and political rights to the Negroes, but also desiring a liberal treatment of the Southern whites. In 1871, he was re-elected to the Senate but resigned in the next year when elected to the vice-presidency of the United States on the Republican ticket in the administration of Ulysses S. Grant. In 1873 he suffered a stroke of paralysis from which he never fully recovered, and died in office. At the time of his death he was engaged in writing the last volume of his *History of the Rise and Fall of the Slave Power in America* (1873–1875) which he left partially complete. He also wrote *History of the Anti-Slavery Measures of the 37th and 38th United States Congresses* (1865); *Military Measures of the United States Congress* (1866); *Testimonies of American Statesmen and Jurists to the Truths of Christianity* (1867); *History of the Reconstruction Measures of the 39th and 40th Congresses 1865–68* (1868).

WILSON, Sir Henry Hughes, British army officer: b. Edgeworthstown, County Longford, Ireland, March 5, 1864; d. London, June 22, 1922. Commissioned in 1884, he saw active service in Burma, 1886–1888, and during the South African War, 1899–1902. He became commandant of the Army Staff College, 1907–1910. Thereafter he was director of military operations until the outbreak of World War I in 1914, when he went to France as assistant chief of staff to Sir John D. P. French (q.v.). He was later a corps commander, then chief liaison officer with the French supreme command; and after a period in Britain commanding the Eastern division, he visited Russia, in 1916, with the mission headed by Lord Milner (see MILNER, ALFRED). In 1917, he returned to France as British military representative on the newly established Supreme War Council, and the next year he became chief of the general staff. With the war's end he was

promoted field marshal and created baronet, and after leaving the army in 1922, he was elected member of the House of Commons for North Down, Ireland. His criticism in Parliament of the government's Irish policy aroused deep antagonism in some quarters and resulted in his assassination by members of the Irish Republican Army.

WILSON, Henry Lane, American lawyer and diplomat: b. Crawfordsville, Ind., Nov. 3, 1857; d. Indianapolis, Ind., Dec. 22, 1932. After graduating at Wabash College in 1879, he became a journalist, and during 1882–1885 owned and edited the Lafayette, Ind., *Journal.* While United States minister to Chile, 1897–1905, he was appointed minister to Greece (1903) but at his own request remained in Chile in order to complete certain tasks. After serving as minister to Belgium, 1905–1909, he was transferred to Mexico. His tenure of office in Mexico City was beset with difficulties, his actions during the revolution led by Francisco Indalecio Madero (q.v.) arousing considerable criticism. He replied to his critics in his memoirs, *Diplomatic Episodes in Mexico, Belgium, and Chile* (1927).

WILSON, Henry Maitland, 1st Baron Wilson of Libya and of Stowlangtoft, British army officer: b. Stowlangtoft Hall, Suffolk, 1881. Receiving an infantry commission in 1900, he served through the South African War and World War I, and rose through the grades to become brigadier in 1934. The following year, promoted major general, he commanded Britain's first fully mechanized brigade; and in 1939, with the rank of lieutenant general, he was sent to Egypt to command the Army of the Nile. In 1940, after France's surrender in World War II, he directed the operations which extended the British front into Libya, and early in 1941 became military governor of Cyrenaica. He was shortly sent from North Africa to Greece, and, following the evacuation of British troops from that country, he was given command of the forces in Palestine and Transjordan. Promoted full general, late in 1941 he conducted a five-week campaign in collaboration with Free French forces which resulted in the capture of Damascus and retention of Syria in the Allied cause. Before the year closed he was given command of the newly-formed British Ninth Army. With this force made independent of others in the Middle Eastern theater of war, early in 1942 he was appointed commander in chief of the new Iran-Iraq Command, responsible for guarding one flank of the Suez Canal, and in February 1943, he replaced Gen. Sir Harold R. L. G. Alexander (q.v.) as commander in chief in the Middle East. Sir Henry Wilson (he had been knighted in 1940) was chosen in December 1943 to become supreme Allied commander in the Mediterranean theatre in succession to Gen. Dwight David Eisenhower (q.v.), named to supreme command in western Europe, and in this capacity he directed the campaign in Italy. He was promoted to the rank of field marshal in 1944, and in January 1945, he went to Washington, D.C., as head of the British Joint Staff Mission. In this post he was the senior British member of the Combined Chiefs of Staff, an Anglo-American organization which was not dissolved with the termination of World War II. In recognition of his services he was created baron in January 1946.

WILSON, Horace Hayman, English Orientalist: b. London, Sept. 26, 1786; d. there, May 8, 1860. Educated for the medical profession, in 1808 he went to Bengal as assistant surgeon in the service of the East India Company, but soon obtained an office in the Calcutta mint. His leisure was devoted to the study of Sanskrit, and so soon did he become known as an able Sanskrit scholar that in 1812 he was elected secretary of the Asiatic Society of Bengal. He acted for many years as secretary of the committee of public education, and his exertions contributed to revive the interest of the Hindus in their own literature as well as to create among them an interest in the science and literature of Europe. He remained in India till his election in 1832 to the Boden professorship of Sanskrit at Oxford University; he occupied this chair until his death, and from 1836, he was also librarian of the East India Company. His contributions to Oriental scholarship included *The Meghaduta, or Cloud Messenger,* a Sanskrit poem, with an English translation and notes (1813); *Sanskrit-English Dictionary* (1819–40); *Select Specimens of the Theatre of the Hindus* (2 vols., 1826–27; 3d ed., 1871); *The Vishnu-purāna—A System of Hindu Mythology and Tradition,* translated from the original Sanskrit and illustrated by notes (1840; new ed., 1864–77); *Grammar of the Sanskrit Language for the Use of Early Students* (1841); *History of British India from 1805 to 1835* (1844–48); *Rig-Veda-Sanhita,* translated from the original Sanskrit (1850–58).

WILSON, Hugh Robert, American diplomat: b. Evanston, Ill., Jan. 29, 1885; d. Bennington, Vt., Dec. 28, 1946. After graduating at Yale University in 1906 he entered his father's manufacturing business in Chicago, Ill., but soon decided upon a career in diplomacy and in preparation for it studied at the École Libre des Sciences Politiques, in Paris. He became secretary to the United States minister at Lisbon in 1911, and the next year he was appointed secretary to the legation in Guatemala. Successively he served in Buenos Aires, Berlin, Vienna, Washington, D.C., Berne, and Tokyo, and in 1927 he was appointed United States minister to Switzerland. During his 10 years in that capacity he frequently represented his country at meetings concerned with limitation of armaments, and in August 1937, he was made assistant secretary of state under Cordell Hull (q.v.). In December of the same year he was selected as ambassador to Germany, but he was destined to spend only eight months in that country. The Nazis had already embarked upon their fatal attempt to conquer the world, and in 1938, as a final protest against German arrogance and cruelty, his government recalled him. Assigned to special duties with the State Department in Washington, D.C., he resigned his ambassadorship in September 1939 without having returned to Germany. He was appointed an advisor to Cordell Hull in 1940, and the next year he retired. Recalled to duty after the United States entered World War II, he worked with the Office of Strategic Services until termination of the conflict. He wrote the autobiographical *Education of a Diplomat* (1938) and *Diplomat Between Wars* (1941).

WILSON, James, American statesman and jurist: b. St. Andrews, Scotland, Sept. 14, 1742;

d. Edenton, N. C., Aug. 21, 1798. He was educated at the universities of St. Andrews, Glasgow, and Edinburgh, and in 1765 arrived in New York City. Moving to Philadelphia, Pa., the next year, he taught Latin at the College of Philadelphia while studying law. Admitted to the Pennsylvania bar in 1767, he practiced successively in Reading, Carlisle, Annapolis, and Philadelphia. His pamphlet entitled *Considerations of the Nature and Extent of the Legislative Authority of the British Parliament* (1774) made a deep impression upon that year's Continental Congress. He was a member of the Pennsylvania Provincial Convention in 1775, and as member of the Continental Congress during 1775–1777, he was a signer of the Declaration of Independence. His *Address to the Inhabitants of the United States* (1777) was a strongly-worded appeal to support the movement for independence. During 1782–1783 and 1785–1787, he again served in the Continental Congress; and in 1787, he exerted considerable influence in the Federal Constitutional Convention and in the Pennsylvania convention to ratify the Federal Constitution. As member in 1789–1790 of the Pennsylvania convention to remodel the state constitution, he urged the direct election of state senators. From 1789 till his death, he was an associate justice of the Supreme Court of the United States; and from 1790, he was the first professor of law at the University of Pennsylvania. Consult Konkle, Burton A., *Life and Writings of James Wilson, Constitutionalist,* 6 vols. (1932).

WILSON, James, American globe maker: b. Londonderry, N. H., 1763; d. Bradford, Vt. March 26, 1855. He was largely self-taught. In 1796 he moved to Bradford where he constructed solid wooden balls on which he pasted thick layers of paper. The paper shell was then divided into hemispheres, removed, and joined to form hollow spheres. He engraved his own map sections, which where pasted to the shells. Wilson's globes were first published in 1814.

WILSON, James, American agriculturist: b. Ayrshire, Scotland, Aug. 16, 1836; d. Aug. 26, 1920. In 1851 he was taken to Connecticut by his parents, who moved four years later to a farm in Tama County, Iowa. He served in the state assembly, 1868–1873, and was a Republican member of Congress, 1873–1877 and 1883–1885. "Tama Jim," as he was widely known, was director of the agricultural experiment station and professor of agriculture at Iowa Agricultural College, Ames, from 1890 until 1897. Thereafter he was United States secretary of agriculture till 1913; during his 16 years in office the scope of the department was greatly expanded.

WILSON, James Falconer, American lawyer and politician: b. Newark, Ohio, Oct. 19, 1828; d. Fairfield, Iowa, April 22, 1895. In 1853, he moved to Fairfield, where he practiced law. He served in both houses of the Iowa state legislature, in 1861 becoming president of the Senate. From 1861 to 1869 he was a member of Congress; he was chairman of the judiciary committee and, in 1868, one of the managers of the impeachment proceedings against Andrew Johnson. He was a member of the United States Senate from 1883 till his death. The original package act, 1890, which he sponsored, is sometimes named for him.

WILSON, James Grant, American author and editor: b. Edinburgh, Scotland, April 28, 1832; d. New York City, Feb. 1, 1914. He was brought to the United States in 1833 by his father, William Wilson (q.v.), who settled at Poughkeepsie, N. Y. In 1857, he founded in Chicago, Ill., *The Record,* first literary paper in the Middle West, and edited it until 1862, when he joined the Union Army in the Civil War; before hostilities closed he had reached the rank of brigadier general. Thereafter he settled in New York City, where he wrote biographies of Ulysses Simpson Grant (1868) and Fitz-Greene Halleck (1869), and *The Poets and Poetry of Scotland* (1876). In addition to these works he edited or wrote a large numebr of volumes; notably, with John Fiske (q.v.) he edited *Appleton's Cyclopedia of American Biography,* 6 vols. (1886–1889).

WILSON, James Harrison, United States army officer: b. Shawneetown, Ill., Sept. 2, 1837; d. Wilmington, Del., Feb. 23, 1925. Graduating at West Point in 1860, he joined the engineer corps, and following outbreak of the Civil War the next year he took part in the Battle of Port Royal Bay (q.v.). He was brevetted major April 11, 1862 for conduct at Fort Pulaski, Ga., and subsequently was aide-de-camp to Gen. George Brinton McClellan (q.v.), participating in the battles of Antietam and South Mountain. In the campaign against Richmond and in the operations against Chattanooga and Knoxville he was assistant engineer and inspector general of the Army of Tennessee; in 1863 he was made brigadier general of volunteers and brevet lieutenant colonel of regulars for gallantry at Chattanooga. He was brevetted colonel for conduct at the battle of the Wilderness; and he was engaged in the siege of Petersburg and in the Shenandoah campaign. In September 1864, he was transferred to the command of the cavalry of the Mississippi Division; he took part in the campaign in Tennessee and was conspicuous at the battles of Franklin and Nashville. In March 1865, he made a raid into Alabama and Georgia, in 28 days capturing Selma, Montgomery, Columbus, and Macon, and taking 6,820 prisoners, among whom was Jefferson Davis. He received brevet rank as brigadier and major general, and in 1866 was mustered out of the volunteer service. He was appointed lieutenant colonel in the regular army in that year, but resigned in 1870 and was subsequently engaged in railroad engineering until the outbreak of the Spanish-American War in 1898, when he was appointed major general of volunteers and commanded the 1st division of the 1st Army Corps at Puerto Rico. In 1900, he served in the American contingent sent to China during the rebellion of the Boxers (q.v.), being second in command to Gen. Adna Romanza Chaffee (q.v.). He retired in 1901 with the rank of brigadier general of the United States Army. He wrote biographies of Andrew Alexander (1868), Ulysses Grant (with Charles A. Dana, 1868), and Charles Anderson Dana (1907).

WILSON, Jeremiah Morrow, American jurist: b. Warren County, Ohio, Nov. 25, 1828; d. Washington, D.C., Sept. 24, 1901. He served as judge of the Fayette County, Ind., court of common pleas, 1860–1865, and of the Indiana state circuit court, 1865–1871. From 1871 till 1875, he was a member of Congress. After

retiring from Congress he took up the practice of law in Washington, D.C.

WILSON, John, American colonial clergyman: b. Windsor, England, about 1591; d. Boston, Mass., Aug. 7, 1667. He was educated at King's College, Cambridge, and was made a fellow there in 1608, but was converted to Puritanism and resigned in 1610. He became lecturer at Sudbury, Suffolk, in 1618, and having been frequently suspended as a Puritan, embarked for America with John Winthrop in 1630. At Charlestown, Wilson organized what later became the First Church of Boston. As a spokesman of orthodoxy, he opposed the Antinomians. He was associated with John Eliot in missionary work among the Indians, and was chaplain to the force sent against the Pequots in 1637 He was well known as a writer of pious verse, epigrams, and anagrams.

Consult M'Clure, A. W., *The Lives of John Wilson, John Norton and John Davenport* (Boston 1846).

WILSON, John, English lutanist and composer: b. Faversham, Kent, April 5, 1595; d. Westminster, London, Feb. 22, 1674. He wrote music for *The Maske of Flowers,* presented at Whitehall in 1614, and was a distinguished lute player, whose playing and singing made him a favorite of Charles I. He became one of the king's musicians in 1635. During the civil war he went to Oxford, where later he was professor of music, 1656–1661. He returned to court after the Restoration and in 1662 became gentleman of the Chapel Royal. He wrote numerous songs and ballads, and set to music Shakespeare's *Take, O Take Those Lips Away* (*Measure for Measure,* Act IV, scene 1). He may have been the "Jack Willson" mentioned in the stage directions to Act II, scene 3 of *Much Ado About Nothing* in the folio of 1623, who sang *Sigh no More, Ladies* in the part of Balthasar.

WILSON, John (pseudonym CHRISTOPHER NORTH), Scottish author: b. Paisley, May 18, 1785; d. Edinburgh, April 3, 1854. He was educated at Glasgow University and Magdalen College, Oxford. Upon his graduation in 1810, having come into a comfortable fortune, he retired to a property he had purchased at Elleray on Windermere to live as a country gentleman, writing poetry. Here he became closely associated with William Wordsworth, Robert Southey, Thomas De Quincey, and Samuel Coleridge.

In 1812 Wilson published the once-famed *Isle of Palms;* another poem in dramatic form, *The City of the Plague* (1816), was still more successful, but is now forgotten. In 1815, however, he lost his fortune through the fraudulent speculations of an uncle, and in 1817, together with John Gibson Lockhart, became connected with *Blackwood's Magazine.* His fame now rests on his contributions to this famed Tory organ, to which he brought the qualities of an expert conversationalist overflowing with boisterous humor, as well as a vitriolic pen. Among his numerous pieces are celebrated ones on fishing, shooting, and kindred pursuits, printed under his well-known pseudonym, and above all his renowned *Noctes Ambrosianae,* a series of conversations on literary, political, philosophical, and general subjects, written as though they had taken place between contributors to *Blackwood's* at convivial meetings in Ambrose's Tavern, Edinburgh. These were begun in 1822, and from 1825 to 1835, when they ended, were written almost solely by Wilson.

In 1820 Wilson obtained the chair of moral philosophy in the University of Edinburgh, a post for which he had few qualifications, but which he nevertheless filled with credit for 31 years. He published three works of prose fiction, *Lights and Shadows of Scottish Life* (1822), *The Trials of Margaret Lyndsay* (1823), and *The Foresters* (1825). They contain beauty of description, but are far from being faithful transcripts of human nature and at times degenerate into mawkish sentimentality. Wilson resigned his professorship in 1851, and a pension of £300 a year was bestowed upon him. An incomplete edition of his works, edited by J. F. Ferrier, was published in 12 volumes (London 1855–1858); a complete edition of the *Noctes Ambrosianae,* edited by R. S. Mackensie, in five volumes (New York 1854).

Consult *"Christopher North": a Memoir of John Wilson . . by his daughter Mrs. Gordon* (New York 1866); Douglas, G. B., *The "Blackwood" Group* (New York 1897); Winchester, C. T., *John Wilson* in *Group of English Essayists of the Early Nineteenth Century* (New York 1910).

WILSON, John, Scottish missionary and Orientalist: b. Lauder, Berwick, Scotland, Dec. 11, 1804; d. near Bombay, India, Dec. 1, 1875. He was educated at the University of Edinburgh, and in 1828 went to Bombay in the service of the Scottish Missionary Society. He lived in India the rest of his life, except for the years 1843–1847 and 1870–1872, when he was on leave. In 1835 he transferred his services to the Church of Scotland; in 1843 to the Free Church of Scotland.

Wilson was a remarkable linguist, and established numerous schools, chiefly in the Bombay area, in which instruction was given in native languages. He traveled all over India, establishing missionary centers, collecting manuscripts, and investigating inscriptions and cave temples. He was elected to the Royal Asiatic Society in 1836, and to the Royal Society in 1845.

In 1830 he founded the *Oriental Christian Spectator,* the pioneer Christian periodical in India, which was issued for 30 years. Among Wilson's published works were *The Parsi Religion Unfolded, Refuted, and Contrasted with Christianity* (1843); *Lands of the Bible* (1847); *India Three Thousand Years Ago* (1858); and other works on religion and Orientalogy.

WILSON, John Leighton, American missionary and author: b. near Salem, S. C., March 25, 1809; d. there, July 13, 1886. He graduated from Union College, at Schenectady, N. Y., in 1829, and soon after became interested in missionary work in Africa. Wilson was ordained a Presbyterian minister in 1833 and sailed for western Africa, where he spent five months in investigation. Returning in 1834, he married, and after freeing his wife's 30 slaves, took them to Liberia, establishing his mission at Cape Palmas among the Grebos. Seven years later he moved it to the Gabon, among the Fans (Fangs or Mpangwes) of the Ogooué basin. He compiled dictionaries of the languages of these two peoples and made various translations into them.

Following his return to the United States in 1852, Wilson lived in New York, publishing his comprehensive *Western Africa, its History, Conditions, and Prospects* in 1856. At the beginning of the Civil War he returned to the South, serving as an evangelist and chaplain to the Confederate troops. After the war he maintained a school in his father's farmhouse near Salem.

WILSON, John Mackay, English author: baptised at Tweedmouth, Berwick upon Tweed, England, Aug. 15, 1804; d. Berwick upon Tweed, Oct. 2, 1835. His birthdate is unknown. In 1832 he became editor of the *Berwick Advertiser.* On Nov. 8, 1834 he began publishing a weekly series, *The Tales of the Borders,* of which he was editor and chief writer. Their great popularity in Great Britain and North America led to their being continued after his death by others, mainly by Alexander Leighton (1800–1874), until 1840.

WILSON, Richard, Welsh landscape painter: b. Penegoes, Montgomeryshire, Wales, Aug. 1, 1714; d. near Llanberis, Caernarvonshire, May 15, 1782. He went to London in 1729 and studied portraiture with Thomas Wright, later executing a number of portraits, including a group of the prince of Wales (later George III), his brother Edward Augustus, and their tutor, which is in the National Portrait Gallery and dates from about 1748. From 1749 to 1756 Wilson was in Italy, where Francesco Zuccarelli persuaded him to become a landscape painter. He acquired a great reputation in Rome and Naples, which preceded him on his return to England, where, however, few commissions were forthcoming. Generally neglected by his contemporaries, a verdict which time has reversed, he was glad to obtain the post of librarian to the Royal Academy in 1776. Among his best known works are *Niobe* (1760), *The Lake of Nemi* (1761), and *View of Rome from the Villa Madama* (1765), as well as numerous landscapes in Italy, England, and Wales.

Consult Grant, M. H., *A Chronological History of the Old English Landscape Painters* (London 1926); Bury, A., *Richard Wilson, R. A.* (London 1947).

WILSON, Robert, English comic actor and playwright: d. 1600. The place and date of his birth are unknown. He was one of the actors who comprised the Earl of Leicester's Company when it was formed in 1574, and soon made a reputation as a comedian and extemporaneous wit equal or only second to Richard Tarlton. From 1583 to 1588 he was one of the 12 players who comprised the Queen's Company, and afterward joined the Lord Chamberlain's Company, of which Shakespeare also became a member.

The three plays—moralities personifying vices and virtues—generally assigned to Wilson (with their dates of publication) are: *Three Ladies of London* (1584); *Three Lordes and Three Ladies of London* (1590); and *The Coblers Prophesie* (1594). One episode of the *Three Ladies of London* shows a Jewish creditor attempting to recover a debt from an Italian merchant, undoubtedly a forerunner of Shakespeare's *Merchant of Venice.*

WILSON, Robert Burns, American painter and author: b. near Washington, Pa., Oct. 30, 1850; d. Brooklyn, N. Y., March 31, 1916. He was educated at Washington, Pa., and in Virginia, and determined to become a painter. In 1871, he went to Kentucky and in 1875 settled at Frankfort. Here he met with considerable success as a painter and magazine poet. The slogan for the war with Spain was supplied by his poem *Remember the Maine,* published in the New York *Herald,* April 17, 1898. In 1902 Wilson moved to New York.

His best paintings are his landscapes, romantically softened by hazes and shadows. His verse was collected in *Life and Love* (1887), *Chant of a Woodland Spirit* (1894), and *The Shadows of the Trees* (1898). His only novel, *Until the Day Break* (1900), is Gothic in style.

WILSON, Sir Robert Thomas, English soldier and author: b. London, Aug. 17, 1777; d. there, May 9, 1849. He served as cornet of dragoons against the French in Flanders in 1794–1795, where he won the gratitude of Emperor Francis II, and was a member of the staff in Ireland during the revolt of the United Irishmen in 1798. He served in the Netherlands in 1799, and in 1800, with the rank of major, was engaged in Egypt under Sir Ralph Abercromby and Maj. Gen. John Hely-Hutchinson.

Wilson again served under Hutchinson on a diplomatic mission, 1806–1807, to the Allied armies on the Russian frontier, during which he gained the confidence of Frederick William III of Prussia and Czar Alexander I. In 1808–1810 he commanded the Lusitanian Legion and later a Spanish brigade in Portugal and Spain under Wellington. In 1812 he went to Russia as British military commissioner, and distinguished himself in the pursuit of the Napoleonic armies, and also at the battles of Lützen, Bautzen, Dresden, and Leipzig in 1813, being promoted to major general. He came under official displeasure in 1816 for his part in the escape of Antoine Marie Chamans, comte de La Valette, who had been condemned to death by Louis XVIII, and was dismissed from the army in 1821. He was reinstated in 1830. Wilson was member of Parliament for Southwark, 1818–1831, and governor of Gibraltar from 1842 to 1849.

He was the author of *The History of the British Expedition to Egypt* (1802); *Narrative of Events During the Invasion of Russia by Napoleon Bonaparte and the Retreat of the French Army* (1860); *Private Diary* (1861), dealing with the campaigns of 1812–1814; and other military works.

Consult Putnam, Peter, ed., *Seven Britons in Imperial Russia* (Princeton, N. J., 1952).

WILSON, Samuel Alexander Kinnier, British neurologist: b. Cedarville, N. J., Dec. 6, 1874; d. London, Eng., May 12, 1937. His father was an Irish clergyman temporarily living in New Jersey. Wilson was educated at Edinburgh University, and following his graduation B.S. in 1903, studied in Paris (1903–1904), and in Leipzig, and in 1904 became resident medical officer at the National Hospital for the Paralysed and Epileptic in London. He was associated with this institution until his death, and was junior neurologist at King's College Hospital from 1919; senior neurologist there, from 1928. Wilson's disease, or Wilson's syndrome, is a name given to hepatolenticular degeneration, a progressive degeneration of the lenticular nucleus of the brain associated with cirrhosis of the liver, which he described in 1912.

Wilson was a brilliant writer and teacher who attracted many students, rather than a laboratory researcher. He was a member of neurological societies throughout the world. In 1920 he founded the *Journal of Neurology and Psychopathology* and became its first editor. His published works include *Aphasia* (1926); *Modern Problems in Neurology* (1928); and *Neurology,*

edited by Alexander Ninian Bruce, 2 volumes (1940).

WILSON, Theodore Delevan, American naval constructor: b. Brooklyn, N. Y., May 11, 1840; d. Boston, Mass., June 29, 1896. He became a ship's carpenter in 1861, and in 1866 was appointed assistant naval constructor, serving in the navy yards at Pensacola and Philadelphia. Wilson was instructor in ship construction at the Naval Academy, Annapolis, Md., from 1869 to 1873, when he was promoted to naval constructor, serving at the Portsmouth Navy Yard.

He was chief of the Bureau of Construction and Repair from 1882 to 1893, during which period the navy was largely transformed from wood to steel. Some 45 vessels were constructed or laid down under his supervision, including the battleship *Maine,* the cruisers *Boston, Chicago,* and *San Francisco,* and the gunboats *Concord, Bennington,* and *Petrel.* Wilson resigned because of failing health, but returned to duty in 1895 at the Boston Navy Yard. He wrote *An Outline of Shipbuilding, Theoretical and Practical* (1873).

WILSON, Thomas, English Anglican prelate: b. Burton, Cheshire, England, Sept. 20, 1663; d. Isle of Man, March 7, 1755. He was educated at Trinity College, Dublin, and was curate of Newchurch Kenyon, Lancashire, from 1687 to 1692. Wilson then became chaplain to William Stanley, ninth earl of Derby, who in 1697 appointed him bishop of Sodor and Man, his consecration taking place in 1698. Wilson's episcopate, covering the remainder of his life, is noted for his strict insistence on his privileges as head of the ecclesiastical court. This brought on disputes with Alexander Horne, governor of the Isle of Man from 1713 to 1723, and led to his imprisonment for two months in 1722.

Wilson was the author of *Principles and Duties of Christianity* (1707), commonly called the *Manx Catechism,* the first book printed in Manx, as well as other devotional works, and instituted the translation of various parts of the New Testament into Manx. His works, with a biography, were published by John Keble, five volumes (Oxford, Eng., 1847–1863).

WILSON, William, Scottish American poet and bookseller: b. Crieff, Perthshire, Scotland, Dec. 25, 1801; d. Poughkeepsie, N. Y., Aug. 25, 1860. Before emigrating to the United States in 1833, he had made a reputation as a poet and composer of songs, and as editor of the Dundee *Literary Olio.* He established himself at Poughkeepsie in 1834 as a bookseller, publisher (after 1841), and contributor of poems to newspapers and magazines. His *Poems,* edited by Benson Lossing, appeared in 1869; enlarged editions in 1875 and 1881. Wilson's verse has little originality, recalling numerous Scottish poets of the 18th century.

WILSON, William Bauchop, American labor leader and public official: b. Blantyre, Scotland, April 2, 1862; d. Savannah, Ga., May 25, 1934 He accompanied his family to the United States in 1870 and in the next year, at the age of nine, went to work in the coal mines at Arnot, Tioga County, Pa. In the 1880's and 1890's he was often forced into other work because of his ardent unionism. From 1888 to 1890 he was president of the district miners' union, and in the last-named year was one of the founders of the United Mine Workers of America, which he served as secretary-treasurer from 1900 to 1908. He was active in the coal strikes of 1899 and 1902.

In 1907 he was elected to the House of Representatives as a Democrat, serving until 1913, when he was appointed to President Wilson's cabinet as the nation's first secretary of labor. He left this post in 1921. In 1926 he ran for the Senate, but was defeated. Wilson was prominent in promoting mediation and collective bargaining. He died on a train while on his way to Washington.

Consult Babson, R. W., *W. B. Wilson and the Department of Labor* (New York 1919).

WILSON, William Lyne, American legislator and educator: b. Middleway, Va. (now in West Virginia), May 3, 1843; d. Lexington, Va., Oct. 17, 1900. He graduated from Columbian College, Washington, D.C., in 1860, and studied at the University of Virginia until 1861, when he enlisted in the Confederate cavalry, with which he served throughout the Civil War. From 1865 to 1871 he was assistant professor of ancient languages at Columbian College, where he studied law simultaneously. He was admitted to the bar in 1869, and in 1871 began practicing at Charles Town, W. Va.

Wilson was president of the University of West Virginia from 1882 to 1883, and from 1883 to 1895 was a member of the House of Representatives, distinguishing himself as a leader in the movement to reduce tariffs, which resulted in the so-called Wilson Act of 1894. Following his defeat for re-election in that year, he was appointed postmaster general by President Cleveland, serving from 1895 to 1897. He inaugurated rural free delivery. A staunch believer in the gold standard, he vigorously opposed William Jennings Bryan in 1895–1896. From 1897 until his death Wilson was president of Washington and Lee University.

WILSON, Woodrow (in full Thomas Woodrow Wilson), president of the United States: b. Staunton, Va., Dec. 28, 1856; d. Washington, D.C., Feb. 3, 1924. He was the son of Scotch-Irish parents, who had lived in Pennsylvania, Canada, and Ohio. James Wilson, his paternal grandfather, had emigrated from Ireland in 1807. When Wilson was about a year old, his father, Joseph Ruggles Wilson, became pastor of the Presbyterian church in Augusta, Ga. The family remained there until 1870, when they moved to Columbia, S. C., where the father was a professor in the Presbyterian Theological Seminary. Woodrow experienced some of the terrors of the Civil War, when the people of the town of Augusta daily expected a visit from Gen. William Sherman's army, and again in Columbia where a large part of the city remained a burnt-over area until the Wilsons moved away to Wilmington, N. C., in 1875.

Wilson's early training was received in private schools in Augusta and Columbia, and from his father and grandfather, Dr. Thomas Woodrow, of Columbus, Ohio, the latter being a devotee of the ancient classics and frequently in the Wilson home. From this Presbyterian home, Woodrow went to Davidson College, North Carolina, a staunch Presbyterian college, in the autumn of 1874, where he remained a year. But in the

autumn of 1875 he went to Princeton, where his father had studied theology and where the great Presbyterian leaders of the country were wont to live and teach.

At Princeton, Wilson took rank as a leader among his fellows, attained a fair standing in his class, but made it plain to all that wide reading and close study of public affairs were his chief interests. He and his family were already close observers of British politics, William Gladstone being a hero in their circle. Wilson showed this interest, while still an undergraduate, in a remarkable article, *Cabinet Government in the United States,* published in the *International Review* (August 1879), in which the germ of his first book was uncovered. He graduated in 1879 and the next year went to the University of Virginia to study law. There he took a law degree in 1881 and early in 1882 settled in Atlanta to practice his profession. He probably did not make his mark as a lawyer, but he continued his study of government and politics, as illustrated in the workings of Congress.

Woodrow Wilson.

True to his bent, he abandoned the law and entered Johns Hopkins University in 1883 where he wrote his first book, *Congressional Government,* published in 1885. The same autumn he began teaching history and political economy in Bryn Mawr College and the next year, somewhat against his wishes, he took his examinations at Johns Hopkins and was awarded the degree of doctor of philosophy, then so highly prized among college teachers everywhere. In 1888 he went to Wesleyan University, Middletown, Conn., as professor of history and political economy. There he gained a grip upon student life and opinion that marked all his later educational career. But the popularity of *Congressional Government* and the importance of its criticism of American governmental practices were making him a national and even international reputation. At Wesleyan he wrote a review of James Bryce's *American Commonwealth,* which brought him into close friendly relations with that eminent Englishman. In this review one sees the reflection of a keen historical mind and independent thinker.

In 1890 Wilson was called to Princeton as professor of jurisprudence and political economy, a position he held until 1910 when he ceased his connection with the university to become governor of New Jersey. As professor at Princeton, he practically founded the department of political science, as it is now taught in all American universities. His power over students, his activity as a leader in the rapid development of the college into a university, his many articles in periodicals, his lectures in various parts of the country, and his books raised him to the foremost position in the faculty; and when President Francis Patton resigned in 1902, he was chosen to head the university.

Wilson at once set about far-reaching reforms. American college and university students, reflecting the growing riches of their parents, had already become loiterers at their work. Wilson endeavored to compel them to study. Instead of increasing the number of students at Princeton, he pressed so closely his requirements that scores, even hundreds, of young men were sent away each year because they failed in their examinations. Some witty undergraduate is reported to have said that if Dr. Wilson kept on he would make Princeton an educational institution. But the necessity of passing the examinations was not all. Wilson introduced what has been called the preceptorial system at Princeton. By this method every student was brought into close relations with a teacher who made it his business to lead a small group of young men in their work and introduce them to the world of books. The new system cost a great deal of money and Wilson endeavored to collect it. His activity in that direction brought him into closer touch with Princeton men all over the country and he became very popular.

His next reform was of a similar nature. There had grown up at Princeton an elaborate club system which was more important to most of the undergraduates than the passing of examinations. To become a member of one of the clubs was the first ambition of most students. Moreover the social life of the students was absorbed by these clubs. Wilson proposed in 1907 that as soon as suitable dormitories could be provided, all students should live together and have their rooms assigned to them by lot; that they should eat together, the rich and the poor, in dining places on or near the quadrangle; and that the unmarried tutors should live with the students in the dormitories. This reform was aimed at making student life democratic and helpful to all alike. It was, however, too much for the students. Some professors also found the new pace a little too swift and the alumni encouraged resistance.

But before the resistance became effective, a gift to the proposed graduate school, which all held as necessary to the very existence of the university, introduced a new subject of discussion. Dean Andrew West, a close friend of the president, desired the graduate school to be set up at a distance from the quadrangle which Wilson would make the center of college life. Wilson objected gently. The matter remained in abeyance until in 1909 a conditional gift of something like a million dollars to the graduate school compelled a decision. The gift was to be applied according to the wishes of Dean West. Wilson refused to accept it on those conditions. The segregation of the graduate students seemed to him to thwart the democratic purposes of his whole reform program. The trustees sided with Wilson and the gift was formally declined, but not before the subject had become a national one, for the newspapers of the country discussed the issue. In May 1910, Isaac Wyman of Boston died and left

a legacy, reported to be several millions, to the graduate school. Dean West was to be one of the executors of the will and he was to use the new millions to carry out his ideals in the new school. Wilson could not refuse these millions. And, before this time, the opposition to his quadrangle reforms had assumed formidable proportions. Dean West's influence and that of the students and professors who opposed the president were united. The Wilson reforms, popular as they were in educational circles throughout the country, were halted. It was commonly rumored that Wilson would resign at commencement 1910.

This work at Princeton had made Wilson widely known in the United States as an educator. Before it took its final turn in 1910, Col. George Harvey, representing the conservative wing of the Democratic party and editor of *Harper's Weekly,* inaugurated a movement to bring about Wilson's nomination for President by the Democratic party in 1912. Harvey enlisted newspaper editors and political party leaders of the type of James Smith, Jr., of New Jersey in the cause. The country was growing restless at the conduct of the Republican party. Wilson was a progressive Democrat; Harvey and his friends were reactionary Democrats. The presidential election was then two years off and the situation in the Democratic party was one of great uncertainty. The efforts of Wilson's friends, however, had resulted in making him a prominent political figure and there arose a popular demand in his home State for his nomination as a candidate for governor. His nomination followed in September 1910, and in October the presidency of Princeton was given up. The campaign that Wilson conducted that autumn in a stalwart Republican State attracted the attention of the country. The election of Wilson by a majority of 49,000 made him a real candidate for the Presidency which his administration as governor further advanced. He could not fulfil the hopes of the conservative Democrats as governor and broke with Smith. Later he broke with Harvey. When the conservatives abandoned him and endeavored to give all their influence to other candidates for the Democratic Presidential nomination, the more progressive elements of the Democratic party turned to Wilson. Of greater moment was the break-up of the Republican party in June 1912. Colonel Roosevelt endeavored to prevent the renomination of his former friend, Taft, and, failing to do so, led a revolt from the convention. It was plain that a new convention, composed of the Roosevelt men, already announced in Chicago, would nominate the colonel. These events focussed the national attention upon the Democratic party when it assembled in convention at Baltimore 25 June 1912. No such convention had ever been held in American political history. It lasted until 2 July and was marked from the beginning by intense bitterness between the conservative and progressive elements of the party. In addition to Mr. Wilson the leading candidates were Speaker Champ Clark of Missouri, Judson Harmon of Ohio and Oscar W. Underwood of Alabama. Mr. Wilson won on the 46th ballot, largely through the support thrown to him by William Jennings Bryan.

Wilson made an active campaign and was elected by a vote of 435 in the electoral college against 88 for Colonel Roosevelt and eight for Mr. Taft, the regular Republican candidate. The popular vote for Wilson, however, totaled only 6,293,019 as against 7,604,463 votes cast for Roosevelt and Taft. But the Democrats won large majorities in both houses of Congress and Wilson entered the Presidency in March 1913, with every branch of the government at his command. He summoned Congress in extra session in April. All the great committees were headed by Democrats, if not by his friends. He urged at once some of the greatest reforms that have ever been effected in the history of the country. Acting on his recommendations Congress reduced the tariff from a general level of 45 to 25 per cent and greatly enlarged the free list. Many economists alleged that for the first time in half a century the tariff was written in the interest of the masses and not in that of the manufacturers. Of even greater importance was the reform of the national currency system in the Federal Reserve Act of 1913, by which the control of the money of the country was taken from private hands and placed in the Treasury Department. The country was divided into 12 banking districts and the reserves of those districts were placed in certain reserve cities in order that the needs of the country as a whole might the better be served and what had been called financial panics, produced by the nervous financial state of mind of New York, the reserve centre under the old system, might be averted. This measure was immediately successful. These reforms of 1913 were followed by the Clayton Anti-trust and the Federal Income Tax laws of 1914, the former of which definitely settled an old issue, while the latter subjected the incomes of the country to a graduated tax that quickly proved to be of revolutionary character.

Although the Democratic party was not in entire accord with Wilson, and the Republicans as a whole resisted him with all their might, he held Congress in session almost continuously till the great European War brought another series of problems before the country. But already the Wilson foreign policy was shown in his refusal to allow the army and navy to be used on behalf of money lenders or investors in Mexico and South America. He even went so far as to say at Mobile, in October 1913, that the United States would never again annex a foot of land against the will of those most concerned. This attitude bewildered European diplomats and it angered important elements in the United States. Wilson had an excellent opportunity to illustrate his foreign policy in Mexico where General Huerta rose to the presidency through the assassination of Madero early in 1913. Huerta was favorably disposed toward American investors in Mexico. Wilson refused to recognize Huerta and by his attitude compelled the overthrow of that leader, only to find that the two Mexican generals who had together fought Diaz and Huerta now fell to fighting each other. Wilson gave his support to Carranza, but the months and years that passed did not suffice to pacify the distracted country; and in 1916 Wilson was compelled to send expeditions into the country to compel respect for American law and international rights. The Mexican difficulty, however, soon paled into insignificance in comparison with the difficulties produced by the European War

which began on 1 Aug. 1914. While the President was preparing for his first taking of the sense of the country on the policies he had put into practice, this great upheaval set men's thoughts upon other subjects. The election of 1914 resulted in a return to Congress of a majority of Democrats, most of whom were pledged to support the administration.

Meanwhile, on 18 August, Wilson declared in a proclamation to the country that all men must maintain a strict neutrality as between the warring powers. Leading public men and newspapers, regardless of party alignments, gave him hearty support; but as the war continued and cast its shadow over the whole world, the different elements of the composite country took sides. A particular source of irritation was occasioned by German propagandists who did their utmost to break the country's neutrality; others of the same group tried to affect the course of the war by attempting the destruction of bridges and canals and by inciting strikes in munition plants from which the Allies derived a considerable portion of their supplies. Wilson took every possible occasion to press upon the country the necessity of national unity, of devotion to the ideals for which the United States had been established and of refraining from deeds that might commit the country to either side. He went so far even as to say that "there was such a thing as being too proud to fight." He endeavored to bring about peace in Europe by the offer of his services as a mediator. On 7 May 1915, a German submarine commander deliberately sunk the great British liner, the *Lusitania,* sending 1,154 persons to their death, of whom 114 were American citizens. The country was intensely excited; but Wilson felt that he could not then go to war. He demanded apology and reparation and gave Germany solemn warning. Other ships were sunk during the year and other American lives were lost; but confronted with a national election in 1916, neither Wilson nor the Republican national convention of that year proposed war as a remedy. Nor did the Progressive convention, which Colonel Roosevelt dominated, suggest war. The leaders did not know what the people thought. The Republicans finally nominated Mr. Justice Hughes as their candidate and the Progressives confirmed him as their choice. The platforms dealt with domestic problems insisting on foreign affairs only in the commercial rights of the country.

Wilson was renominated The Democratic platform simply approved the Wilson policies and asked that he be returned to office on the ground that as President he had kept the country out of war. Wilson was re-elected, his plurality reaching 581,941 votes. Yet so close was the contest in the Electoral College that a reversal of 2,000 votes in California would have made Mr. Hughes President. During the campaign Wilson had said that the rôle of neutrality had been about played out. The President's attitude at this time toward the struggle in Europe is best gathered from his address at Omaha on 5 Oct. 1916, in which he said: "It will take the long enquiry of history to explain this war, but Europe ought not to misunderstand us. We are holding off, not because we do not feel concerned, but because when we exert the force of this nation we want to know what we are exerting it for. . . . We want to know whenever we act what the purpose is — what the ultimate goal is." In the request for the passage of the so-called Adamson law, of the preceding September, he had asked for the extension of the United States eight-hour law to include workers in the railroad trains service. A great strike was averted. He was about to make one more effort to bring the European war to an end, when Germany on 12 December asked for a conference of the warring powers for the purpose of securing peace. Germany did not disclose her conditions. Wilson submitted the German proposal to the Allied powers. The reply was a quick refusal. On 22 Jan. 1917, Wilson spoke to the Senate in what was at once called a remarkable address. The principal ideas that later became famous in the Fourteen Points were now suggested to Europe as a basis of peace. He even said that a lasting peace could only be secured by a "peace without victory." He meant that the bitterness of a war to the "last man" ought to be avoided.

His effort failed. On the last day of January the German Ambassador in Washington handed the government a note in which the German government announced its intention to declare a submarine blockade about England, France and Italy and warned all nations to beware on penalty of having their ships and their people sunk without notice. Wilson's reply was to dismiss the German Ambassador and request Congress to declare the country in a state of armed neutrality. Congress failed to grant the request and Wilson set about preparing for American entrance into the conflict. When the regular session of that Congress came to an end, he promptly summoned the new Congress in extra session for 2 April "to receive a communication concerning grave matters of national policy." On 2 April he addressed Congress in a great speech recommending that Congress declare "the recent course of the Imperial German government to be in fact nothing less than war against the government and people of the United States." On 6 April war was declared by large majorities. But Wilson took pains to insist to the country and all the world that the United States did not go to war for any material interests or any imperialistic purposes of any of the powers concerned. It was to be a war to "make the world safe for democracy." He endeavored to convince the people of the United States that annexations and commercial exploitation were the natural causes of war; and he sought to impress Europe with the idea that democracy was the only safe rule for governments and that absolute equality among all peoples, great and small, was the only safe rule of international conduct. From 2 April 1917 to 11 Nov. 1918, Wilson's career is in great part world history; he swayed the whole world as no other statesman had ever swayed it. An English Liberal has said that "it was like the voice of God talking over our heads to the continent and to the nations of the world." The sum of it all was expressed on 8 Jan. 1918, in the marvelous address in which the Fourteen Points, now so well known to the world, were laid down. He wished to commit all men to the freedom of the seas, the self-determination of peoples, open diplomacy. the

freest possible trade among nations, access of inland nations to harbors, disarmament everywhere and a League of Nations that should lead and guide mankind into better ways. Upon such a basis would the United States conclude peace. From public statements of European leaders and from the avowals of responsible diplomats, these points were accepted, although thoughtful men everywhere doubted whether, at the end, the greater European powers would actually abide by such a program of self-denial.

There was a strenuous protest in the industrial centres of the United States against the possibility of free trade. Colonel Roosevelt denied in a vigorous campaign in the autumn of 1917 that the United States fought to make the world safe for democracy. In January 1918 he and many other prominent leaders, both Democratic and Republican, tried to press through Congress a bill which would have set up a war cabinet to assist the President. Wilson opposed the movement and it failed. But the fight upon the President and his war platform was continued till the Congressional election of 1918. Wilson asked the country in a formal statement to return Democrats to Congress in order that he might the better carry the war to a conclusion. It was a close election in which the Republicans won a majority in the Senate by two votes and in the House by a larger margin. Much money was spent in the campaign and one of the senators was still defending himself in court, late in 1919, against the charge of corrupt use of money. It was the first time that Wilson was confronted with the prospect of a hostile Congress, a fact which appeared the more significant as the near approach of a breakdown of Germany and her allies became known. When an armistice was proposed by Germany, the Allied governments agreed that Wilson should be the common spokesman; but Colonel Roosevelt and Senator Lodge gave out a statement of Republican conditions of peace which were supposed to be more hostile to Germany than Wilson's Fourteen Points. The Republicans announced that they were unwilling to allow Wilson to represent the country in the peace conference.

In his annual message of December 1918, Wilson announced that he would go in person to Paris to aid in the negotiation of a world peace. The leaders of the Senate warned him against this course and many of the greatest papers in the North took the view that it was inexpedient if not improper and unconstitutional for the President to attend the peace conference in person. A former senator and a former attorney-general of the United States gave it as their matured opinions that Wilson would cease to be President the moment his ship passed beyond the boundary of the country. Nevertheless Wilson sailed for Europe on 4 December, and arrived in Paris on the 14th. He received an ovation that surpassed anything witnessd in France since the days of Napoleon I. In London a similar demonstration was made when he arrived there just after Christmas. Early in January he visited Rome where he was counted as a sort of messiah, come to save Europe from the terrors of future wars. These visits were made at the request of the governments concerned and during the delays incident to the gathering of the peace conference. Still, he was not unaware of the risks of his position. He had remarked to a friend in September preceding that he almost dreaded to think of the end of the war, for then every nation of Europe and every group of interests in the United States would begin to think of selfish ends.

When the peace conference opened, it was promptly discovered that the first of the Fourteen Points, open covenants openly arrived at, could not be realized. Men simply would not discuss in public the graver issues involved, lest the very ends they sought should be jeopardized. The conference decided to sit behind closed doors. Then it was found that the conference was too large for rapid work and a council of five, including Wilson, Lloyd George, Clemenceau, Orlando of Italy and Makino of Japan took its place. This was later changed to a council of four, the Japanese representative simply absenting himself. Wilson labored a month to induce his colleagues to accept the Fourteen Points, including the proposed league of nations, the most important of all. The other representatives endeavored for a month to arrange the preliminaries of a peace without applying the Wilson principles and without accepting the league idea. But unable to agree, the whole conference met on the 14th of February and accepted the idea of a league as a part of the treaty. Wilson returned to America and in public addresses warned his opponents that the covenant of the League of Nations would be so interwoven with the Treaty of Peace that the rejection of the former would involve the rejection of the latter. How little this statement availed its author was revealed in the months that followed.

Returning to Paris about the middle of March 1919, Wilson found the conference had abandoned the League of Nations idea and had set about a peace of indemnities, annexations and reprisals. For a month Wilson fought almost single-handed for a peace which he could call democratic. He won to the extent that France abandoned her demand for a Rhine frontier and agreed to self-determination in Poland and other European submerged nationalities; and the League of Nations was made a part of the treaty. But the concessions greatly weakened the President, while the opposition to him on substantially imperialistic grounds gained constantly in the United States. Wilson returned with the Treaty and, calling Congress together, laid it before the Senate on 10 July 1919. Immediately the bitterest opposition was manifest. Wilson fought for his work at Paris. He recognized that the essentials of his whole career in the White House were under attack. He made a tour of the country on behalf of the adoption of the Treaty and the League of Nations. He spoke at Columbus, Ohio, at Saint Louis, at many other points in the Middle West and on the Pacific Coast. Everywhere he urged acceptance of the Treaty and at many places received extraordinary ovations. But he was taken ill at Wichita, Kans., and was hurried home to Washington, where he was kept in bed for several months. He never regained his health. The real cause of his death was a stroke of paralysis which followed the collapse above

referred to. In 1885 he was married to Ellen Louise Axson (d. August 1914) and in 1915 to Edith Bolling Galt, who survived him. The Nobel Peace Prize for 1920 was awarded to President Wilson.

Among Wilson's numerous published works were *Congressional Government, A Study in American Politics* (1885); *The State: Elements of Historical and Practical Politics* (1893); *Division and Reunion, 1829–1889* (1893); *An Old Master and Other Political Essays* (1893); *George Washington* (1896); *Mere Literature and Other Essays* (1896); *A History of the American People* (1902); *Constitutional Government in the United States* (1908); *The New Freedom* (1913).

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WILSON, city, North Carolina, seat of Wilson County, 40 miles east of Raleigh, on the Atlantic Coast Line and the Norfolk Southern railroads. Situated at an altitude of 140 feet in a cotton and tobacco region, it is a large bright-leaf tobacco market, with 18 tobacco warehouses and 10 redrying plants. Among its many manufactures are cotton textiles, clothing, fertilizer, truck and bus bodies, neon signs, and veneer. Located in the northwestern part of the city is Atlantic Christian College (coeducational, founded in 1902). Incorporated in 1849, it has a city manager form of government. Pop. (1950) 27,473.

WILSON, borough, Pennsylvania, in Northampton County, 14 miles east-northeast of Allentown, located at the confluence of the Lehigh and Delaware rivers. It is a residential suburb of Easton, and is officially a part of the Easton Post Office. Local industries include foundries and the manufacture of textile products and paper cups. Its incorporation dates from 1920 and it has a mayor-council form of government. Pop. (1950) 8,159.

WILSON, Mount, a peak, 5,710 feet above sea level, in the San Gabriel Mountains, Los Angeles County, California, just northeast of Pasadena. It is well known for its scenic views and for the Mount Wilson Observatory, established in 1904, which is operated jointly by the Carnegie Foundation and the California Institute of Technology and has a 100-inch telescope.

WILSON CLOUD CHAMBER. See WILSON, CHARLES THOMSON REES.

WILSON COLLEGE, a college of arts and sciences for women, located at Chambersburg, Pa. Affiliated with the Presbyterian Church, it is a privately controlled, accredited institution offering a four-year course leading to the degree of Bachelor of Arts. The campus, through which the Conococheague Creek flows, comprises about 55 acres in the suburbs of Chambersburg. It has dormitories and dining halls as well as several classroom and administrative buildings, and residence on campus is required. To the liberal arts curriculum has been added an experimental course, which includes the basic physical sciences, history, and English, with readings in great literature, and courses of study in contemporary problems of the Orient. In 1952 the college library contained 62,000 bound volumes, and the endowment of the college at that date was $1,106,449. Named for Miss Sarah Wilson, who made the initial endowment, it was founded in 1869 as Wilson Female College and in 1920 adopted its present name.

WILSON DAM. See MUSCLE SHOALS.

WILSON-GORMAN TARIFF, in United States history, the tariff bill, enacted by Congress in 1894, which succeeded the McKinley Act of 1890. Originally proposed by Congressman William Lyne Wilson to put basic raw materials on the free list and to lower protective duties on manufactured goods, it was held up in the Senate by a tariff lobby headed by Senator Arthur Pue Gorman, which cut down the list of raw materials on the free list and advanced the protective rates. Wool, copper, and lumber became duty-free and rates on manufactured goods were set at an average level of 39.9 per cent, about 10 per cent lower than the McKinley Tariff levels. President Cleveland denounced the bill but allowed it to become law without his signature.

WILSON'S CREEK, Battle of, an engagement in the American Civil War, fought on Aug. 10, 1861 near Wilson's Creek, about 10 miles southwest of Springfield, Mo. Gen. Nathaniel Lyon commanded the Federals, who numbered 5,400, while the Confederates under Gen. Ben McCulloch and Gen. Sterling Price were nearly 11,000. On Aug. 9 General Lyon sent 1,200 men under Col. Franz Sigel to take up position for attack on the Confederate right flank on the morning of the 10th. Lyon meanwhile prepared to attack the Confederate left. Sigel failed in his attack, and the Confederates resisted Lyon and compelled his forces to retreat to Rolla. Lyon was killed during the battle. The losses were equally divided, about 1,200 for each side.

Consult Johnson, R. U., and Buel, C. C., *Battles and Leaders of the Civil War,* 4 vols. (New York 1884–1888).

WILSON'S RAID, in the American Civil War, the march of the Union general, James Harrison Wilson, from his winter cantonment north of the Tennessee River, through northern Alabama to Selma, Ala. and Macon, Ga., beginning March 18, 1865 and ending with the surrender of Macon on April 21. His forces numbered about 12,000 cavalry troops in three divisions, commanded by Generals Emory Upton, Eli Long, and Edward Moody McCook, and about 1,200 unmounted men who were to act as train guards until sufficient horses could be captured from the enemy. As the entire country near the Tennessee River was nearly destitute of forage, it was necessary to scatter the troops over a wide extent and march as rapidly as circumstances would permit. This, according to Wilson himself, was rendered safe by the fact that Gen. Nathan Bedford Forrest's Confederate forces were at the time much scattered, some near West Point,

Miss., 150 miles southwest of Eastport, while Roddey's forces occupied Montevallo, on the Alabama and Tennessee Railroad, nearly the same distance to the southeast. By starting on diverging roads the enemy was left in doubt as to the real object and compelled to watch equally Columbus, Tuscaloosa and Selma. Therefore the divisions marched on different roads, but the objective point of each was Selma, distant 180 miles, and the average march of each division to reach it was 250 miles. The command moved southward in three columns and on the 26th reunited at Jasper, about 80 miles southeast of Tuscumbia, from which it crossed the two forks of the Black Warrior, and pushed for Montevallo, a centre of iron manufacture. General Croxton's brigade was detached to move on Tuscaloosa, to burn bridges, factories and public stores, and rejoin the command in the vicinity of Selma. Ironworks and rolling mills were destroyed near Elyton, and 31 March, after passing Montevallo a mile, Upton encountered Roddey, who disputed the road to Randolph. After two brisk engagements Roddey was driven back, losing 100 men, and was pursued by Upton, who occupied Randolph at dark. Here a courier was captured with dispatches to Forrest, showing that several columns were moving to join Forrest for the defense of Selma, and detachments were sent to check them. McCook was left at Randolph to guard the trains and rear, while Wilson, with the divisions of Long and Upton, on 1 April, rode straight for Selma, encountered and brushed away several detachments of Forrest's cavalry and at Ebenezer Church came upon Forrest in position, with the brigades of Roddey, Crossland and D. Adams, about 1,500 men, covering the two roads from Randolph by which Wilson had marched. Long's division and Alexander's brigade of Upton's attacked and carried the position in less than an hour, the Confederates retreating in great disorder toward Selma despite all of Forrest's efforts to rally them. At night the whole command bivouacked about Plantersville, 19 miles from Selma, after almost constant fighting during the day of 24 miles, during which Wilson had captured three guns and over 200 prisoners. Early in the day McCook, with Colonel La Grange's brigade, had been ordered to march rapidly to Centreville, 40 miles distant, to seize and hold the bridge over the Cahaba, and to fall upon Jackson's Confederate cavalry division, which had thrust itself between the main body and Croxton. At daylight, 2 April, Wilson resumed his march and by rapid movement, without opposition, the troops were in sight of Selma and mostly in position by 4 P.M. The city had been sufficiently fortified, as was believed, against any possible cavalry attack. The works contained 24 bastions and a number of strong redans, with deep ditches and an interior line of four detached forts. They were of semi-circular form, nearly three miles in extent, with both flanks resting on the Alabama River, above and below the city. They mounted 32 guns and were held by Forrest, with about 4,000 veteran cavalry and some 2,000 Alabama militia, home guards and citizens, mostly old men and young boys. Wilson had obtained accurate plans of the works and of the ground in front of them. During the day these sketches were shown to all his general officers and the plan of attack explained, from which it resulted that upon reaching the vicinity of the works, the various brigades went quickly into position, with great precision. At a given signal Long's division was to lead in the assault, supported by Upton, but before the signal had been given Long had become engaged and without waiting he ordered the charge, and in the gathering darkness his men went forward, under a severe fire of artillery and musketry, scaled the works and after a hand-to-hand encounter drove the Confederates from them and took many prisoners. Some of Upton's men joined in the fight. Gens. Forrest, Armstrong, Roddey and Adams escaped, with a number of men, under cover of darkness. A portion of Upton's division pursued on the Burnsville road until long after midnight, capturing four guns and many prisoners. Wilson had engaged and in support 8,000 men. His loss was 44 killed, 277 wounded and seven missing. Forrest's loss in killed and wounded was less. It was one of the most remarkable feats ever accomplished by cavalry, and its result was the capture of 2,700 prisoners, many colors, nearly 2,000 horses, 104 field and siege guns and an immense quantity of ammunition. Wilson destroyed the arsenal, with 44 buildings, covering 13 acres, filled with machinery and munitions, powder works, three gun foundries, three rolling mills and several machine shops, and large accumulations of quartermaster and commissary stores. On the 3d Upton's division was sent from Selma to open communication with McCook and Croxton, west of the Cahaba. McCook had found Jackson's cavalry between himself and Croxton, and after skirmishing with it at Scottsville, had retired east of the Cahaba. Nothing was heard of Croxton and Upton, and McCook returned to Selma on the 6th. Croxton made a wide detour to the west and south of Tuscaloosa, and then northward and eastward across Alabama into Georgia before rejoining the corps. Preparations were now made to march on Montgomery. It was necessary to prepare 900 feet of bridging to cross the Alabama River, which was running high, horses enough had been captured to mount the whole command, supplies in the country were abundant, and on the 9th the entire command, except Croxton's brigade, started for Georgia by way of Montgomery. When the advance, which had not been strongly resisted, was near Montgomery on the 12th, the mayor surrendered the city, Adams, who was in command, having retreated, after burning 90,000 bales of cotton. With bands playing and colors flying the column marched through the city and encamped. Here five guns, a large quantity of stores, small arms and cotton were destroyed, also five steamboats loaded with military supplies. On the 14th the command moved with the greatest celerity to secure the crossings of the Chattahoochee at Columbus, on the direct road to Macon and West Point, further up the river. On the afternoon of the 16th Upton's division, in the advance on the Columbus road, struck Buford's cavalry pickets and drove them rapidly through Girard to the lower bridge over the Chattahoochee. The bridge was fired by the Confederates before it could be seized, and it was then decided

to make a night attack upon the central bridge, one of the three that crossed the river at this point. Three hundred men of the 3d Iowa Cavalry, properly supported, were selected to make the attack. The lines were quietly formed and moved up to within range of the intrenchments covering the bridge, and at a signal the attack began at 9 P.M.; the troops opened a rattling fire from their Spencer rifles, which was replied to by a storm of canister from 27 guns, but the Iowa men went over the works at many points and all rushed for the bridge. At the same time the Confederates tried to escape by the bridge, which was so crowded with the men of both forces that the Confederates holding the works at the east end of the bridge and commanding it with two guns, were restrained from firing and the Union forces made a rush upon them and gained possession, and Columbus was taken. Wilson's loss was six killed and 24 wounded. He captured 1,200 prisoners, nearly half of the militia that had defended the place under command of Gens. Howell Cobb and Robert Toombs. Columbus was one of the great manufacturing centers of the Confederacy, and its capture resulted in the destruction of a great quantity of war material, 63 guns, the ram *Jackson,* mounting six guns, 125,000 bales of cotton, 15 locomotives, 250 cars, a navy yard and armory, two rolling mills, powder magazines and an arsenal, with a great quantity of machinery, two ironworks, three foundries, and 10 mills and factories turning out war material. The Confederates abandoned and burned the gunboat *Chattachoochee* 12 miles below Columbus. On the same day that Wilson captured Columbus, La Grange's brigade captured West Point. La Grange had been detached at Tuskegee and marching northeast, after some sharp skirmishing, appeared before West Point about 10 A.M. of the 16th to find that the bridge spanning the river was defended by an earthwork, mounting three guns, and held by Gen. R. C. Tyler with about 265 men. The fort was taken after a hard fight, during which La Grange's men bridged the ditch of the work, under fire. General Tyler and 18 of his men were killed, 28 wounded and 218 captured. La Grange had seven killed and 29 wounded. The captures were three guns, 500 stands of small arms, 19 engines and 245 cars loaded with army supplies. After destroying the bridges, railway equipment and stores, La Grange moved toward Macon. With the main column Wilson also marched for the same place on the 18th and when nearing the city, on the 20th, his advance was met by a communication from General Beauregard, with information of a truce between Generals Johnston and Sherman. Before the communication could reach Wilson, who was marching near the rear of his column, his advance had dashed into Macon and received the surrender of Gens. G. W. Smith, Howell Cobb and other prominent officers, and these, with the garrison, were held as prisoners of war. Here Wilson heard of the surrender of General Lee, and the next day, April 21, he received a dispatch from General Sherman to suspend hostilities until notified of the result of the negotiations then pending between Sherman and Johnston. The surrender of Macon included four generals, 3,500 men, five colors, 60 guns, a large number of small arms and great quantities of military stores and supplies. Croxton, who had been detached from McCook's division at Elyton on March 27, rejoined the corps at Macon on May 1. He had captured Tuscaloosa and advanced as far as Bridgeville, then returned to Tuscaloosa and Jasper; thence his line of march was 100 miles north of that pursued by Wilson, and on the way through Alabama he had a sharp engagement at Blue Mountain, near Talladega. He marched 653 miles, most of the time through mountainous country, so destitute of supplies that his command could subsist only by the greatest efforts. Swimming four rivers, destroying five large ironworks, the last in the cotton states, three factories, numerous mills, immense quantities of supplies, capturing four guns, several hundred arms, and nearly 300 prisoners, he rejoined the corps with men and horses in fine condition. He lost in all 172 officers and men. The closing act of Wilson's campaign was the capture of Jefferson Davis by regiments from his command.

In the campaign Wilson had marched 529 miles, captured five fortified cities, 288 guns, 6,820 prisoners and 23 colors. He subsequently paroled over 59,000 officers and men of the armies of Lee, Johnston and Beauregard, and had destroyed a vast amount of property of every kind. He lost 99 killed, 598 wounded and 28 missing, an aggregate of 725.

He had conducted the most notable cavalry movement of the war, none other equaled it in skillful planning, bold and successful execution.

Consult *Official Records of the Union Armies and Navies,* vol. 49 (Washington, D.C., 1880–1901); Johnson, R. U., and Buel, C. C., *Battles and Leaders of the Civil War,* vol. 4 (New York 1884–1888); Cox, J. D., *The March to the Sea* (1882); Piatt, D., *Life of General George H. Thomas* (1893); Boynton, H. V., *General George H. Thomas at Nashville.*

E. A. CARMAN.

WILTON, Joseph, English sculptor: b. London, July 17, 1722; d. there, Nov. 25, 1803. He studied in Paris and in Rome, and while at Rome in 1750 won the gold medal awarded for sculpture by Benedict XIV on the occasion of his jubilee. He returned to England in 1755 and in 1758 became director of the art gallery of the Duke of Richmond. He was one of the founders of the Royal Academy and one of its first exhibitors. His busts and monuments were in much demand, among the former being those of Bacon, Cromwell, Isaac Newton, Chesterfield, Chatham and other prominent characters. From 1790 until his death he was keeper of the Royal Academy. A bust of Wilton by Roubillac was presented to the academy by his daughter, Lady Chambers.

WILTON, town, Maine, a resort located in Franklin County, altitude 470 feet, on the Maine Central Railroad, and on one federal and one state highway; it is 38 miles from Augusta. Settled in 1789, it was incorporated in 1803. Wilton Academy and Goodspeed Memorial Library are located here. Woolens, shoes, wooden novelties, and canned goods are the factory output. Pop. (1940) 3,228; (1950) 3,455.

WILTON CARPET, a variety of carpet made similar to Brussels, excepting that the wire is flattened instead of being round and has a groove along the upper surface, which acts as a director for the knife by which the loops are cut and the wire liberated. It is named for Wilton, Eng., where the exiled weavers from France produced it by the Jacquard process. See also CARPET AND RUG INDUSTRY.

WILTS or **WILTSHIRE**, England, a southwestern county bounded on the north and northwest by the county of Gloucester, on the west by Somerset, on the south by Dorset and Hampshire, on the east by Hampshire and Berkshire; area, 1,345 square miles. The county town is Salisbury. The north is principally a fertile flat, with scarcely any perceptible slope, except on the frontier where it begins to rise in the direction of the Cotswold Hills and near the center, where it is broken by a ridge of downs; the south, though presenting at a distance the appearance of an almost uninterrupted plain, has an undulating surface, broken by downs and intersected by some fertile and well-watered valleys. In this south division is Salisbury Plain, an elevated plateau used as an army training ground. On the plain are the megalithic remains of Stonehenge, situated about nine miles north of Salisbury and those of Avebury, about five miles west of Marlborough. The chief rivers are the Bristol Avon, the Salisbury Avon and its tributaries Bourne, Wily and Nadder. Though the arable land is of considerable extent, the larger proportion of the surface is kept in pasture, devoted chiefly in the south division to the rearing of sheep, and in the north to cattle-grazing and dairying. Wiltshire bacon and cheese are famous. The manufactures comprise woolen goods for which the principal localities are Wilton, famous particularly for carpets, Bradford, Trowbridge, Westbury, etc.; excellent cutlery and steel goods at Salisbury, ropes and sacking at Marlborough, large engineering works at Devizes; and iron ore found in mines nearby is smelted at Westbury. Pop. (1951) 387,379.

WIMAN, Erastus, American mercantile agent: b. Churchville, Ontario, April 21, 1834; d. Saint George, S. I., Feb. 9, 1904. He entered the mercantile agency service in 1858 and in 1867 removed to New York, where he became interested in rapid transit schemes for Staten Island. He increased the number of steamboat trips between that island and New York from 15 to 65 a day, built the Arthur Kill bridge and in 1902 secured congressional authority for the construction of a tunnel under New York Bay connecting New York, Long Island and Staten Island. His later years were clouded by financial reverses and the frustration of his extensive plans for rapid transit. He wrote *Chances of Success* (1892).

WIMBLEDON, wĭm'bŭl-dŭn, residential municipal borough, England, in Surrey, eight miles southwest of Trafalgar Square, London. A suburb of London, it is situated at the northeast extremity of the common of same name. It is the headquarters of the All England Lawn Tennis Club where international matches are held. The first championship match was held here in 1877. Pop. (1951) 58,158.

WIMBORNE, wĭm'bĕrn, or **WIMBORNE MINSTER,** urban district, England, in east Dorsetshire, on the Wimar Allen River, near its confluence with the Stour, about seven miles northwest of Bournemouth. It is of historical interest in connection with its fine cruciform minster, the collegiate church founded by Edward the Confessor which succeeded the convent established by Saint Cuthburh, King Ine's sister, in 705. The minster exhibits various styles of transitional architecture from the Norman onward, has a central and a west tower and contains several interesting features, including the tomb of Ethelred I, and a medieval chain-library, one of the few in existence where the books are chained to the shelves. The grammar school in the town was founded in 1496. Pop. (1951) 4,488.

WIMPLE or **WIMPEL,** a covering of silk or linen for the neck, chin and sides of the face, worn usually out of doors. It is still retained as a conventual dress for nuns.

WINAMAC, wĭn'ă-măk, town, Indiana, Pulaski County seat; altitude 709 feet; on the Tippecanoe River; 89 miles southeast of Chicago; on the Pennsylvania Railroad. It is a trading center in a farming region. Settled in 1837 and incorporated in 1868, its government is administered by a town board. Pop. (1950) 2,166.

WINANS, Ross, American inventor: b. Vernon, N. J., Oct. 17, 1796; d. Baltimore, Md., April 18, 1877. In the fall of 1828 he accompanied George W. Whistler, Jonathan Knight, and William G. McNeill to England to examine English railroad systems in the interest of the Baltimore and Ohio Railroad. On his return he assisted Peter Cooper (q.v.) in the construction of his famous *Tom Thumb* locomotive. About 1834 he took charge of the railroad's Mount Clare shops and for the next 25 years devoted himself to improving railroad machinery. He designed the first eight-wheel car ever built for passenger service, and is said to have been the first engineer to have mounted a car on two four-wheel trucks. In 1848 he invented the powerful "camelback" locomotive for use on steep grades. Sympathetic to the Confederacy during the Civil War, he was twice arrested in 1861 while a member of the Maryland legislature. He wrote several unorthodox works on religious subjects including *One Religion, Many Creeds* (1870).

WINANS, Thomas De Kay, American engineer, son of Ross Winans (q.v.): b. Vernon, N. J., Dec. 6, 1820; d. Newport, R. I., June 11, 1878. Taken into partnership by his father on coming of age, Thomas was sent by him in company with his brother William to St. Petersburg in 1843 to deliver a locomotive and at the same time negotiate with the Russian government for furnishing and managing the equipment of a railroad between Moscow and St. Petersburg, the construction of which was to begin the following year under the direction of George W. Whistler. With Joseph W. Harrison of the Philadelphia firm of locomotive builders, Eastwick and Harrison, he secured a contract to equip the railroad in five years with locomotives and other rolling stock. The original contract for $5,000,000 was supplemented by others totaling $2,000,000. The contract was completed more than a year before the stipulated term. On his return to the United States in 1851, he became interested in invention, and with his father and brother invented a system of steam navigation known as the "cigar-steamer," a long, narrow vessel foreshadowing the hulls of modern steamers; a tubular adjustment for the feeding of young trout; and various other mechanical devices.

WINATSHIPUM INDIANS, a small tribe of the Salishan stock of North American Indians,

also known as Piskwaus or Pisquouse, residing on Wenatchee River (whence the name of the tribe), and the north branch of Yakima River in Kittitas County, Wash. They took part in the Yakima treaty of 1855, but do not live on the reservation. There are six smaller tribes or bands connected with them and speaking the same language.

WINCHELL, Alexander, American geologist: b. North East, Dutchess County, N. Y., Dec. 31, 1824; d. Ann Arbor, Mich., Feb. 19, 1891. A graduate of Wesleyan University, Middletown, Conn., in 1847, he was appointed professor of physics and civil engineering at the University of Michigan in 1853 and of botany and geology there in 1855. He served as state geologist of Michigan 1859–1862, professor of geology at Kentucky University 1866–1869, director of the Michigan Geological Survey 1869–1871, and chancellor of Syracuse University 1873–1874. From 1879 until his death he was professor of geology and palaeontology at the University of Michigan. He lectured extensively and published *Sketches of Creation* (1870); *Geological Chart* (1870); *The Doctrine of Evolution* (1874); *Science and Religion* (1877); *Preadamites* (1880); *Sparks from a Geologist's Hammer* (1881); *World-Life* (1883); *Geological Studies* (1886); *Walks and Talks in the Geological Field* (1886).

WINCHELL, Newton Horace, American geologist, brother of Alexander Winchell (q.v.): b. North East, N. Y., Dec. 17, 1839; d. Minneapolis, Minn., May 2, 1914. He was graduated at the University of Michigan in 1866, and in 1869–1870 was assistant state geologist of Michigan. For two years he assisted in the Ohio Geological Survey. Appointed state geologist of Minnesota in 1872 and a year later professor of geology and mineralogy at the University of Minnesota, he retained both posts until 1900. Elected president of the American Geological Society in 1902, he edited the *American Geologist* with his son, Horace V. Winchell, an economic geologist. He was joint author of *The Iron Ores of Minnesota* (1891), and with another son, Alexander N. Winchell, professor of mineralogy and petrology at the University of Minnesota, he was author of *Elements of Optical Mineralogy* (1909). Independently he was author of *Catalogue of the Plants of the State of Michigan* (1861); *Geology of Ohio and Michigan* (1872–1900); *The Aborigines of Minnesota* (1911); *Weathering of Aboriginal Stone Artifacts* (1913).

WINCHENDON, wĭn'chŭn-dŭn, town, Massachusetts, Worcester County; altitude 992 feet; on Millers River, which flows westward into the Connecticut River; 36 miles northwest of Worcester, and 68 miles northwest of Boston; on the Boston and Albany, and the Boston and Maine railroads. Situated less than five miles below the New Hampshire boundary, its environment combines agricultural, industrial, and forested regions. Its industries produce furniture, toys, wooden buckets and tubs; also textile goods and woodworking machinery. Wood-working here began in the late 1820's; later the industry specialized in educational toys. The public school system includes junior and senior high schools; the public library is the Beals Memorial.

The town comprises the villages of Winchendon and Winchendon Springs, the chalybeate waters of which were used medicinally by the Indians. For some time after its settlement (about 1753) the place was known as Ipswich Canada, but it was renamed in honor of Winchendon, England, in 1764, on its incorporation. The town's government is administered by a board of selectmen. The water supply system is municipally owned; the power and light systems are under private ownership. Pop. (1950) 6,585.

WINCHESTER, Caleb Thomas, American educator: b. Montville, Conn., Jan. 18, 1847; d. Middletown, Conn., March 24, 1920. He was graduated from Wesleyan University 1869, and studied at the University of Leipzig 1880–1881. He served his Alma Mater as librarian 1869–1873; was professor of rhetoric and English literature 1873–1890 and thereafter professor of English literature. He was a lecturer of great charm and wide reputation. He is the author of *Five Short Courses of Reading English Literature* (1892; 3d ed., 1911); *Some Principles of Literary Criticism* (1899); *The Life of John Wesley* (1906), considered by many critics superior to any of the earlier biographies; *A Group of English Essayists* (1910); *Representative English Essays, with introduction and notes* (1914); *Wordsworth—How to Know Him* (1916).

WINCHESTER, Oliver Fisher, American industrialist: b. Boston, Mass., Nov. 30, 1810; d. New Haven, Conn., Dec. 11, 1880. After conducting a jobbing and importing business in New York, he established a shirt manufacturing company at New Haven about 1850 and in five years acquired a fortune. Meanwhile he had invested in an arms manufacturing company, became principal owner in 1856, and in 1857 reorganized it as the New Haven Arms Company with himself as president. By 1860 he was producing Henry rifles, used by many state troops in the Civil War. In 1866 he reorganized his company as the Winchester Repeating Arms Company. Lieutenant governor of Connecticut in 1866, he was widely known for his philanthropies and benefactions to Yale.

WINCHESTER, municipal borough, England, capital of Hampshire, situated on the right bank of the Itchen, 11 miles north of Southampton. The most important edifice is the cathedral; the oldest parts date from the 11th century, but the greater part of the main building was erected at various times from the 13th to the 16th century, William of Wykeham (1324–1404) having an important share in the work. It has a low central tower which alone rises above the general level of the roof; length from east to west, 545 feet, width of the transepts 186 feet. The length of the nave, which has a beautiful interior, is 351 feet, height 86 feet; the transept contains several beautiful chapels and altars. Numerous monuments include the tombs of William Rufus, of Edmund, son of King Alfred, of William of Wykeham, Cardinal Beaufort, and of Izaak Walton; also the shrine of Saint Swithin.

It is said that there was a Christian church erected at Winchester in the latter part of the 2d century. Late in the 3d century it was converted into a temple to Wodin. In the second half of the 7th century, the exact date not being definitely known, Winchester became an episcopal see with an unbroken line of bishops, including the famous Saint Swithin, down to the present. Other no-

table edifices and establishments are Winchester College (q.v.), oldest of the great English public schools, founded by William of Wykeham in 1382, richly endowed and accommodated in a large range of buildings, of which the chapel, hall and library are beautiful specimens of architecture; the guildhall; the old castle, which has been restored, and assize courts built adjoining; a corn exchange; barracks for infantry; the hospital of Saint Cross, founded in 1132, several other charitable institutions, a free library and museum, school of art, etc. The Abbey Gardens are very beautiful, and statues of Alfred the Great by Hamo Thornycroft, erected for the millenary of the king celebrated at Winchester in 1901, and of Queen Victoria by Alfred Gilbert, adorn the town. There are no manufactures or trade of any consequence.

Winchester was called Caer-Gwent by the Britons, Venta Belgarum by the Romans—under whom it was an important place, with a Christian church—and Wintanceaster by the Saxons. It became the capital of England under the Saxons, when the country was united under the sway of Egbert, in the first half of the 9th century, and it retained this dignity till the middle of the 11th century, being a royal residence and place where parliaments met after this also. After the Battle of Naseby it stood a week's siege by Cromwell. Intending to make the town a royal residence, Charles II began construction of a palace; unfinished at his death, it was eventually used as a barracks. For nearly six centuries Winchester sent two members to Parliament (1295–1885), in the latter year reduced to one. Since 1918 its representation is included in the county. Pop. (1951) 25,710.

WINCHESTER, city, Illinois, Scott County seat; altitude 546 feet; on Big Sandy Creek; 84 miles northwest of St. Louis, Mo.; on the Chicago, Burlington and Quincy Railroad. There is coal in the vicinity; the city has grain elevators, flour mills and a hatchery. In the city is a monument to Stephen A. Douglas, who taught school and practiced law here in 1833–1834. Here too Lincoln made his first speech on the Kansas-Nebraska issue. Platted in 1830, it was incorporated in 1843. Pop. (1950) 1,591.

WINCHESTER, city, Indiana, Randolph County seat; altitude 1,088 feet; on the West Fork of White River; 20 miles east of Muncie; on the Pennsylvania, and Cleveland, Cincinnati, Chicago and St. Louis railroads. It is in an agricultural region, with grain, dairy and poultry farms, and in an old natural-gas belt. It has manufactures of moulds, burial slippers, gloves, glass, and furniture, machine and repair shops. It was settled in 1812. Pop. (1950) 5,467.

WINCHESTER, city, Kentucky, Clark County seat; altitude 981 feet; 18 miles east of Lexington; on the Chesapeake and Ohio, and Louisville and Nashville railroads. It is in an agricultural region in the "Blue Grass" country. It has manufactures of children's wash suits, seed harvesters, bricks, lumber, beverages, and bluegrass seed strippers. The principal shipments are tobacco, blue-grass seed and livestock. The educational institutions are the Kentucky Wesleyan College, opened in 1866, and public and private schools. There are also a Carnegie library and a hospital. Incorporated in 1793, it was named for Winchester, Va., by the founder, John Baker. Pop. (1950) 9,226.

WINCHESTER, town, Massachusetts, Middlesex County; altitude 22 feet; 8 miles northwest of Boston; on the Boston and Maine Railroad. Winchester has factories for glue, gelatine, watch hands, felt and leather uppers. It has many places of great beauty, and has long been a favored residential suburb of Boston. A part of Middlesex Fells, a state park which has an area of 3,020 acres, is here. Educational institutions include a high school, established in 1850, graded public schools and a public library. In 1638 the place was known as Waterfield, which in 1640 was changed to Charlestown Village. In 1642 it was called Woburn, and in 1850 the present name was adopted honoring a Watertown businessman of that name. Pop. (1950) 15,509.

WINCHESTER, town, Tennessee, Franklin County seat; altitude 958 feet; 45 miles west-northwest of Chattanooga; on the Nashville, Chattanooga and St. Louis Railroad. It is near the foot of the Cumberland Mountains, and the surrounding area has agricultural, mining, and lumbering activities. The town has varied industrial interests, including canning, flour milling, and the making of medicinal compounds. The Winchester creamery, organized in 1910, was one of the first cooperatives in the South. A farmers' market is held in the courthouse square. The town was founded about 1814. Pop. (1950) 3,974.

WINCHESTER, city, Virginia, Frederick County seat, but independent of the county; altitude 725 feet, on the Baltimore and Ohio, and Pennsylvania railroads; about 65 miles west of Washington, D.C. It is in the beautiful Shenandoah Valley, famous especially for its apples, and the Apple Blossom Festival held here each year since 1924 about the first of May draws thousands of visitors. Cider, vinegar, brandy and other apple products; woolens, knit goods, hosiery, rubber heels, barrels and boxes, and frozen foods are manufactured here. The public school system is endowed by a $2,000,000 bequest made in 1895 by Judge John Handley, a Pennsylvanian. The Handley Library also was his gift. Frederick County Courthouse was built in 1840. There is a National and a Confederate (Stonewall) cemetery here. George Washington's headquarters were here in 1755 after Braddock's defeat, and Fort Loudoun was built by Washington in 1756–1757. The homes of James Wood, founder of the settlement, and Daniel Morgan, Revolutionary general, are preserved here. There was a settlement here as early as 1732. The town was incorporated in 1779, and a city charter given in 1852. It has a mayor and council, with city manager. Pop. (1950) 13,841.

WINCHESTER, Battle of. See OPEQUON, BATTLE OF.

WINCHESTER, Military Operations at and near. Winchester, Virginia, was an important strategic point during the Civil War. On good local authority it is said to have been occupied or abandoned 68 times by the troops of both armies. It was held by the Confederates until March 11, 1862 when Gen. J. E. Johnston having retreated from Centreville and

Manassas, Gen. "Stonewall" Jackson, under Johnston's orders, withdrew from the place and retired up the Shenandoah Valley, and the Union troops, under General Banks, occupied it on the 12th. General Shields, who had followed Jackson up the valley, with a division of Banks' command, fell back to Winchester and Jackson followed him as far as Kernstown (q.v.), four miles south of Winchester, where Shields attacked and defeated him on March 23; Jackson again retreating up the valley, Banks following and finally taking up a fortified position at Strasburg. Jackson flanked Banks out of Strasburg by moving through Luray Valley and defeating Colonel Kenly at Front Royal (q.v.) May 23, and Banks retreated to Winchester closely pursued by Jackson.

Winchester, First Battle of.—Banks arrived in Winchester late on the 24th with about 8,000 men and 16 guns. Colonel Donnelly's small brigade was put in position to cover the Front Royal and Millwood roads, and was supported by eight guns, judiciously placed on rising ground. Colonel Gordon's brigade, on the right, held a low ridge running southwest from the town and west of the Valley turnpike, a little over half a mile from the suburbs. Its left rested on the turnpike and its right extended westward along the ascending ridge in front of Winchester. Skirmishers were thrown out in advance and guns were placed on either flank. Five companies of Michigan cavalry were held in reserve under cover of the ridge. Between Gordon and Donnelly was an interval of nearly a mile, which was filled by the principal part of General Hatch's cavalry brigade and two guns. The line formed the arc of a circle, covering Winchester from the west around by the south to the east. Jackson confronted this position with 16,000 men and 48 guns, and with the main body lay close to Gordon, while Ewell, with two brigades which had marched directly from Cedarville on Winchester, bivouacked opposite Donnelly's position. Jackson's plan was to hold Gordon fast, throw Ewell upon Donnelly, and then move his main body around Gordon's right, and he expected to advance upon a disorganized and demoralized army. At dawn of the 25th Ewell advanced the 21st North Carolina and opened with his artillery, whose shells fell among Donnelly's men, as they were preparing coffee and brought them to arms as they saw the Carolinians advancing in line across an open field upon the centre of the position crossing the Front Royal road. The North Carolina men met a severe front and flank fire from the stone fences, and as they fell back Captain Best's guns threw canister into their disordered ranks and they left the field with a loss of 80 officers and men, including the two field officers with them. A Confederate officer says, "the slaughter was appalling and the survivors fled to the rear in the utmost confusion" Ewell now brought up two batteries, and an artillery duel ensued, which soon ceased as a heavy fog settled over the field. Ewell then made an unsuccessful attempt to turn Donnelly's right and then endeavored to turn his left and gain the Martinsburg road in his rear. The attempt was checked, Donnelly losing some ground, but at this moment he received an order to retreat, as Gordon had been driven from position and was in retreat through Winchester. Donnelly moved his three regiments and guns from the field in perfect order, under a heavy fire of shot and shell, and continued his retreat, keeping to the right of the Martinsburg road. He had made a successful resistance of over four hours against double his number, with trifling loss.

Jackson attacked Gordon's small brigade with six brigades, his attack beginning at daybreak, and being several times repulsed. Finally he got artillery in position and opened on Gordon's front and gradually worked his infantry toward the left. Then he moved two brigades around Gordon's right. Gordon detected the movement while it was in progress and changed position to meet it, pouring a destructive fire of musketry into the Confederate ranks, making great gaps in the line, without checking its advance; the gaps were closed and with almost perfect alignment the two brigades came on and flanking Gordon's two right regiments drove them back in some disorder. The five companies of Michigan cavalry were now brought up and as quickly swept away. At this juncture Jackson ordered forward his entire line of six brigades and Gordon ordered a retreat through Winchester, which was conducted in a manner to command Jackson's admiration. There was some confusion in the streets of the town, but once clear of it, Hatch's cavalry and the artillery covered the withdrawal, until the infantry was well on the Martinsburg pike. Jackson with his main body pursued five miles beyond Winchester and Banks continued his retreat to the Potomac, crossing it at Williamsport on the 26th. Banks' loss May 23-25, including Front Royal and the retreat from Strasburg to the Potomac, was 62 killed, 243 wounded and 1,714 missing. Jackson's loss was 68 killed, 329 wounded and three missing. Jackson remained at and in the vicinity of Winchester until May 31, when, his rear being threatened by the converging columns of Frémont from the west and McDowell from the east, he retreated up the valley and the Union troops reoccupied Winchester. Consult *Official Records* (Vol. XII); Allan, *Jackson's Valley Campaign.*

During Lee's campaign against Pope the town was occupied by Gen. Julius White with a brigade of over 2,000 men. On the night of September 2, 1862, White, under General Halleck's order, spiked four heavy siege guns in the works and withdrew to Harper's Ferry; the Confederates occupying the place next day. The Confederates held the place in small force until December 3, when, upon the advance of a Union column from Harper's Ferry, under General Geary, they retired, and Geary occupied the town next day. Geary soon withdrew and the Confederates reoccupied and held the town until near the end of December, when it was again taken by Union troops under General Milroy. Milroy fortified the place and occupied also Berryville and Romney, with outposts toward Strasburg and Front Royal. Harper's Ferry, Martinsburg, Williamsport and posts westward to Cumberland and New Creek were held by Union troops belonging to Gen. B. F. Kelley's command.

Winchester, Second Battle of.—When General Lee began his preparations for the second invasion of Maryland, which culminated in the battle of Gettysburg, he turned his

thoughts to the clearing of the Shenandoah Valley. At this time Winchester was held by General Milroy, with the two brigades of Gen. W. L. Elliott and Colonel Ely, numbering about 7,000 effective men. Colonel McReynolds' brigade of 1,800 men was at Berryville. The main works defending Winchester were on a ridge north of the town and consisted of two forts known as the «main fort» and the «Star fort,» mounting four 20-pounder Parrotts and two 24-pounder howitzers. Surrounding these were smaller works connected by rifle-pits. The expressed object in holding the place was to observe and hold in check the enemy in the valley, and to secure the Baltimore and Ohio Railroad against depredations. Milroy was expressly instructed to undertake no offensive operations in force. On 7 June General Lee began his operations in the valley by ordering General Imboden, in the upper valley, to make a demonstration with his cavalry brigade on Romney in order to cover the movement against Winchester and prevent the Union troops at that place from being reinforced by Kelley's troops on the line of the Baltimore and Ohio Railroad. General Jenkins' cavalry brigade was ordered to join Ewell's infantry corps near Front Royal. Both Imboden and Jenkins were in position by the 10th, and on that day Ewell set out from near Culpeper Court House for Winchester by way of Gaines' Cross Roads, Chester Gap and Front Royal, to Cedarville, which was reached on the 12th. Here, next day, Ewell detached Rodes' division and Jenkins' cavalry brigade to move on Berryville and endeavor to capture McReynolds' brigade, but, warned by Milroy, McReynolds made good his retirement, with small loss, joined Milroy at Winchester on the night of the 13th, and was assigned to the Star fort, immediately north of the main work. On the same day Early's division marched on Winchester by Newtown and the Valley pike, while Edward Johnson's division moved upon the town by the direct road from Front Royal. The two divisions, driving in Milroy's outposts, were in position before Winchester on the evening of the 13th. For some days Milroy had felt the pressure from Confederate cavalry, but had no idea that Lee was threatening the valley until a prisoner taken in a skirmish on the Strasburg road, on the evening of the 13th, informed him that he was confronted by Ewell's corps and that Longstreet's was near. Fully recognizing the fact that an orderly withdrawal was impracticable, he resolved to act on the defensive, and, if not relieved, force his way through what might appear the weakest part of his lines. At night of the 13th Ewell ordered Early to attack the works on the north and west of the town next morning, while, as a diversion, Johnson demonstrated against the east and southeast. In the forenoon Johnson made his attack on the eastern side of the town, between the Millwood and Berryville roads, held by Colonel Ely's brigade, and was repulsed by the Eighth and 87th Pennsylvania, which charged Johnson's retreating troops, but were speedily driven back by fresh troops, and after some sharp fighting Johnson gained part of the town, but was quickly shelled out and made no further effort. West of the ridge on which the main forts were thrown up, and about 1,300 yards distant, is another parallel ridge, called Flint Ridge, where an isolated earthwork of slight strength had been thrown up to command the Pughtown and Romney roads. It was held by the 110th Ohio, a company of the 116th, and a regular battery, commanded by Lieutenant Wallace F. Randolph, all under command of Col. J. W. Keifer. Early, leaving Gordon's brigade south of the town to engage Milroy's attention, moved with the remainder of his division to the left and west, then north, crossed the Romney road, and about 5 P.M., having gained Round Mountain, south of the Pughtown road, and put 20 guns in position, without being perceived, opened an unexpected fire on Keifer's work and soon silenced Randolph's battery, upon which Hays' brigade, in two lines, made a quick dash and after a stubborn resistance carried the work, and captured the battery of six guns. Keifer, with a loss of over 40 men, withdrew under cover of the fire from the guns of the main works. This was followed by an artillery duel which was kept up until 8 P.M., during which Milroy withdrew his detachments to his main works. Darkness ended the contest.

Milroy was now in a critical position. His cannon ammunition was nearly exhausted and he had but one day's rations for his men. At 9 P.M. he assembled his brigade commanders, and it was concluded to give up further effort to defend the place, to abandon all the artillery and wagons, and to force a way through the Confederate lines that night, taking with them only the horses, small arms and usual supply of ammunition. All the guns were spiked and the ammunition thrown into the cisterns. At 1 A.M. of the 15th Milroy, abandoning his sick and wounded, avoiding the town, moved silently through a ravine about a mile and struck the Martinsburg pike, which was followed cautiously, with many halts to close up the stragglers, for about three miles, when, about 3.30 A.M., Elliott's brigade, which was in the advance, was fired upon by Confederate skirmishers, and it was soon ascertained that their main body was east of and very near the road. The retreat had been anticipated and intercepted. Under Ewell's order, General Johnson had left one brigade to prevent Milroy from escaping toward the east, and moved with the remainder of his division by way of Jordan Springs to Stephenson's Depot, about five miles north of Winchester, to intercept the retreat in that direction. Just as Johnson's head of column reached the railroad, 200 yards from the Martinsburg pike, Milroy's men were heard coming down the road and Johnson formed his line on elevated ground in a woods east of the road and in a field south of and adjoining the woods. The greater part of his men were sheltered by a stone fence which bounded a railroad cut. As soon as Elliott took in the situation he formed line of battle with his three leading regiments to push back the Confederates and thus clear the way for the rest of the column to pass on toward Martinsburg. An hour's fight ensued with varying success, Johnson's right being forced back and his artillery silenced, but the left of his line held firm against all efforts to shake it. The main road being blocked Milroy determined to try another, and directed the troops to fall back a short distance and turn to the right. Part of them did so, but the greatet

number filed to the left, leaving the Martinsburg road and taking that to Bath. The diverging columns could not be reunited. A part of the command, accompanied by Milroy, reached Harper's Ferry by way of Smithfield late in the afternoon. Those retreating on the Bath road made good their escape, crossed the Potomac at Hancock and rallied to the number of 2,700 at Bloody Run. The greater part of Ely's and McReynolds' brigades were captured. Johnson claims the capture of 2,300 men, 175 horses and 11 colors. The capture of Winchester and defeat of Milroy gave the Confederates 28 guns, 300 loaded wagons, many horses and 4,000 prisoners. The Union loss was 95 killed, 348 wounded and 4,000 captured or missing. The Confederate loss was 47 killed, 219 wounded, three missing. Consult 'Official Records' (Vol. XXVII); Doubleday, 'Chancellorsville and Gettysburg.'

On marching into Maryland General Early left a small garrison at Winchester, and after the return from Gettysburg Lee's army was encamped around the place until it fell back beyond the Rappahannock. The town was not then reoccupied in force by Union troops, being only visited occasionally by small detachments from Harper's Ferry and Martinsburg. It was subject also to Confederate forays from the upper valley. In December 1863 General Early was sent into the valley, and throughout the winter and early spring of 1864 kept his troops very active, occasionally making dashes into Winchester. On 29 Feb. 1864 General Sigel was assigned to the command of the Union troops in the lower valley, and soon thereafter Winchester was occupied as an outpost to Harper's Ferry and Martinsburg. Sigel was relieved by General Hunter after the battle of New Market (q.v.), 15 May, and when Hunter was repulsed at Lynchburg and forced to retreat to the Kanawha General Early moved down the valley, and driving everything out of it, encamped near Winchester, 3 July, preparatory to his attempt on Washington (q.v.). After his failure on Washington Early returned to the lower valley and being hard pressed from the east and north fell back toward Strasburg, at the same time sending Ramseur's division of infantry toward Stephenson's Depot, a few miles northeast of Winchester, to support his cavalry and check General Averell's division of Union cavalry, advancing from Martinsburg. Averell defeated Ramseur at Stephenson's Depot (q.v.), 20 July, and followed him through Winchester. He was joined by General Crook's division, on the 22d, Crook assuming command, and the two divisions of 11,000 men advanced to Kernstown on the 23d. Early returned, defeated Crook at the second battle of Kernstown (q.v.) 24 July, drove him through Winchester and across the Potomac, and reoccupied Winchester and Martinsburg. Early's successes called for a strong commander of the Union forces to oppose him, and General Sheridan was selected. On 7 August when Sheridan assumed command, near Harper's Ferry, Early's army was concentrated west of the Opequon River, covering Winchester and Bunker Hill. Sheridan advanced from Halltown toward Winchester, on the morning of the 10th, and Early, abandoning Bunker Hill and Winchester, fell back to Strasburg to await reinforcements coming from Lee's army at Richmond. Sheridan followed to Cedar Creek on the 12th. Early's reinforcements arriving, Sheridan's infantry fell back to Winchester on the night of the 16th, the cavalry following next day. From Winchester Sheridan, on the 17th, fell back to Berryville, behind the Opequon, leaving his cavalry to cover the withdrawal. Wilson's cavalry division, Lowell's cavalry brigade and Penrose's brigade of New Jersey infantry, 850 men, were ordered to cover the flank of the army in its march from Winchester to Berryville. The Jersey brigade was deployed along a small branch of the Opequon, south of and near Winchester, with dismounted cavalry on the flanks, the remainder of the cavalry massed near the town. Early had followed Sheridan from Cedar Creek and, in the afternoon of the 17th, his cavalry advanced driving in the Union cavalry, was checked and held by the Jerseymen, until Wharton's division of infantry attacked their right and Ramseur's their front, while Gordon's division advanced against the cavalry. Under this pressure the entire Union line gave way about dark and fell back to Summit Point. The Jersey brigade lost 97 killed and wounded and about 200 prisoners. The cavalry had about 50 captured. Early again occupied Winchester and advanced to confront Sheridan at Halltown. For some days both parties were feeling each other's lines and suffering some losses, and 2 September, General Averell, who had been guarding the crossings of the Potomac, south of Hancock, advanced through Martinsburg to near Bunker Hill, where he attacked and routed General Lomax's cavalry division of two brigades, capturing two battle-flags, 55 prisoners, some wagons and a herd of cattle, finally driving Lomax nearly into Winchester next day, but Averell, in turn, was driven back by Rodes' infantry division. On the 13th General McIntosh, with five cavalry regiments and two guns, started from Sheridan's lines near Berryville, captured some prisoners, and on approaching Winchester caught sight of an infantry line and charged it, driving it to a piece of woods, which he surrounded, capturing the Eighth South Carolina of Kershaw's division, with its battle-flag. The rest of Kershaw's division advanced and McIntosh fell back with his 143 prisoners. These minor encounters were followed on the 19th by the greatest battle fought at Winchester, which to distinguish it from other battles of Winchester is known as the battle of the Opequon (q.v.), in which Sheridan with 38,000 men defeated Early's 15,000, and drove him from Winchester up the valley, not again to return. From this to the close of the war Winchester remained in Union possession. See also SHENANDOAH VALLEY, MILITARY OPERATIONS IN.

E. A. CARMAN.

WINCHESTER COLLEGE, a public school at Winchester, England, the oldest of the "Great Public Schools" of that country. It was founded in 1382 by William of Wykeham, and was opened in 1393, although its buildings were not finished until 1395. The original foundation consisted of a warden, 10 fellows, three chaplains, 16 choristers and 70 students who were to live at the school. Outside scholars, or "Commoners," to the number of 10, were admitted, and this number was afterward increased. The original buildings are still

in use and are exceptionally fine architectural types. The school from the time of its establishment prepared for New College, Oxford, and it has scholarships at that institution. The curriculum is classical in its base, gives mathematics, history, modern languages, and science. Enrollment is approximately 500.

WINCKELMANN, vĭng'kĕl-män, **Johann Joachim,** German classical archaeologist and art critic: b. Stendal, Prussia, Dec. 9, 1717; d. Trieste, Austria, June 8, 1768. The son of a cobbler, he acquired his early schooling as charity pupil in his native town. He was graduated from a gymnasium at Berlin, and later studied theology at Halle. He next undertook the study of medicine at Jena, but was unable to complete the course because of lack of means and for a number of years he was obliged to serve as private tutor and schoolmaster. He became librarian to Cardinal Passionei in 1754 and in the same year he joined the Roman Catholic Church, and through the efforts of the papal nuncio at Dresden was enabled to visit Rome in 1755. Here he entered the service of Cardinal Alessandro Albani, an art connoisseur and collector, and gave the public his ideas on classical art. The more important of his works are *Geschichte der Kunst des Altertums* (*History of Ancient Art,* 1764); and *Monumenti Antichi Inediti* (1767); with various sets of letters on the remains at Herculaneum and Pompeii. From 1763 he was in charge of antiquities and scriptor of the Vatican. He was recognized as the leading authority in Europe in the field to which he had devoted himself. In 1768 he revisited Germany, but at Munich a longing for Italy so overmastered him that he determined to return. Going by way of Vienna, he was well received there, and was presented to the Empress Maria Theresa, who bestowed rich presents on him. At the beginning of June he departed for Trieste, where, for the sake of the gold medals and valuables in his possession, he was murdered by a fellow traveler, named Arcangeli. The robber was interrupted, and fled without securing any booty, but was subsequently taken and executed. A collective edition of Winckelmann's works was published (1808–1820) and another (1825–1829). Winckelmann is considered by all authorities as the founder of scientific archaeology and his conception of the beautiful elicited Gotthold Lessing's *Laokoon.*

Consult Justi, C., *Winckelmann: sein Leben, seine Werke und seine Zeitgenossen,* 3 vols., 2d ed. (Leipzig 1898); Pater, Walter, *The Renaissance: Studies in Art and Poetry* (London 1902).

WIND CAVE NATIONAL PARK. This park, created by act of Congress on Jan. 9, 1903, is 12 miles northwest of Hot Springs in Custer County, S. Dak. It is on the southeast slope of the Black Hills and has an area of 41.5 square miles. The cave has extensive galleries in Pahasapa limestone with many fine crystal formations on its walls. It was once the channel of subterranean streams and owes its origin to the solution of the limestone by water. The name is appropriate because at most times a strong air current is passing into or out of the narrow entrance to the cave. The park includes a game preserve in its northwestern corner, maintained by the United States Biological Survey.

WIND INSTRUMENTS, a general name for musical instruments played by the human breath, as the flute, the cornet, etc., or by artificially-produced currents of air, as the organ, harmonium, etc., in all of which the vibrations of a column of air produce the sound. The wind instruments of an ordinary orchestra are usually divided into two classes: wood instruments and brass instruments; the organ or harmonium being classed apart. The woods, some of which are partially composed of ivory, are the piccolo, flute, flageolet, clarionet, bassethorn, oboe and bassoon. Their tone is light, smooth and soft, and almost vocal in its character and can be produced in all the delicate crescendo and diminuendo shadings. The brasses comprise the cornet-a-piston, horn, trumpet, trombone, euphonium, bombardon, etc. Their tone is somewhat harder and generally more powerful and majestic than that of the woods. Being fixed-toned instruments (except the trombone) they cannot, like the strings, play in perfect tune, and they can only produce one sound at a time. See also MUSICAL INSTRUMENTS; ORCHESTRA, THE, AND ORCHESTRAL INSTRUMENTS; ORGAN.

WIND TUNNEL, a tunnel-like passage through which a homogeneous jet of air is blown at a known velocity to determine the action of the air stream on scaled models which will be exposed to such forces, either by passage through the fluid medium of the atmosphere or subject to high winds. The validity of experiments run in a wind tunnel depends on the principle that causing air to move past a stationary model yields the same forces as those that would act on the model if it were moving through the air at the same speed.

The predominant application of the wind tunnel is in the field of aeronautical research and development (see AERONAUTICS—*Aerodynamics*), since aircraft can only be effectively engineered if accurate information is available on precisely what happens when these objects move through the air.

Although the actual flight of an aircraft is the final proof of the designer's skill, flight test programs are expensive and hazardous to flight personnel if the designer is not reasonably certain of the aircraft's handling characteristics before it leaves the ground for the first time. Therefore, the wind tunnel plays an important role in the early stages of airplane development.

Theoretical and empirical methods for the prediction of flight characteristics are utilized in the preliminary design stage, but it is difficult to estimate the stability, control, and drag characteristics to the degree of accuracy required for final design. When the preliminary design is completed, a scale model of the configuration is constructed and a test program is run in the wind tunnel to verify the designer's estimates. A study of the experimental data usually results in revisions to the configuration, followed by confirming wind tunnel tests, until the desired aerodynamic characteristics are realized.

At this stage, extensive wind tunnel test programs on the final configuration are initiated to establish the complete flight characteristics, control surface hinge moments, and other related aerodynamic information throughout the design speed range of the aircraft. The aerodynamic information is usually obtained by supporting a scale model in the air stream and measuring the resultant forces and moments on the model by means of a balance mechanism. Frequently, the actual pressures acting on the various components

of the model are measured by means of small orifices on the surface of the model which are connected by tubing to pressure gages. The experimental data provide the airplane designer with the aerodynamic loads which are used for structural design of the actual full-scale aircraft.

History.—The first wind tunnels were built several years prior to the first successful flight of the Wright brothers in 1903. Although they were not the first to employ such a device, the Wrights did build and use a wind tunnel (Fig. 2) in designing their first successful airplane. A circular section acted as a shroud for the fan which sucked air through the box-shaped test section. A 2-bladed, 24-inch diameter fan driven by a 2-horsepower gasoline engine produced a maximum wind velocity of 27 miles per hour.

It is apparent that early wind tunnels were quite simply constructed; however, the increasing demand for higher speeds necessitated greater horsepower. Many design innovations were introduced to attain these speeds with a minimum of initial cost and operational expense. Although the complexity of wind tunnels has increased over the years, it should be remembered that the original objective of obtaining a homogeneous jet of air traveling at a controlled velocity has not changed. For example, compare the complexity of the modern, high-speed, 12-foot, variable-density wind tunnel in Fig. 1 with that of Fig. 2.

Wind tunnels have come into wide usage over the past years and there are about 200 wind tunnels in the United States today. They range from a few square inches in test-section size, to a 40 by 80-foot giant, and in power, from only a few horsepower to more than 200,000 horsepower. Velocities range from less than 100 miles per hour to several times the speed of sound. Although the majority of the wind tunnels are government-owned by such agencies as the National Advisory Committee for Aeronautics, the Bureau of Standards, the Department of the Navy, the Department of the Army, and the United States Air Force, many tunnels are owned and operated by air frame and engine builders, and by universities.

Types of Wind Tunnels.—The basic elements of a continuous flow, closed-circuit tunnel are shown in Fig. 3. The motor-driven fans propel the air around the tunnel circuit in a counter-clockwise direction. Through the large diameter sections of the tunnel, the air speed is quite moderate. The energy losses at the corners are minimized by turning vanes. The water-cooled radiators are required to eliminate the temperature rise from the heat of compression generated by the fan blades. As the test section is approached, the cross-sectional area is contracted to about one eighth of the upstream area. Because of this contraction, the air speed increases to about eight times its upstream value as it flows through the test section where the model is mounted. At the end of the test section, the air slows down again in the diffuser, which is in turn connected to the fan section, thus completing the circuit.

Subsonic Tunnels.—In a subsonic tunnel the velocity in the test section is so low that the air can be considered incompressible (that is, the density of the air remains essentially constant throughout the flow field). Most of the early tunnels were of the open-circuit type; however, more modern subsonic tunnels (Fig. 6) are closed circuits. A relatively small amount of power is required in the subsonic wind tunnel, but it must be accurately controlled because the air velocity in the test section is directly proportional to the pressure ratio.

High-Speed Tunnels.—Higher speeds may be attained in the subsonic wind tunnel by increasing the power provided to the fans or compressor. As the speed of the air stream increases above 400 miles per hour, but still less than the speed of sound or Mach number 1.0, the air can no longer be treated as an incompressible medium because the air density no longer remains constant throughout the flow field. Such wind tunnels are known as "high-speed wind tunnels."

Of course, obtaining additional speed by increasing power has its limitations, since the air speed in the minimum contraction or throat will not exceed the speed of sound. When this speed is approached, the test section "chokes" and further increases in pressure will not increase the test section velocity. Furthermore, the introduction of even a small model in the test section will establish a new throat which slows the air down in the free stream ahead of the model.

Transonic Tunnels.—The problem of alleviating choking near sonic velocity in high-speed wind tunnels proved a major stumbling block in the development of wind tunnels. Extensive research ultimately proved that tunnel choking could be essentially eliminated by cutting several streamwise slots in the test section walls and encasing the unit in a tank or plenum chamber. Perforating the test section walls with small holes (equivalent to approximately 20 per cent porosity) accomplished the same purpose, and was even more successful in essentially eliminating the troublesome reflected shock waves at the low supersonic Mach numbers. These shock waves, or pressure discontinuities, emanate from the nose of the model, rise almost vertically to the flow direction, reflect from a solid wall of the tunnel, and impinge on the model aft of the nose. This would create an error that has no physical counterpart in free flight but, with a perforated wall, the pressure disturbance can pass through the wall into the low-pressure plenum that surrounds the test section.

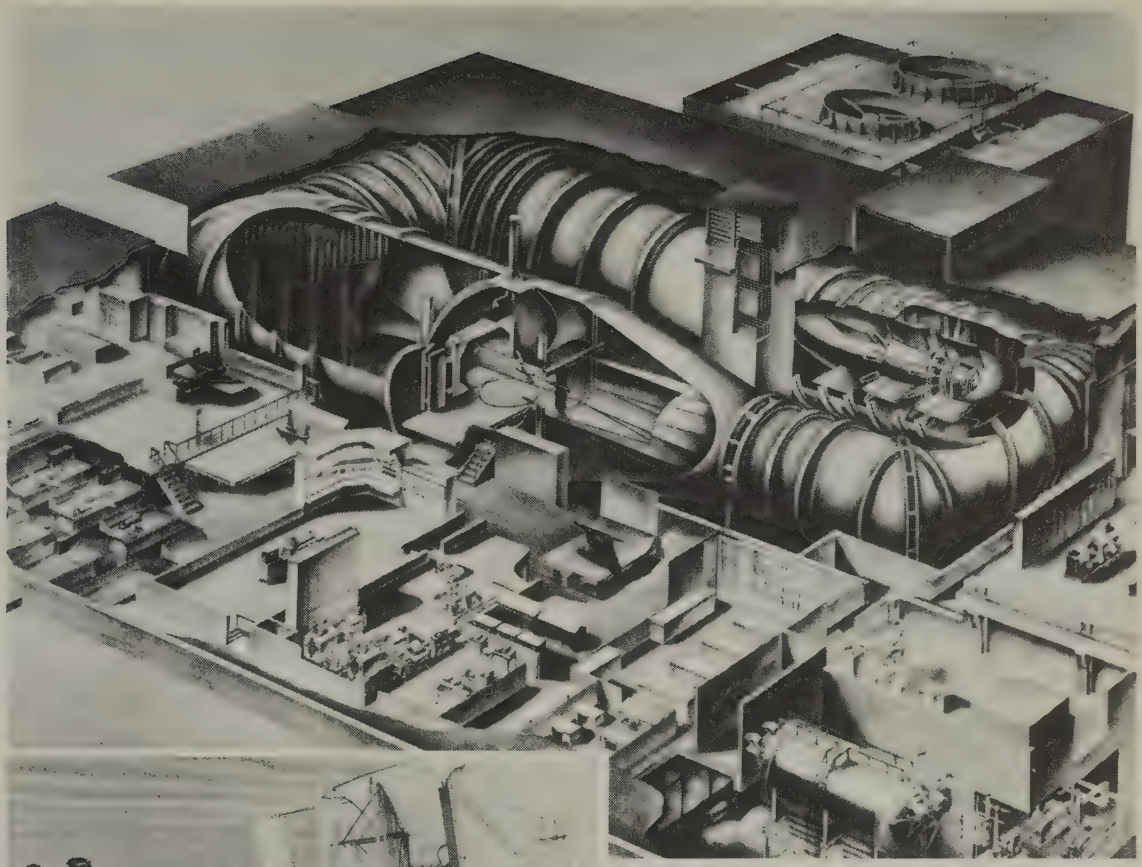
Supersonic Tunnels.—The fundamental difference between a subsonic and a supersonic wind tunnel is that any speed may be produced at the test section of a subsonic tunnel without altering the shape of the rest of the channel; however, in a supersonic wind tunnel, the speed in the test section is determined uniquely by the geometry of the channel (in other words, by the ratio of test section to throat area). The expansion of the walls of the channel between the minimum area or throat and the test section must be done in a very precise manner in order to attain homogeneous test-section velocities greater than the speed of sound.

A typical closed-circuit, supersonic wind tunnel is shown in Figs. 4 and 5. The air is traveling at approximately 50 miles per hour in the stilling section, then speeds up to sonic velocity in the throat of the nozzle. At this point, the nozzle expands once more to a size that provides the desired supersonic speed in the test section.

RAYMOND J. VOLLUZ,
CONVAIR, A Division of General Dynamics, Daingerfield, Texas.

WIND VANE. A contrivance, sometimes known as an anemoscope, for showing the direc-

WIND TUNNEL



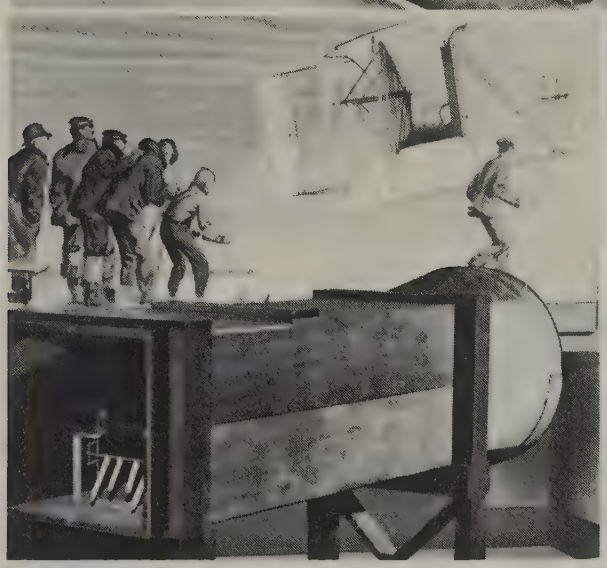
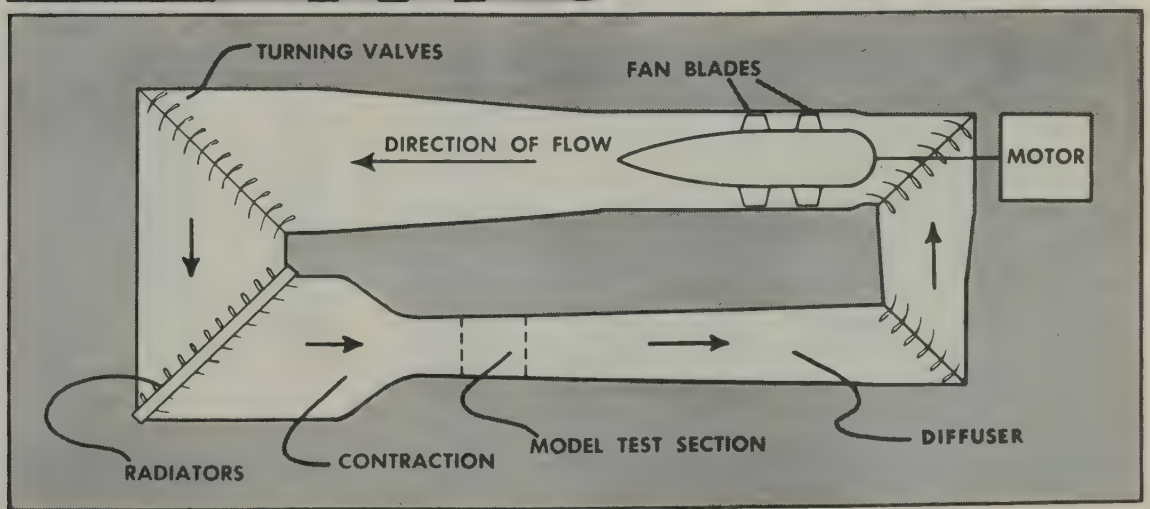


Fig. 1 (above). The 12-foot, variable-density, high-speed wind tunnel at the Cornell Aeronautical Laboratory, Buffalo, New York.

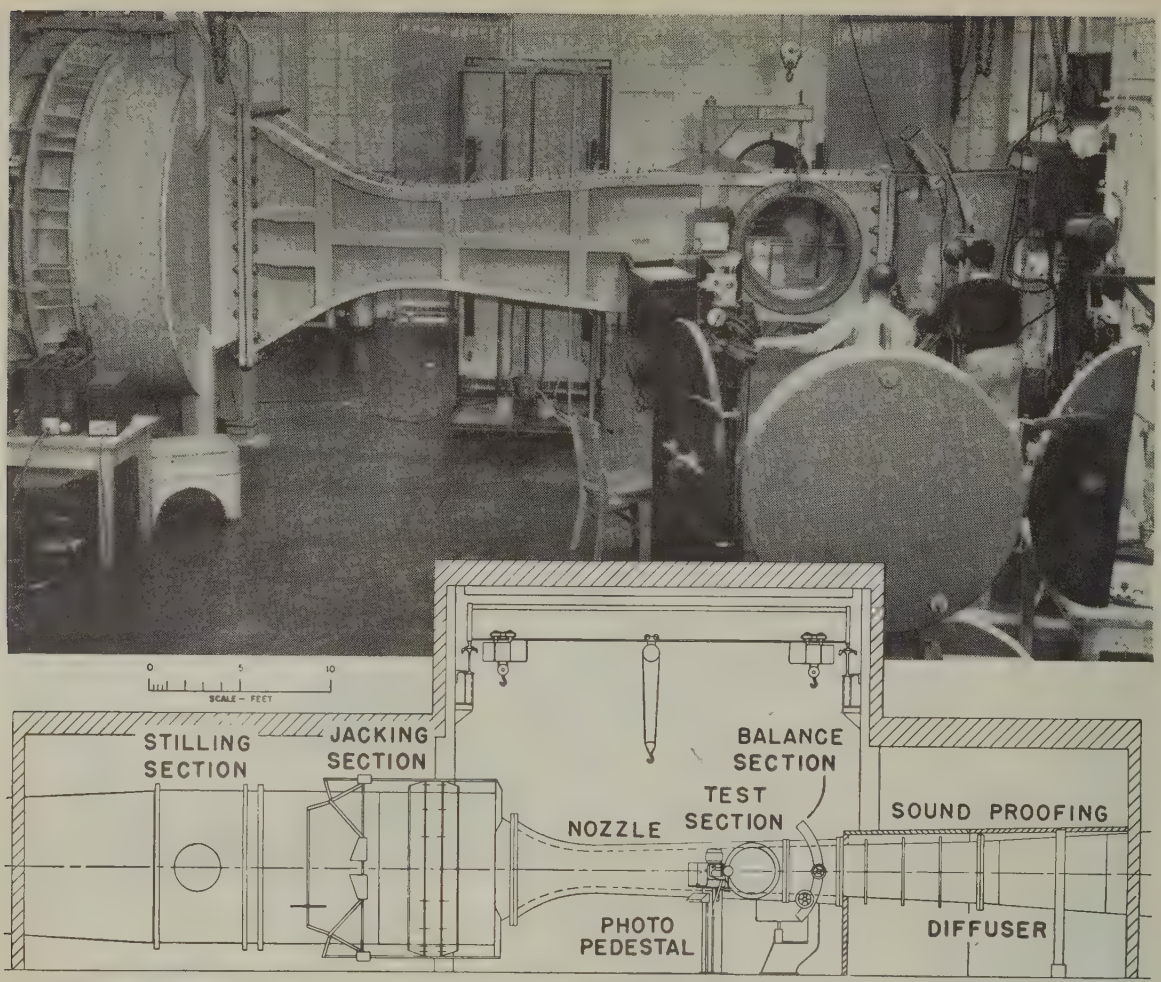
Fig. 2 (left). Full-scale reproduction of Wright brother's wind tunnel in the Hall of Aviation at the Franklin Institute. Mural in the background is entitled "First Flight" by William Heaslip.

Fig. 3 (below). The basic elements of a closed circuit wind tunnel.

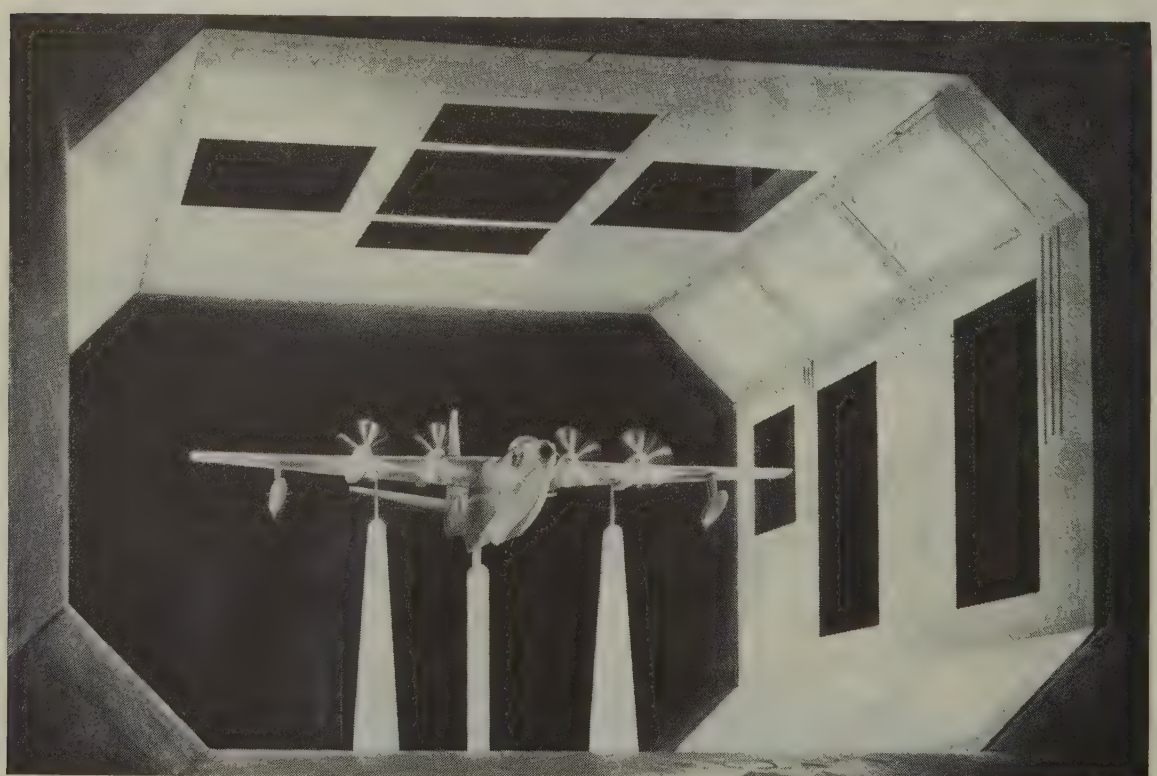
Cornell Aeronautical Laboratory



WIND TUNNEL



Figs. 4 and 5 (above). View of the supersonic wind tunnel nozzle and test section at the Ordnance Aerophysics Laboratory, Daingerfield, Texas; and cross sectional diagram. Fig. 6 (below). A powered model of the Tradewind flying boat mounted on a conventional balance support system in the Convair subsonic wind tunnel.



(Top) Ordnance Aerophysics Laboratory, Consolidated-Vultee Aircraft Corp.; (bottom) Convair, General Dynamics Corp.

tion of the wind. The simplest and most common form consists of an arrow balanced delicately on an upright post and free to revolve. The post or rod often carries a compass scale, placed near the arrow. The United States Weather Bureau uses a vane in which the arrow head balances a tail-piece of two thin boards, six inches wide and 36 inches long. These boards are close together near the axis but diverge about five inches at their outer extremities, thus steadying the oscillations. The axis is fitted with ball-bearings to reduce friction and is provided with mechanical or electric arrangement for the automatic registration of wind direction. To indicate the true local wind the vane must be placed in an open space and at a sufficient height above surrounding buildings or other obstructions which might cause it to show a wind direction other than the true one. In aviation it is known as a wind tee. See also ANEMOMETER.

WINDAUS, vĭn'dous, **Adolf,** German chemist: b. Berlin, Dec. 25, 1876. A professor at Innsbruck in 1913, two years later he was appointed head of the University of Göttingen's chemical institute. He is noted for his researches on sterols, and especially for experiments proving that ultraviolet light activates ergosterol and gives it antirachitic properties. He was awarded the Nobel prize for chemistry in 1928.

WINDBER, borough, Pennsylvania, in Somerset County; altitude 1,683 feet; 9 miles southeast of Johnstown; on the Pennsylvania Railroad. It is in a soft-coal mining area. Next in importance after the collieries, as fields of industrial employment, are the brick and lumber yards. Organized in 1897, by the Berwind-White Coal Mining Company, its name was formed by transposing the syllables of the first element of the company's name. Pop. (1950) 8,010.

WINDBREAK, in agriculture, rows of trees planted along the edge of fields of grain, orchards, etc., to break the force of the wind and to protect the crops.

WINDER, city, Georgia, Barrow County seat; altitude 969 feet; 19 miles west of Athens; on the Seaboard, and the Gainesville Midland railroads. A textile center, it has manufactures of work clothes, blankets, rugs, and furniture. The city was incorporated in 1893. Pop. (1950) 4,604.

WINDERMERE, wĭn'dĕr-mĕr, England, a lake between Lancashire and Westmoreland, 10½ miles in length, and from one-third of a mile to a mile in width, its area being a little over five square miles. Its greatest depth is 210 feet. Its outlet is the river Leven, which discharges its waters into Morecambe Bay. The lake, England's largest, is surrounded by gentle, well-wooded eminences and the neighborhood is noted for its beautiful scenery, celebrated by the Lake poets, Wordsworth, Coleridge, and Southey. Wordsworth lived at Rydal Mount, about two miles from the head of the lake.

WINDERMERE, an urban district near the eastern shore of the lake, is in Westmoreland; it includes the resort village of Bowness-on-Windermere. Pop. (1951) 6,306.

WINDFLOWER. See ANEMONE.

WINDHAM, wĭn'dăm, **William,** English statesman: b. London, England, May 3, 1750; d. there, June 4, 1810. He was educated at Eton College and Oxford University, and entered political life as chief secretary to the lord lieutenant of Ireland in 1783. The following year he was elected as a Whig to the House of Commons; he represented Norwich until 1802, and thereafter, until his death, he sat for various constituencies. He would not support his party's program for parliamentary reform, and following outbreak of the French Revolution he associated himself with Edmund Burke (q.v.) and other leading Whigs in opposition to the policy of Charles James Fox (q.v.) in favoring it. From 1794 until 1801 he served as secretary of war in the Cabinet of William Pitt (q.v.), resigning his post because Roman Catholic disabilities had not been removed in Ireland as had been expected. During 1806–1807 he was once more a member of the Cabinet, holding the secretaryships of war and the colonies; against strenuous opposition he secured passage of a measure introducing shorter periods of enlistment for soldiers and providing them with pensions. He was a man of thoroughly independent character, but his independence sometimes passed over into eccentricity.

WINDHOEK or **WINDHUK,** vĭnt'hŏŏk, capital of South West Africa, 253 miles east of Walvis Bay. Located at an altitude of 5,600 feet above sea level, the town is the center of a rich pastoral district. Natural hot water springs occur in the vicinity. The town contains several creameries, and other industries include cabinet making, brewing, and engineering. On May 12, 1915, during World War I, South African forces commanded by Gen. Louis Botha (q.v.) captured Windhoek from its German defenders. Pop. (1946) 14,929 including 6,985 Europeans.

WINDHOVER, wĭnd'hŭvĕr, a name in Great Britain for the kestrel (q.v.), referring to its habit of holding a stationary position facing the wind, while it searches the ground beneath it for indications of prey.

WINDISCH-GRAETZ, vĭn'dĭsh grâts', PRINCE **Alfred Candidus Ferdinand zu,** Austrian army officer: b. Brussels, Belgium, May 11, 1787; d. Vienna, Austria, March 21, 1862. He distinguished himself in the campaigns against Napoleon in 1813–1814, and reached the rank of lieutenant field marshal in 1833. During 1848–1849 he suppressed the revolutionary movement at Prague and Vienna, and with his brother-in-law, Prince Felix Schwarzenberg (1800–1852), he helped elevate Francis Joseph I to the throne. Leading an army against the Hungarians, he took Budapest in January 1849, but after his defeat at Gödöllő he was removed from command. In 1859 he was appointed governor of the fortress at Mainz, then under control of the Diet of the Germanic Confederation, and two years later he became a Conservative member of the upper house of the Austrian legislature.

WINDLASS, wĭnd'lăs, in mechanics, a machine for raising weights from a pit, consisting of a cylinder or roller moving on an axle supported on a frame and turned by levers inserted in square holes cut in the cylinder, or by a crank fitted onto one or both ends of the axle. One end of a rope or chain is attached to the cylinder,

and the other to the weight, which is raised by the rope being shortened in passing around the roller.

WINDLE, wĭn'd'l, Sir **Bertram Coghill Alan,** English medical scientist and Roman Catholic apologist: b. Mayfield, Staffordshire, England, May 8, 1858; d. Feb. 14, 1929. He was educated at Repton School and the University of Dublin, and from 1884 until 1904 he was professor of anatomy at Birmingham University. For the next 15 years he served as president of University College, Cork, after 1910 being also professor of archaeology there; he was one of the organizers of the National University of Ireland (of which the college was a constituent) and a member of its senate. In 1919 he went to Canada to take the professorship of cosmology and anthropology at St. Michael's College, Toronto. Under the auspices of the Catholic Truth Society of Canada, of which he was president, he sought to reconcile scientific advance with the teachings of the church.

WINDMILL, a machine furnishing power for grinding grain, pumping water, or doing other useful work, operated by the wind. History does not record the date of the invention of the windmill, but it is known that it was used in Europe as early as the 12th century A.D. In the traditional European form of windmill the sails upon which the wind acts in driving the machine consist of a light framework upon which canvas is stretched. The surface of the canvas makes an angle (called the angle of weather) with the plane of the windmill, which is usually about 18° at the inner end of the sail, gradually decreasing to about 7° at the outer end. To allow the windwheel to be turned as the direction of the wind changes, the upper part of the supporting structure rests on rollers so as to rotate about the vertical axis of the tower, often a building of stone. An auxiliary tail wheel is provided to maintain the main wheel properly orientated with respect to the wind; a change in the direction of the wind tends to cause rotation of the blades of the auxiliary wheel, and through a gear system to bring the main windwheel again into the wind. A friction brake is used to vary the load, while to vary the sail area the canvas forming the sail is rolled up or unrolled. Such is the typical Dutch windmill. In many examples of German origin, the whole tower is made to pivot about its vertical axis.

In the American type of windmill, the sail surface is usually formed from wooden or metal slats. The sail area is changed by opening or closing the slats, either by hand or by a suitable automatic governor. The slats are much greater in number than the European sails and occupy, comparatively, a much larger part of the area swept by them. This makes it possible to reduce the diameter of the windwheel, for a given power, considerably below that necessary in the European windmill; the American windmill is usually mounted on a tall, open-framework tower, and may utilize a more simple directing vane. Power is transmitted from windwheel to the point of power utilization by a reciprocating vertical rod or, as in the geared type, by a rotating shaft.

Experiments with windmills have established the following facts: (1) The maximum power which may be obtained from a given windwheel varies directly as the cube of the wind velocity. (2) The sail speed of the windwheel, when developing its maximum power, varies directly, and the load thereon directly as the square of, the wind velocity. (3) The capacity of a windwheel varies directly as the square of its diameter. (4) The number of turns which a windmill will make in a given time varies inversely as its diameter. (5) There is nothing gained by having the sail area of a windwheel greater than seven eighths of the area swept by the sails, and there is little gained by having it more than three fourths.

WINDOM, wĭn'dŭm, **William,** American lawyer and administrator: b. Waterford, Belmont County, Ohio, May 10, 1827; d. New York, N. Y., Jan. 29, 1891. Admitted to the bar in 1850, he engaged in law practice at Mount Vernon, Ohio, and, in 1852, was prosecuting attorney of Knox County, Ohio. After holding this position for three years, he removed to Winona, Minn. Sent to Congress as a Republican from that state in 1859, he was re-elected to serve four successive terms, a period of 10 years, ending his career in the House of Representatives in 1869. He was appointed to the United States Senate in 1870 to fill the unexpired term of Daniel S. Norton, deceased, and was elected for the terms ending in 1877 and 1883. Windom resigned, however, in 1881, to accept the treasury portfolio in President James A. Garfield's cabinet; on his resignation from the cabinet, after that president's death, he returned to the Senate and served out the remainder of his term. He was occupied with various financial interests in New York from 1883 to 1889. Appointed secretary of the treasury in President Benjamin Harrison's cabinet (1889), he held that office until his death.

During his decade of service in the House Windom was a member of the Committee of Thirty-three, a loyal friend and supporter of Lincoln, and allied himself with President Andrew Johnson in the latter's contest with the Radicals, the extremists who gained control of Congress after Lincoln's assassination. Serving two terms as chairman of the Committee on Indian Affairs, he showed a fair attitude toward the government's wards. A high-tariff man and generally a believer in sound money—though he voted for the Bland-Allison Act (q.v.) of 1878—he was one of the few Westerners regarded as "safe" by conservative Eastern Republicans. At the Republican Convention of 1880, he was nominated for the presidency by the Minnesota delegation. His high reputation for integrity was never assailed in an era of great political corruption.

WINDOM, wĭn'dŭm, city, Minnesota, Cottonwood County seat, located on the Des Moines River, 120 miles southwest of Minneapolis, altitude 1,360 feet. It is served by the Chicago, St. Paul, Minneapolis and Omaha Railroad. An important flax-growing and flax-milling center, it also trades in the other agricultural products of the surrounding region, such as rye, barley, oats, corn, alfalfa, and soybeans. Industries include meat packing and the manufacturing of agricultural implements and concrete. Laid out in 1870, Windom was incorporated as a village in 1875, and became a city in 1920. Pop. (1950) 3,165.

WINDOW, an open wall space reserved for the admission of daylight into the interior. The opening may be filled with glazed sash or casement arranged to open and shut, as in the mod-

ern houses; or with glazed sash of wood, iron, or lead fixed firmly to the solid frame of the window, or with only a single panel here and there made to open, as in the case of churches both ancient and modern; or the space may have a slab of semi-transparent stone let into it through which much light may enter, as in some Oriental and ancient European buildings; or a slab of marble with holes cut in it may be inserted, or in place of this a continuous grating, as of bronze, both of which were frequent in classical Roman buildings. Finally, the space may be left without permanent filling of any sort, shutters being used to close it when needed, as in many parts of Europe in the Middle Ages, and as common now in the tropics. Still a further modification of the last-named scheme is found in those tropical houses which have all the openings filled with *jalousies,* namely, shutters with slats (louver shutters), some of which may even be fixed fast, while others open on hinges. As the climate becomes too warm for the necessity of closing the windows at any time in the year, they often replace solid shutters and casements.

Architecturally the window is of the greatest importance to certain styles, and in others does not count at all. Thus in Grecian architecture there are no windows; and in Graeco-Roman architecture the window has never been a controlling member because the great windows of the public halls are commonly the lunettes under the vaulting, simply pierced and filled with gratings instead of built up solid with masonry. The window of the ancient Roman dwelling, also, so far as we know it, was of less consequence because there were no openings of any great size in the outer walls, and courtyard rooms needed only a curtain or the like to screen them. Even in Byzantine and Syrian art the window, though beginning to be emphasized by a stone trimming or casing, is not that which the style depends upon. But in the medieval styles of northern and western Europe the window is the chief feature after the roofs with their fixed slope and their height above the walls. The earliest Romanesque had windows, small indeed, but with jambs richly molded in the thickness of the heavy walls. The Gothic window in a church is the opening up of the whole wall space between buttress and buttress and below the vault; and this space tends to be filled with elaborate tracery. Even apart from the tracery, the moldings of the jamb—often with colonnettes produced by fitting a round molding with capital and base, and with sculpture added to the sill-course—may be very decorative. In dwelling-houses tracery was rare, but the window, if large, was closed with a pointed arch and the head filled with a slab of stone pierced with a decorative opening and supported by colonnettes, or in some other way architecturally treated. The numerous windows with square heads, that is, with lintels instead of arches, were made ornamental by moldings, and by the free use of colonnettes to carry the lintels. In the neoclassic style a regulated and ordered system of arranging the windows became customary in the early days of the Renaissance, and was completely developed in the 16th century in Italy, and 50 years later in the north. Under the name of fenestration this has become an important part of designing.

WINDOW TAX, a tax formerly imposed in England on all houses having more than six windows and worth more than £5 per annum. It was enacted in 1696, during the reign of King William III. The tax was repealed on July 24, 1851, during the reign of Queen Victoria, and a new levy imposed on all inhabited dwellings in its stead.

WINDS, natural horizontal movements of air over or above the surface of the earth. The movement of broad-scale winds over the earth is dependent upon the existence of a continuous atmospheric pressure gradient, or difference in pressure, as established through the ceaseless interaction of meteorological "Highs" and "Lows." As water flows downhill, so air flows always from an area of high atmospheric pressure toward one of low. This striving for dynamic adjustment in pressure and density distribution is the basis of all winds, from the largest hurricane over the ocean to the smallest dust devil of the desert or "whirly" of the Antarctic.

Importance of Winds.—Waves in the ocean, the set and drift of ocean currents (q.v.), and state of the sea are all factors related to the motion and intensity of surface winds. Tidal waves may be produced by the build-up of their force in hurricanes. Dust storms and sandstorms are the product of wind action, as are sand dunes and the constantly shifting topography of desert regions. Wind is a primary geologic agent of both aggradation and denudation through the deposition of wind-borne silt and the erosion of native soil. The drying action of the winds is important in many facets of everyday life, and their transportive effects are of widespread utilization. Winds aid materially in the pollination of plants and flowers. They are used as a driving force for sailing craft, as a source of power for windmills, and as a means for gliding and efficient air navigation. While posing a serious threat to forest fires and overhead power cables, they at the same time serve as a useful harbinger of approaching weather. Although mountain gales may pile deep snowdrifts and block roads, foehn winds act as "snow eaters" and prevent disastrous floods.

Meteorological Origin of Winds.—The origin of the large-scale, transient winds of the earth's atmosphere is air flow between contiguous high and low pressure systems, as modified and influenced by: (1) rotation of the earth; (2) surface friction; (3) local factors of temperature and thermal convection; (4) frontal movements; and (5) nature and topography of the ground surface. As the pressure systems move over the earth's surface, the direction and speed of local winds change accordingly.

Three forces are at work within each atmospheric pressure system. The first of these is in each case a real force, the other two are effective but physically illusory influences (see FORCE).

Within a low (cyclone): (1) pressure gradient acting radially inward; (2) centrifugal force acting outward; (3) Coriolis force acting outward.

Within a high (anticyclone): (1) pressure gradient acting radially outward; (2) centrifugal force acting outward; (3) Coriolis force acting inward. These relationships apply to the Northern Hemisphere.

The net result is that equilibrium is established between these various forces. Free from the effects of ground friction, winds move parallel to the isobars of a weather map, either in closed

circulation systems—counterclockwise about a low, clockwise about a high—or in the corresponding directions of motion along open "troughs" and "ridges" (see also METEOROLOGY—*General Circulation*).

The relationship of these traveling pressure systems to the winds they produce may be determined from Buys Ballot's law: "With one's back to the gradient wind in the Northern Hemisphere, high pressure lies to the right and low pressure to the left." As a function of the existing pressure gradients, wind speeds are always higher in the close spacing of the isobars around an atmospheric low, and calm in the center of a high pressure system.

At the earth's surface, frictional interaction between wind and ground acts to produce a diminution in wind velocity and a resultant turning of the wind across the isobars into the regions of low pressure. The angle of inward deflection is about 30° to 45° over land, and some 20° over the sea. With increasing height above the surface, the effect of frictional retardation of winds is diminished and the process of free circulation exactly parallel to the isobars becomes more pronounced.

The Gradient Wind.—The stratum of the atmosphere within the first 2,000 feet from the ground is a critical region of air-ground frictional interaction lying between the Prandtl boundary layer and the gradient wind level, above which the influence of ground friction and surface turbulence may be assumed negligible. With an idealized steady movement of air over smooth ground or a broad body of water, the variation of wind direction with altitude normally follows a logarithmic spiral pattern known as the Ekman spiral. A polar-coordinate plot based upon pilot-balloon wind data (see Fig. 2 of GRAPHICAL ANALYSIS) usually reveals that within this low-level transition zone, the wind veers (rotates clockwise) with altitude in the Northern Hemisphere up to the gradient level, where it abruptly sheers off in a new direction.

Wind speed increases fairly steadily with altitude up to this level. At or above the gradient wind level, the speed of the wind is a function of the existing horizontal pressure gradient, and the wind direction parallels almost exactly the direction of the isobars. When the isobars are approximately straight, and the Coriolis force produced by wind movement along the isobars just balances the pressure gradient, the gradient wind is termed "geostrophic"; if the isobars are curved and centrifugal force comes into play, the gradient wind is termed "cyclostrophic." The geostrophic wind equation which defines the speed of straight winds above the gradient level is as follows:

$$V_G = \frac{\frac{dp}{dn}}{2\omega\rho \sin \phi}$$

where V_G is the velocity of the gradient wind, ρ is the mean density of the air, dp/dn is the horizontal pressure gradient, ω is the angular velocity of the rotating earth, and ϕ is the latitude. All values are expressed in the centimeter-gram-second system of units.

Upper Atmospheric Winds.—Balloon observations of wind movements aloft reveal an average increase of wind velocity with height in the troposphere, and a decrease in velocity in the lower stratosphere. At still higher elevations in the stratosphere, wind velocities may reach 200 miles per hour, while in the variable *jet streams* velocities of 250 miles per hour have been recorded. However, conditions of approximate or even absolute calm have also occasionally been observed at great heights in the stratosphere. Certain variations of wind velocity with height are also apparent, attributable to the differing thermal properties of cyclonic and anticyclonic pressure systems with altitude above the earth.

Prevailing Winds of the Atmosphere.—Prevailing winds resulting from the large-scale planetary circulation of the atmosphere, as affected by the Coriolis force, are described in detail in the article on CLIMATE, and are further summarized, with brief explanation, in the glossary below. These winds include the westerlies, the Trades, and the polar easterlies.

Orographic Effects on Winds.—Mountains have a mechanical effect on winds both by producing lee-side turbulent eddies in winds blowing over their peaks and by channeling winds which flow down their sides. Vastly intensified and gusty winds may result from either cause.

The forced uplift of an air mass by a mountain with ensuing downflow on the lee side is also important from another standpoint. On the windward side of the mountain, the rising, moist air mass expands and cools adiabatically (see also METEOROLOGY—*Adiabatic Process*) at the moist adiabatic lapse rate of 2.25°F. per 1,000 feet of ascent; moisture condenses from the air and clouds form. On the leeward side of the mountain, the descending dry air is warmed at the dry adiabatic lapse rate of 5.5°F. for each 1,000 feet of descent. This more than compensates for the adiabatic cooling produced in the ascent, and a sharp temperature rise occurs in the air descending the lee side of the mountain. The relative humidity drops abruptly (as much as 80 per cent) and the resultant wind is very warm and dry. Such warm, dry winds descending the after slopes of mountains and produced by this cause are called katabatic or foehn-type winds.

Effects of Thermal Convection.—Heating of an air mass at the ground by solar radiation causes the air to expand and become less dense; the air rises. As the air moves upward into colder surroundings, it is cooled by reradiation; in cooling, the mass of air contracts and acquires greater density. Having a density greater than its environment, the parcel of air again sinks and a closed circulation pattern is set up—a process known as convection. Strong currents of air and so-called "thermal winds" may result from this cause.

Wind Turbulence.—In the first few hundred feet of the atmosphere closest to the ground, wind movement is characterized by mechanical turbulence, which is influenced in large measure by the roughness of the surface terrain. As a function of both mechanical and thermal influences, various types of basically turbulent winds may result, individually classifiable as eddies, air fountains, cataracts, sinks, cascades, cloud currents, air breakers, billows, wind layers, gusts, and air torrents.

Local Winds.—Thermal effects may combine with mechanical and orographic influences to create a great variety of local winds in widespread geographic distribution and existing under a number of colloquial names. A list of representative local winds of the world is included in the glossary below.

GLOSSARY OF WINDS

Winds Dependent upon the General Circulation of the Atmosphere:

Polar Easterlies.—Cold easterly winds which occur north of the Arctic Circle and south of the Antarctic Circle. They are produced by sinking of air over the poles and subsequent equatorward movement, combined with the Coriolis effect.

Prevailing Westerlies.—Strong westerly winds which occupy the belt between 40° and 60° latitude, north and south. The "roaring forties," also known as the "Brave West Winds," occur in latitude 40° south. They are very intense, blustering, cold, west winds which sweep unimpeded across the waters of the South Pacific. The westerlies are the result of poleward moving air, combined with the Coriolis effect.

Trade Winds.—The name implies a constant *course.* Prevailing northeasterly winds in the Northern Hemisphere, and southeasterly winds in the Southern Hemisphere, located in two separate belts between the approximate latitude boundaries 5° and 23°, north and south, although subject to a seasonal shifting of about 1,000 miles toward the pole in the summer of the respective hemisphere, following the sun. Over the Pacific, they are most pronounced during the winter season of the respective hemisphere. They are dry winds, and are produced by the equatorward movement of air, subject to the Coriolis effect.

Between the Trades in a narrow belt on either side of the equator is the zone of tropical calms, or doldrums. These are produced by upward moving air over the *heat equator* of the earth, a variable region as noted above. The regions between the Trades and the prevailing westerlies comprise two further zones of calm and variable winds, resulting from a general downward motion of air from aloft. In the Northern Hemisphere, this belt is known as the "horse latitudes," from an old nautical colloquialism.

The Monsoons:

These winds are characterized by a complete reversal in direction from winter to summer, in accordance with the prevailing pressure pattern of highs and lows over the area. In order for monsoons to occur, an area must have cold winters and warm summers. Monsoon winds are always extratropical, since in the tropics there are no contrasting high and low pressure areas.

Winter Monsoons.—The result of high pressure over cold continents, producing offshore winds—northwest winds over Japan and northern China; north winds on the Chinese coast between Hong Kong and Shanghai. These winds are very cold, very dry, and very clear. Particularly strong monsoon winds occur in the far east of Russia, and over northern China, where they make mountains impassable in winter. Over India, the winter monsoons are gentle, northeasterly winds.

Summer Monsoons.—Onshore winds toward the heated interior of continents. They are damp winds of the rainy season, associated with extreme cloudiness in Asia, Australia, and India. Such monsoonlike winds also occur in Spain and over Asia Minor.

Foehn-Type Winds:

Manner of creation: Air rising over a mountain; being appreciably warmed by adiabatic compression (see Meteorology—*Adiabatic Process*) in flowing down the lee side.

Foehn (Föhn) (*Switzerland; Austria; South Africa*).—Foehn winds are very warm, dry winds, blowing down out of the mountains into neighboring valleys and plains, occurring in all seasons of the year, and very common in both the Swiss and Tyrolian Alps. They are always associated with clearing skies and excellent atmospheric visibility, although at the outset a huge wall of clouds (the "foehn wall") is produced over the mountain summit. In Europe, the typical "foehn tongues," or regions where foehns are heavy and frequent are: *Switzerland*—upper Aare River, upper Reuss River (St. Gotthard Pass), upper Rhine, upper Rhone; *Austria*—in the extreme west part over Bludenz and Innsbruck. The "Jauk" or southern foehn is also found in the southeast, in Carinthia, on the Austria-Yugoslavian border; *Scandinavia*—between Norway and Sweden, Sweden being on the foehn or clear side; *Sudetes Mountains*—between Czechoslovakia and Silesia, Silesia being on the foehn side, and the sunniest area of all Europe; *southwest France*—over the Plateau Central and Cévennes Mountains. Here the foehn is called "Marin" on the west and "Autin" on the east of the mountains. In general, foehn conditions prevail over Europe whenever fronts move in from the Atlantic coast.

Chinook (*Rocky Mountains, Western Plains of the United States*).—A west wind, occurring normally in the colder half of the year; extremely dry and gusty. When such a wind blows, the temperature may rise to as much as 100°F. within a few hours; hence, a "snow eater," and prevents spring floods by its evaporation effects. It may flow over an appreciable area of adjacent lowlands before coming down to the surface, and hence may produce extreme atmospheric temperature inversions over the area.

Santa Ana (*Southern California*).—A hot, dry northerly or northwesterly wind, blowing from the Mojave Desert into the Los Angeles Basin; a winter phenomenon responsible for very warm winters in southern California.

Canterbury Foehn (*South Island of New Zealand*).—A prevailing westerly wind of the region of the "roaring forties"; occurs particularly frequently in the colder half of the year on the Canterbury Plains; results in clear skies and radiation fog.

Greenland "Double Foehn" (*East and West Coasts of Greenland*).—Very strong, warm winds of winter, blowing seaward from the interior ice-covered, high plateaus of Greenland.

Zonda (*Southern Chile, in belt of "roaring forties"*).—A west wind, occurring particularly in the colder half of the year; a foehn-type sirocco often associated with the warm sector of traveling atmospheric waves; extremely dry on the lee side of the mountains; results in the "dry pampas."

Bohorok (*Dutch East Indies, especially Sumatra, Java*).—A warm, southerly, mountain wind, occurring in the winter half of the year.

Bora-Type Winds ("Fall Winds"):

These are created by a gravity-drainage or katabatic wind, flowing down from a cold, continental interior off mountains of moderate altitude toward warm seashores.

Bora (*Along the Adriatic Sea from Croatia to Albania, and the Black Sea southwest of the Caucasus Mountains* [*Bora of Novorossisk*]).—A cold "fall wind" blowing southwestwardly toward the seacoast from the cold mountainous interior. Characteristics of the bora: (1) An atmospheric high pressure area located over a high, snow-covered plateau in winter produces an intensely cold, dense mass of air, which eventually "spills over" an adjacent ridge; (2) Under the action of gravity, the wind flows toward the warmer seashore. The flow is strongest in the early morning when the air is coldest and most dense; (3) The wind descends where the mountains are low, hence reaches the coast only slightly warmed by adiabatic compression, dry, but still much colder than the warm sea air.

Mistral (*Southern France*).—A dry, cold, winter wind that flows from the north down the Rhone River Valley to the Mediterranean Sea, existing as a continuous flow from the mountains of the interior toward the sea, and assisted by the frequent high (anticyclonic) pressures over southeastern France. It is less violent than the bora.

Sno, or Elvegast (*Norway*).—Cold, dry, offshore winds, blowing from the interior toward the west coast of Norway in winter.

Williwaw (*Alaska; Patagonia; Straits of Magellan; Fireland*).—Brief and violent "fall winds" rushing down from steep snow-covered mountain passes toward the coastal regions of Alaska; also such violent squall winds encountered in the Straits of Magellan.

Reffoli (*Dalmatia*).—Italian name for the peak gusts of the Bora; extremely cold, gusty winds of Dalmatia.

Cierco (*Spain* [*Ebro*]).—A cold west wind, similar to the mistral.

Winds Produced by Outbreaks from a Cold Atmospheric Source Region:

Texas "Norther" (*Texas and Gulf Coast*).—Strong and gusty northerly winds produced by the southward outbreak of continental polar air from Alaska or Canada into the Great Plains during winter. These winds usually accompany a huge, U-shaped cold front, with associated transient bad weather, followed by rapidly clearing skies and an abrupt drop in temperature, sometimes from the mid 70's or 80's to below freezing in half a day.

Tehuantepecer (*Gulf of Tehuantepec, Mexico; Central America*).—Strong northerly winds similar to the Texas "norther," produced by the extreme southward penetration of polar air from Alaska or Canada into Mexico and Central America, the air being somewhat

warmed and moisturized by passage over the Gulf of Mexico. Channeling of these winds by the mountains of the Central American Cordillera produces an extra strong, northerly gale. These winds occur both in winter and early spring.

Papagayo (*Gulf of Papagayo, northwest coast of Costa Rica*).—A strong northeasterly wind, resembling the Tehuantepecer, and occurring during the colder season; associated with strong high pressure over southern and southeastern United States.

Southern Busters, or Southeast Busters (*Australia*).—Strong, cold, southerly winds caused by the outbreak of polar air from an Antarctic source, associated with well developed cold fronts, line squalls, and bad weather. The accompanying drop in temperature (some 20°-30°F. only) is limited because of marine influences.

Pampero (*Argentina; Uruguay*).—Cold, southerly and southwesterly winds produced over the pampas in the same manner as the southern busters of Australia. A drop in temperature of some 20-30°F. is possible. When they occur as southwest squalls associated with dust storms and poor visibility, they are known as the "dirty pamperos." These are accompanied sometimes by thunderstorms which may penetrate as far north as 15° south latitude.

Nor'easter (*New England Coast of the United States*).—Gales produced by the incursion of Polar Atlantic air into an area formerly occupied by Polar Canadian air. The clear skies, low temperatures, and northerly winds of the Polar Continental air mass are replaced by lowering clouds, light rain or snow, a 15-20°F. temperature rise, and a wind shift to the northeast. Cyclogenesis along an old front offshore often results in an intensification of the pressure gradient and strong winds.

Winds Produced by Outbreaks from a Warm Atmospheric Source Region:

Sirocco (Genuine) (*Palestine; Syria*).—East winds which blow off the Arabian Desert; hot, dry, and dusty.

Sirocco (Modified) (*Northern Africa; Eastern Spain; Dalmatia; Albania; Ionian Sea; Palermo, and northern coast of Sicily*).—Winds from a hot, dry, desert region, but modified by passage over the warm waters of the Mediterranean; hence very warm, humid, and dusty. They are principally southerly winds of the winter season blowing off the Sahara Desert toward the northern coast of Africa and the south European peninsulas, associated with the warm sectors of eastbound traveling disturbances (waves on atmospheric fronts).

Garvi (*Aegean Islands*).—Same as the modified siroccos.

Leveche (*Spain*).—Same as the genuine siroccos.

Harmattan (*West Coast of Africa*).—A dry, northeasterly, winter wind blowing from the interior of the Sahara Desert toward the west coast of Africa. It is accompanied by clear skies, but poor atmospheric visibility due to dust, along the entire west coast and even hundreds of miles offshore.

Chihili or Khamsin (*Atlas Mountain countries and Egypt*).—A hot, dry, sirocco-type wind, usually south or southeasterly, from the interior of the Sahara Desert, and blowing over the countries to the north. Dust-laden, and associated with the warm sectors of eastbound traveling atmospheric disturbances, it occurs in winter and spring.

Chibli (*Libya*).—Wind from a hot source region, further modified by katabatic (foehn-type) warming effects in descending a mountain slope. This results in the hottest observed temperatures on earth, very frequently above 100°F.; the highest temperature recorded was 137°F., at Azizia, Tripolitania, Sept. 13, 1922.

Winds Dependent upon the Existence of a Strong Pressure Gradient:

Bise (Bize) (*Switzerland; France*).—A northeasterly wind, very cold, dry, gusty, and extremely strong, occurring in Switzerland and in the French Alps during winter. It is produced when the pressure gradient along the pressure axis of the Balkan and surrounding seas is particularly strong, with low pressure over the Mediterranean.

Krivetz (*Rumania; Hungary*).—A northeasterly wind of winter from a continental source region; cold and gusty; same origin as the bise.

Nemere (*Transylvanian Alps*).—A northeasterly wind, accompanied by blizzards, occurring in the Transylvanian Alps in winter, and blowing from the south Russian Steppes; same origin as the bise.

Kessava (*Hungary; Yugoslavia*).—A south wind which occurs over the lower Danube in Hungary and Yugoslavia in winter, blowing from the Yugoslavian Mountains; very cold and gusty; same origin as the bise.

Etesian-Type Winds:

Etesians (*Eastern Mediterranean*).—Prevailing northerly and northwesterly winds occurring over the entire eastern Mediterranean during summer.

Maestral (*Italy*).—Italian name for the etesians.

Meltemia (*Greece*).—Summer winds, from May to the middle of September, blowing toward very definitely low atmospheric pressure in the Near East (Afghanistan, Baluchistan). These winds last many months. They are always strong by day and die down at night.

Storms and Squalls Producing High Winds:

Tropical Cyclone (*Indian Ocean off Africa and India*).—A low pressure system possessing an extremely tight pressure gradient and strong counterclockwise circulation of winds; distinct from the extratropical cyclone (normal atmospheric low) in the intensity of its action and the recurving parabolic path of its movement.

Hurricane (*Gulf of Mexico; Caribbean; Gulf of California*).—Identical to the tropical cyclone; the term denotes (except for Lower California) such a storm born in the West Indies; diameter of storm is usually 100 to 200 miles; speed of movement 5 to 15 miles per hour in a recurving path; wind speeds up to 150 miles per hour; calm in central "eye" of storm.

Typhoon (*Western Pacific and China Sea*).—Term used in the Far East to denote a tropical cyclone.

Baguio (*Philippine Islands*).—Philippine word for a tropical cyclone.

Tornado (*Senegal, West Africa*).—A local colloquialism for a severe thundersquall; also, in America, the name for a funnelshaped pendulous cloud formation of vortex nature, with intensely whirling winds, cutting a destructive swath 300 to 3,000 feet in diameter over land; over water it is termed a waterspout.

Other local winds and wind-producing storms and their place of origin include: belat (Arabia); brickfielder (Australia); buran (Russia, Central Asia); chubasco (West Coast of Mexico); cordonazo (West Coast of Mexico); elephanta (Malabar Coast of India); fuga (Crimea); gregale (Malta and Mediterranean); imbat (Levant and Cyprus); kaus (Persian Gulf); kona (Hawaiian Islands); leste (North Africa); levanter (Straits of Gibraltar); maestro (Northern Mediterranean); ponente (Mediterranean); purga (Siberia); reshabar (between Black Sea and Caspian Sea); seistan (East Persia); shamal (Mesopotamia); simoom (Africa and Arabia); solano (Gibraltar and Spain); Sumatra (Malacca Straits, Sumatra); tramontana (Mediterranean); trovado (Cape of Good Hope); vendaval (Spain; Mexico); willy-willy (Northwest Coast of Australia).

See also Anemometer; Atlantic Ocean; Chinook Wind; Monsoon; Typhoon.

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WINDSOR, Duke of. See Edward VIII.

WINDSOR, town, Connecticut, Hartford County, altitude 60 feet, is located on the Connecticut River, 6 miles north of Hartford, on the New York, New Haven and Hartford Railroad, in a section raising tobacco, tomatoes, and squash. It has canneries, brickyards, and machine shops. There is a state agricultural experiment station here. The first settlement was made here in 1633 by Pilgrims from Plymouth. In 1635 Roger Ludlow and a colony from Dorchester, Mass., called the place Dorchester. The name was changed to Windsor in 1637. Pop. (1950) 11,833.

WINDSOR or **NEW WINDSOR**, town, England, in Berkshire, is located on the Thames River, 21 miles west of London, on the Great Western, and the Southern railways. It is the site of Windsor Castle (q.v.). Edward I granted its charter in 1276. Pop. (1951) 23,181.

WINDSOR, town, Newfoundland, Canada, formerly called Grand Falls Station, is located

on the Canadian National Railway, adjacent to Grand Falls, site of large pulp and paper mills. It was incorporated in 1947. Pop. (1951) 3,627.

WINDSOR, town, Nova Scotia, Canada, capital of Hants County, is located on the Avon River, 45 miles northwest of Halifax, on the Canadian Pacific, and Canadian National railroads, in a district noted for its apple orchards and deposits of gypsum and building stone. It has a knitting mill and a fertilizer factory. King's College was here until 1923, when it removed to Halifax. Windsor was the birthplace of Judge Thomas Chandler Haliburton (q.v.), author of *The Clockmaker, or Sayings and Doings of Sam Slick.* Pop. (1951) 3,407.

WINDSOR, city, Ontario, Canada, county seat of Essex County, is located on the Detroit River, directly opposite Detroit, Mich. Being the most southerly city in Canada, it is often called the "southern gateway." It is served by the Canadian National Railway, the Canadian Pacific Railway, the New York Central, and the Chesapeake and Ohio; interswitching services are provided by the Essex Terminal Railway. Railway connection with Detroit is provided by a tunnel and by train ferries. Motor vehicles may cross the Detroit River by either the Ambassador Bridge or the Detroit-Canada Tunnel. From Windsor several provincial highways lead eastward to all parts of Ontario and to other Canadian provinces. It is about 230 miles to Toronto and 580 miles to Montreal. Windsor is also a port with five miles of waterfront which will undoubtedly be used more intensively after the completion of the St. Lawrence Deep Waterway. The port is regularly used by the boats of Canada Steamship Lines, Northern Navigation Lines, Great Lakes Transportation Company and Canada-Newfoundland Lines. Windsor Airport, which is only 15 minutes in a southerly direction from the central business district, is used by Trans-Canada Airlines.

Windsor ranks fourth among Canadian manufacturing centers, being especially noted for its automobile industry. Other establishments manufacture drugs and medicines, beer, distilled liquors, salt, chemicals, paints, a great variety of iron and steel products, nonferrous metal products, electrical appliances and supplies, glass, food products, textiles, and rubber goods. Manufacturing industries employed about 45,000 people; and factory shipments were valued at more than $700,000,000 in 1955.

Besides being an industrial city, Windsor is an important port of entry, and is the largest commercial center in southwestern Ontario. The Windsor *Daily Star* is the most widely circulated newspaper in this area. There are two radio broadcasting stations and a television station. The city has well equipped collegiate and vocational schools. Founded as a mission college in 1855, Assumption University now provides courses leading to degrees in arts, science, and commerce.

The Detroit River area was settled by French colonists early in the 18th century. Here many important historical events took place during the French and Indian campaigns, the American Revolution, and the War of 1812. About 25 per cent of the people of Windsor are descendants of the early French colonists. The city of Windsor originated as a series of settlements along the river. Windsor and Sandwich were incorporated in 1857, Walkerville was founded in 1858, and Ford City was established in 1904. Having coalesced into a single urban area, the "border cities" were, in 1935, amalgamated into the city of Windsor, containing more than 100,000. The census of 1951 revealed a population of 120,049 in Windsor, and 157,672 in the larger urban area.

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WINDSOR, town, Quebec, Canada, Richmond County, is located on the St. Francis River, in a farming and dairying district, 12 miles from Sherbrooke, on the Canadian National and Canadian Pacific railways. Industries are pulp and paper manufacturing and the manufacture of paper boxes, bags, and miscellaneous paper products. Pop. (1951) 4,696.

WINDSOR, town, Vermont, Windsor County, altitude 354 feet, is located on the Connecticut River, 24 miles north of Bellows Falls, on the Boston and Maine, and the Central Vermont railroads. It manufactures automatic screw machines, concrete products, dresses, brass, bronze, and aluminum products, rubber soles and heels. The state prison is here. Windsor received its charter from Governor Benning Wentworth of New Hampshire on July 6, 1761. A second grant, allowed by New York, was made on March 28, 1772, to Colonel Nathan Stone. In 1778 the state of Vermont, including several western New Hampshire towns, was organized in Windsor, Thomas Chittenden was elected governor, and the legislature began its sessions here. Pop. (1950) 4,402.

WINDSOR CASTLE, at Windsor, England, an official residence of the monarchs of Great Britain, was originally the site of a fortress built by William the Conqueror, probably in the year 1070. It was improved by succeeding rulers until the reign of Edward III (1327–1377), who demolished the original castle and built the present one, which took 24 years, from 1350 to 1374, designed by William of Wykeham. Succeeding rulers have made additions. The most important alterations were made during the reign of Charles II (1660–1685), under the direction of Sir Christopher Wren. The state apartments are open to the public when the royal family is not in residence. These include the grand staircase; the Rubens Room, with eight original paintings by Peter Paul Rubens; state bedrooms and reception rooms; and St. George's Hall, a banquet room 185 feet by 30 feet, built to entertain the Knights of the Garter.

St. George's Chapel, built during the reign of Edward IV (1461–1483), also has been altered and redecorated by later rulers. Many rulers are buried here, including Henry VI, Edward IV, Henry VIII and Jane Seymour, Charles I, George III, George IV, William IV, Edward VII and Alexandra, and George V. There is a separate smaller chapel, called the Albert Memorial, which was designed largely by Queen Victoria in memory of her husband, Albert, Prince Consort. Another distinctive edifice is the famous Round Tower, or keep, which was once surrounded by a moat and was used as a prison until 1660. A royal mausoleum in the private grounds contains the vaults of Queen Victoria and her husband.

WINDSOR LOCKS, town, Connecticut, Hartford County, altitude 80 feet, is located on

the Connecticut River, 12 miles north of Hartford, on the New York, New Haven and Hartford Railroad. It is in a farming and tobacco-growing region, but is an industrial town, producing cotton and silk yarns, paper, clothing, fireworks, machinery, and lathe chucks. The town is the site of Bradley Field Airport.

Settled as early as 1663, paper milling was introduced here in the 1760's, and a cable ferry was chartered to operate in the 1780's. River navigation was impeded at this point by a six-mile portage past the rapids until 1829, when a canal and locks were built for the river traffic. In recognition of the canal locks, the settlement received its present name in 1833. Set off from the town of Windsor in 1854, it was incorporated in that year. Pop. (1950) 5,221.

WINDTHORST, Ludwig, leader of the Catholic or Center Party in the German Reichstag: b. Kaldenhof, near Osnabrück, Lower Saxony, Jan. 17, 1812; d. Berlin, Germany, March 14, 1891. He received his early education at the Caroline Gymnasium in Osnabrück and studied law at Göttingen and Heidelberg. He began the practice of law at Osnabrück. He occupied various official positions in connection with German courts of law and his talents and impartial character were widely recognized. Politically he clung to the opinion that there should be a union of the German states including Austria. He emphasized the necessity for the preservation of the independence of the various petty German governments and of absolute freedom of religion and education. Elected president of the second chamber of the legislature of Hannover in 1851, two years later he was appointed minister of justice in the cabinet of George V. He held this same portfolio ten years later. In this position his treatment of vexed questions between Catholics and Protestants called forth praise from both parties. When the reigning house of Hanover fell as the result of the war of 1866, he was sadly disappointed, but fitted himself at once into the new order by accepting election for the town of Meppen to the Prussian Lower House and to the Reichstag of the North German Confederation. Here he soon came to occupy a prominent place as a valuable assistant of the leader of the Catholic Party, Hermann von Mallinckrodt. At Mallinckrodt's death, 1874, Windthorst was selected to replace him. For nearly 20 years he remained a successful leader of the party, which under his influence gradually came to have the balance of power in the Reichstag. Once when Vatican influence seemed to be used to urge a political measure, in which the German government was very much interested, he came out distinctly in opposition. Just before the declaration of the infallibility of the pope, he joined with those who thought the moment inopportune but he was always devoted to the Holy See. The model of a successful party leader, he was adept in the management of men, an excellent judge of character, and one of the best parliamentary debaters of the 19th century. After his death foes joined with friends in recognizing his talents, his uprightness of character and the purity of his motives, besides his lofty patriotism. His great merit is to have succeeded in preventing Bismarck from making the church merely a department of state. To his talents as a leader the Catholic Party owed most of their success in the struggle with the German chancellor.

WINDWARD ISLANDS, wĭnd'wĕrd (Fr. Îles du Vent, ēl' dü vän), a group in the South Pacific, forming a part of the Society Islands in French Oceania. Principal islands are Tahiti and Mooréa. See also Society Islands.

WINDWARD ISLANDS, a group of the West Indies, forming the southern part of the Lesser Antilles, roughly between latitudes 12° and 15° N., and as a geographic unit including the French island of Martinique and British-owned St. Lucia, St. Vincent, Grenada, and the Grenadines. In rare instances, Barbados and even Trinidad and Tobago are held to be a part of them. The name was applied, because the group was the most exposed of the Lesser Antilles to the northeast trade winds. The islands are of volcanic origin, the larger islands being quite mountainous. Hurricanes and earthquakes occur occasionally. The tropical climate, averaging about 80°F., changes little during the year. On the generally fertile lower levels sugarcane, cacao, coconuts, sea-island cotton, limes, bananas, and spices are cultivated. Formerly inhabited by Arawak and Carib Indian tribes, the Windwards are now largely peopled by Negroes.

A political subdivision constitutes the British colony of the Windward Islands, actually consisting of the four colonies of Dominica (geographically belonging to the Leeward Islands), St. Lucia, St. Vincent, and Grenada. The Grenadines form dependencies of Grenada and St. Vincent, between which they are situated. The governor resides at St. George's, Grenada. Though these British islands have no common legislature, laws, revenue or tariff, they have a common supreme court and court of appeal, and they unite for other purposes. Their joint area is 821 square miles; pop. (1946) 251,771. For further information see entries on separate islands: Dominica; Grenada; Grenadines, The; Martinique; Saint Lucia; and Saint Vincent.

WINDWARD PASSAGE, ocean channel in the West Indies between easternmost Cuba and the western prongs of Haiti (Hispaniola Island). The approximately 50-mile-wide strait joins the Caribbean Sea with the Atlantic Ocean.

WINE-BERRY, a Japanese plant (*Rubus phoenicolasius*), closely related to the raspberry, with long recurving canes which root at the tips and are clothed with red glandular hairs. The leaflets are usually three, white, tomentose beneath, and the flowers are in dense axillary clusters, forming a loose panicle. The bristly calyx-lobes enlarge in fruit and enclose the immature berry as in a bur, but eventually spread apart; the mature fruit is small, soft, cherry-red in color, in flavor insipid or acid. The wine-berry is frequent in cultivation and has run wild in parts of eastern North America.

The grape, the whortleberry, the gooseberry and the red and the black currants are called wine-berry; as are also the edible, berry-like fruits of the poisonous toot-plant (*Coriaria sarmentosa*), a large shrub of New Zealand.

WINE MEASURE, an old English measure by which wines and spirits were sold. The gallon contained 231 cubic inches.

WINE PRESS, a machine in which the juice is pressed out of grapes. The wine press

of the Bible was a vat in which the juice was expressed by the feet of men who trampled the fruit.

WINE AND WINE MAKING. Wine is the pure, naturally fermented juice of fresh, ripe grapes. Wine may also be produced from other fruits, but the product must be labeled to show the name of the fruit, as "blackberry wine," "orange wine," and the like.

Grapes are grown in all 48 states of the United States, and commercially for wine in 27 of them. California regularly produces between 85 and 90 per cent of the nation's wine, and since the wine-growing conditions of nearly every wine producing country are duplicated in California, the European grape varieties flourish there.

In 1946, products of the grape and wine industry were the most important farm crop in California, and normally they rank first or second in importance. Wineries form the vital outlet for grapes because they absorb all grapes that cannot find a market through other channels. Almost 90 per cent of the wine growers and brandy producers of the state are vineyardists who crush and ferment their own grapes.

Approximately 60,000 persons are directly employed the year around in California wineries and vineyards, and employment during the vintage season reaches a peak of about 120,000. In addition, tens of thousands are employed in wholesale and retail distribution and in allied industries which include the production of containers, closures, labels, transportation and others.

Consumption of United States-produced wines totaled approximately 28,000,000 gallons in 1934. By 1946 wine consumption in the United States had increased to more than 135,000,000 gallons. Of that total, California produced more than 122,000,000 gallons, other states slightly more than 13,000,000 gallons. Wines from foreign countries, amounting to approximately 5,000,000 gallons, brought the total United States consumption to more than 140,000,000 gallons.

Grapes are the first essential of wine, and without good grapes there can be no good wine. Most wines are produced throughout the world from varieties of a single species, the European wine grape, *Vitis vinifera.* This grape seems to have originated in the Near East, and was later carried to Europe, thence to other continents.

Although *vinifera* grapes are those from which the wines of California are produced, the grape does not do well elsewhere in the United States, and virtually all grapes grown east of the Rocky Mountains are those of the native American species, *V. labrusca,* or its hybrids. It is for this reason that the wines of California more nearly resemble those of Europe and other countries, while wines from the other states have a character peculiar to themselves.

Grapes used in wine production must be of selected varieties because not all grapes yield good wine, and since the choicest wine grapes are those which bear the lightest crops, wines from these grapes are more expensive to produce.

Climate and soil also play important parts in the growing of wine grapes because some varieties thrive in high, cool areas, while others do better in warm, dry districts. Wine quality is influenced not only by the grape and the climate, but also by the grape's ability to mature thoroughly and draw the proper nourishment from soil and climate.

Vineyards are cultivated throughout the year, and require more expert agricultural care than almost any other farm land. From 500 to 800 vines are planted to the acre in the United States, and about four years are required for a new vineyard to come into full bearing.

Since fermentation is a natural process, it is impossible to say just when man first enjoyed wine, but archaeological research has shown that the beverage was in daily use from the beginning of recorded time, and presumably long before. The only changes in wine production through the years have been to enable man to watch and protect more effectively the natural process by which the grapes are transformed into wine; closer attention to cleanliness and sanitation have resulted in a more stable and uniform product.

Grapes are harvested in the summer or early fall, when the best, fully-ripened fruit is selected and carefully picked by trained workers. Immediately after picking the fruit is rushed to the winery for crushing before it loses any of its flavor or natural freshness. Mature grapes are picked when they contain from 22 to 24 per cent of grape sugar by weight, although when an unusual tartness in the wine is desired, picking may be slightly advanced.

Ripe wine grapes contain from 12 to 85 per cent of natural grape sugar, 70 to 85 per cent of water, and a variety of acids, minerals and other constituents, all of which contribute to the variations of body, color, aroma, bouquet and taste of the finished wine.

After grapes are weighed and examined at the winery they are placed in mechanical crushers which first discard the stems, then press the juice from the grapes without breaking the seeds. The crushed grapes and the juice, called "must," are pumped into large fermenting vats inside the winery, where the life of the wine really begins.

During fermentation the grape sugar is transformed into almost equal parts of carbon dioxide and wine alcohol, with other substances essential to the finished product. This chemical action may be explained as the breaking down of grape sugar, $C_6H_{12}O_6$, into ethyl alcohol, C_2H_5OH, and carbon dioxide, CO_2, and is caused by the catalytic action of a micro-organism or yeast known as *Saccharomyces ellipsoideus.*

Every grape carries this yeast in the delicate, dust-like "bloom" found on its skin, but although the yeast will produce wine, most winemakers prefer to grow their own carefully cultured wine yeasts. By using these strains they are better able to control fermentation, insure quality, and maintain production of a more nearly uniform wine from year to year. It has also become an almost universal practice for winemakers to add a small amount of sulphur dioxide to the must in order to prevent the action of harmful bacteria and control the wild yeast.

Complete fermentation, which would convert all the grape sugar and thus make the wine completely "dry," takes place in from a few days to several weeks. Factors influencing completion of fermentation and the time necessary include the sugar content of the grape, the yeast used, and the temperature. During this time other elements in the grape undergo changes which produce esters and higher alcohols, all of which influence the aroma, bouquet and taste of the wine.

Expert supervision of fermentation is neces

sary to control the temperature and insure the proper completion of the process. As the yeast cells multiply and the fermentation becomes more active, a good deal of heat is generated, and it is often necessary to cool the must by pumping it through cooling coils, or by running cold water through pipes immersed in the fermenting vat.

The alcohol produced by fermentation, dependent upon the amount of sugar in the grape, seldom exceeds 12 to 14 per cent by volume in the finished wine. Because grapes grown in cooler regions do not generally have enough sugar to yield more than this amount of alcohol, 14 per cent by volume is usually considered the limit for table wines, most of which, being completely fermented, are quite dry.

Some wines have become popular because of their sweetness, and since this sweetness is that of the natural grape sugar, it becomes necessary to halt fermentation while the desired amount of sugar remains. This is usually done, at whatever stage desired, by adding a small amount of pure grape brandy to the fermenting wine. Other methods of halting fermentation are the addition of sulphur dioxide to the must, or pasteurization, but since wines so treated cannot be shipped successfully in large containers, or stored for long periods, the addition of brandy is more generally used.

Pressing takes place after the must has been drawn off the grape solids in the fermenting vats. Wine presses often seen in pictures are used at this stage in production, to press the wine out of the pulp, and not for crushing fresh grapes as generally supposed. Wine drawn off before pressing is called "free run," and is better than the "press wine."

Racking, or the transfer of wine from one cask to another, is done periodically for the purpose of separating clean wine from the natural sediment or "lees" which falls to the bottom of the cask during the aging. This deposit is heaviest in young wine, growing less after the first year. However, the process of racking must be continued at intervals until the wine is ready for bottling.

Blending is an important part of wine production. Most wines are blended to provide uniformity, to emphasize qualities found in certain grapes, and to bring out the best in taste, aroma and body. Some grapes produce wines which have one desirable characteristic, but which lack other qualities which can be supplied only by grapes of other types. In some cases, old wines are improved by blending into them a small quantity of young wine to impart added freshness or flavor.

Filtering is accomplished by running the wine through costly and scrupulously clean filters, to be sure the product will remain "bright," and not deposit too heavy a sediment during shipment to distant markets or while standing in storage. This process assures the bright, practically sediment-free wine preferred by most present-day consumers. However, those who know wine accept a small amount of deposit, provided the wine itself is clear, as a proof of "bottle age" or maturity.

Fining is another winery procedure which further clarifies and brightens wines. This is done by adding a small quantity of pure egg-white or gelatine to the wine. As this fining material slowly floats down through the wine the remaining particles of solid material from the grapes attach themselves to the fining and become a part of the lees or deposit at the bottom of the cask, from which the clear wine is racked off.

Pasteurization is sometimes used as part of the fining process to promote the more complete settling of tiny particles of grape solids. It also serves the same purpose as pasteurization of milk, insuring the proper stabilization of the beverage. Wines thus treated, however, are still perishable.

Age in wine is important, but often misleading, and no one can give a rule of thumb to govern this vital stage in a wine's development. The amount of age needed to bring a wine to its peak of perfection varies not only with the type of wine, but with the character of the grape from which it was produced, the soil and climate in which the grape was grown, and the temperature in which the wine rests and develops.

Some wines must age to be palatable, but more should be consumed while young, before their age has brought them to the brink of disaster. Science does not yet fully understand all the changes which come to wine through aging, although it is known that wine develops smoothness, mellowness and character, not only in the vats, barrels and other forms of cooperage, but in the case of many wines, after it has been bottled. Wine is the only beverage which does improve after bottling.

During aging, especially in the wood, most of the remaining grape solids are deposited, and the wine clarifies itself, so that it does not become cloudy too readily after bottling. Other chemical changes also occur, during which the wine's various individual characteristics of taste, aroma and color are developed. Aging usually begins in large casks, and is continued in smaller containers as the wine nears its peak, until bottling time. It is said that wine "breathes" through the pores of the wooden casks, and certainly the gradual changes in the wine noted during this period are missing when the beverage is bottled without proper aging.

Bottling is done only when the winemaker's experience and careful testing shows the wine has improved to the highest possible degree in the wood, at which stage it is said to be ripe for bottling. If a wine is left in the cask too long it is apt to take on an excessively woody taste, lose character, and especially in the case of white table wines, become over-oxidized.

Because bottle-aging will contribute as much further improvement in some wines as has been attained through aging in the cask, some vintners "bin" their bottled wines, that is, store them carefully for a few months to a year or longer, before shipping them into consumption channels. Some distributors continue this binning, and the consumer who appreciates what aging can contribute to many wines will also "lay down" his wine, allowing it to age in his cellar before using.

Many table wines are at their best in from one to three years, others will improve for several years more; sweet dessert and appetizer wines are usually ready for use from two years onwards. Most of the wines of Europe are consumed before they are even one year old, and many of these wines reach their full maturity within a matter of months after fermentation, after which they lose quality rapidly. California and other American wine-growing areas also have some wines which cannot be aged more than a year. Some native wines continue to im-

prove for many years, as do the selected bottlings of certain foreign viticultural regions.

Basically all wines are produced as explained above, with certain important variations in method affecting champagne, sherry and vermouth. All wines produced and used throughout the world today, with but few exceptions, are included in five general classes. Although there are hundreds of different wine names, these need not be confusing if it is remembered that the five classes include all of them.

This wine classification is made according to the foods with which the wines go naturally, and it should be remembered that wine is essentially a table beverage.

Appetizer wines, such as dry Sherry and Vermouth, are favored for before-meal use, and have keener flavors than those of other wines, ranging from extra dry to semisweet. They are usually served chilled, in two to three ounce portions.

Red table wines, including Claret and Burgundy, are dry and tart, and go best with red meats and the pastes or strongly flavored dishes such as venison, goose, spaghetti and macaroni. These wines vary in tartness, fullness, color and aroma according to the grapes from which they are produced. Red table wines are usually served at cool room temperature, in four to six ounce portions.

White table wines, such as Sauterne and Chablis, vary from very dry to fresh to sweet and full-bodied, and are more delicate in flavor than most red wines. They are especially well-liked with white meats such as chicken, with fish and shellfish, and generally taste best when served well-chilled.

Dessert wines, among which are Port and Muscatel, are all sweeter and of heavier body than table wines, and vary widely in color and flavor. These wines are served between meals as well as with dessert, and are especially popular with cheese, cakes, nuts and other delicacies.

Sparkling wines, Champagne and sparkling Burgundy being typical, are light and effervescent, white or red in color, and with varying degrees of sweetness. The long-accepted wines for festive occasions, they are suitable for service before, during and after meals as well as at other times.

Champagne is a sparkling wine which has been made naturally effervescent by a second fermentation within a closed container, and contains from 10 to 14 per cent of alcohol, just as do other table wines. The second fermentation may be done in the bottle, which is the time-honored method, or in large, glass-lined gas-tight tanks, holding from 50 to 500 gallons. In either case, Champagne begins as a choice white table wine, usually several months old, especially blended for fragrance and tartness. A special Champagne yeast and a small amount of sugar are added to start the secondary fermentation. The wine is then bottled, corked with a waxed cork, and a steel clamp or agrafe is placed over the neck to prevent the cork from blowing out.

Pressure which may become as high as 100 pounds to the square inch is created by the fermentation, since the carbonic acid gas cannot escape from the bottle. This pressure gives the wine its bubbles and is the reason why heavy bottles and wired-on corks are required by sparkling wines.

Stacked horizontally for several months, the wine completes this second fermentation, which forms a slight natural deposit in the bottle. When the Champagne has reached the proper stage of development it is necessary to remove the sediment. This process starts when the bottles are placed, neck downward, in sockets of sloping racks or "pulpits." Then, over a period of several more months, each bottle is lifted, slightly turned and dropped back into place once every day, so that the sediment is gradually shaken down until it rests upon the cork.

Disgorging, or the removal of the sediment, is done by quickly freezing the wine and sediment in the neck of the bottle, then releasing the clamp so that the pressure forces the cork out and with it the sediment. The slight loss of wine is quickly replaced by adding sufficient aged wine with a little pure sugar syrup. New corks then are placed in the bottles and wired in place, after which the bottles are again stored on their sides for final aging before the Champagne is ready for consumption.

Bulk process Champagne is made by a quicker method, and one in which it is not necessary to disgorge sediment from each bottle, since this is left in the bottom of the tank when the wine is bottled, under its own pressure. Bulk Champagnes must be so labeled to distinguish them from the more expensive, bottle-fermented product.

Sherry is the most popular appetizer wine, known for its "nutty" flavor, and ranges from pale to dark amber in color. It is first fermented as are other wines, fermentation being halted at the desired stage by the addition of a little brandy. In some districts a film yeast of "flor" is permitted to form over the surface of the wine in the cask, the "flowering" which results giving the "rancio" taste to the wine.

Baking, or aging in wooden casks at a fairly high temperature, is used in place of the flor yeast in some areas, and continues from three months to a year. The desired warmth is obtained by storing the casks in a warm room, by heating the vats with hot water circulated through large pipe coils, or by the natural heat of the sun. When examination shows that the Sherry has attained the desired flavor, it is slowly brought to cellar temperature, and then is aged as are other wines.

Vermouth is wine to which herbs and other aromatic roots, barks and seeds are added, giving it a distinctive, spice taste. It ranges in color from the pale amber of the dry (French-type) to the dark amber of the sweet (Italian-type). The base of the dry Vermouth is usually a Sauterne-type wine, that of the sweet Vermouth a sweet, dessert-type wine. The base wines are carefully selected and aged, then are flavored by steeping the herbs in the wine, or by adding an infusion of herbs.

Quality requirements for wines in the United States are extremely rigid, and those of California are known to be the strictest in the world, going further than the federal quality standards in guaranteeing a pure and wholesome product. No wine may be sold in California, or shipped out of the state, unless it meets these high standards.

FRANCE

With nearly four million acres of vineyards, France presents the paradox of producing more wine than any other nation but not enough for her own needs. To maintain a per capita consumption of more than thirty gallons a year,

imports of cheap wines, chiefly from Algeria, run to ten times the volume of wines exported. It is as though a baker famous for his cakes and pastries had to buy bread.

The city of Paris alone consumes approximately a hundred million gallons annually, which is almost as much wine as is consumed by all cities and towns of the United States. Every French soldier, every French sailor, has his wine ration. French hospitals serve wine to their patients, notably Champagne to sufferers from nausea after operations. French children are given wine diluted with water. French athletes train on wine.

At least 95 per cent of these wines are *vins ordinaires,* consumed within the year of their making. If kept longer, most of them would deteriorate rather than improve. Above them in quality are many "little" regional wines consumed locally; happy finds for travelers who discover them. For instance the small town of Cassis, near Marseille, produces a dry white wine which goes well with a dish of bouillabaisse, seemingly the extent of its possibilities.

France's great wines are exceptional in every sense of the word. Soil chemistry partially explains them. The soils in which they are grown are so poor, so pebbly or rocky as to be useless for any other form of husbandry. Valiant vines, wresting life from this ruggedness, yield crops meager in comparison with those of vineyards where the soil is hospitable and the growing easy. But soundness and character are there, and vigor for long life, and definite assurance of bouquet.

Bordeaux.—Longest known to the English speaking world are the wines of Bordeaux. This Gascony vinedom, whose first cultivators were Gauls working under their Roman conquerors, comprises five distinctive districts: the Médoc, Graves (named for its gravelly soil; pronounced "grahve"), Sauternes, St. Emilion, and Pomerol. Supplementary areas supply the bulk of the wines that, blended, go to market as Bordeaux blanc and Bordeaux rouge at prices lower than those of wines whose origin is specified and certified.

The principal Claret district is the wedge-shaped Médoc, its succession of vineyard estates, many of them famous, running north of the city between the broadening Gironde estuary and the sea; hence its name, Gasconized from the Latin *in medio aquae* ("in the middle of the waters"). The basic grape is the small black violet-scented Cabernet Sauvignon. At the southern end of this strip it produces Clarets light in body, admired for their delicacy; as one moves north, body becomes progressively fuller and hue deeper. These gradations are reflected in the character of wines marketed under the names of Médoc subdivisions —Saint Julien being fuller-bodied than Margaux, and St. Estéphe still more so. All Médocs are wines of beauty, dry and gently astringent. The choicest are the 59 classified Châteaux—that is, included in a classification made by a committee of Bordeaux experts at the time of the Paris Exposition of 1855. Médoc vineyards thereby acknowledged to be "First Growths" are Château Lafite, Château Latour, and Château Margaux, with Château Haut Brion in the Graves district sharing the same eminence by virtue of its kindred qualities. Below these four are 15 "Second Growths," headed by Château Mouton-Rothschild and followed by 14 "Third Growths," 10 "Fourth Growths," 17 "Fifth Growths." The fact that these ratings are still binding speaks volumes for the continuity of French viticulture as instanced by Bordeauxs. Governments may fall, but a great growth remains a great growth.

The only other Bordeaux wines thus formally established in the order of their excellence are the Sauternes, clustered in a small district to the south, upstream from the city. These are golden, luscious wines, all of them decidedly sweet. Château Yquem, the unique, is accorded a class by itself: "First Superior Growth." Château La Tour Blanche (now a state-owned viticultural school) heads the First Growths, 11 in number; 13 Second Growths complete the classification.

The Graves district—sizable area extending from the Médoc to Sauternes and including the city of Bordeaux—produces many Clarets including some long famous, but is best known for its delicate dry white wines. Any wine labeled merely with the district name Graves is invariably a white wine. The red wines of this district were the first Bordeaux wines to gain popularity in England and were consumed in great quantities during the 12th, 13th, and 14th centuries when Gascony belonged to the English crown, having come to King Henry II as part of the dowry of his wife Eleanor of Aquitaine. During the Elizabethan era British consumption of these wines was enormous.

Bordeaux's heaviest-bodied, deepest-hued wines are the Clarets produced to the east of the city in the small hilly district of St. Emilion and its appendage Pomerol. Often spoken of as "the Burgundies of Bordeaux," these growths, particularly in St. Emilion, include several which are rated great. Château Ausone, for example, has been famous ever since this vineyard was part of the country estate of the poet Ausonius, prefect of Gaul, who sent gifts of his wine to the Caesars in Rome.

Burgundy.—This vineyard region, too, has been under cultivation ever since Roman days. Its most prized growths are those of the Côte d'Or ("Slope of Gold"), a chain of stony hillsides extending southward from Dijon (ancient Burgundian capital) with the west bank of the river Saône at their feet.

A break in the middle divides this chain into two. The northern section, which produces the greatest Burgundies of all, is known as the Côte de Nuits, taking its name from the riverside town of Nuits-St-Georges, where many of the shippers have their warehouses.

In contrast to the lordly estates of Bordeaux, these Burgundy vineyards are subdivided into small holdings, tended with dogged patience. Thus the 127-acre vineyard of the Clos de Vougeot, formerly the property of a Cistercian abbey, is a patch quilt of nearly forty individual holdings, each proprietor entitled to use the name Clos de Vougeot. (In actual practice, the smaller growers usually club their bottlings or sell to a bottler.) The vineyard which produces Chambertin—Napoleon's favorite wine—is likewise a composite but some of its parts have individual reputations; their wines go to market with their estate names stressed in addition to the name Chambertin. The same is true of "majesterial robed" Musigny's split-up vineyard. The Domaine de la Romanée-Conti, possessing the 4½ most valuable acres on the entire Côte de Nuits, has suzerainty also over Romanée la Tache and the choicest portion of the Richebourg vineyard, plus two additional parcels; it bottles

all these wines under their individual names, giving its own guarantee of their respective authenticities. All these extraordinary Burgundies are slow maturers and live to great age, some of them attaining their peak after 30 to 40 years.

Less "tremendous" in character, less mouth-filling (as the French say), are the Burgundies of the southern section of the "Slope of Gold": Côte de Beaune, which has the proud old town of Beaune as its commercial center. The roster of regal reds includes Corton, Pommard (lightest-bodied), and Volnay. Thomas Jefferson, visiting these hillsides in 1787, noted that the stoniest, poorest soils produced only white wines, which brought lower prices than the reds. Since his day these remarkable wines—White Corton, Meursault, and Montrachet—have come to be highly prized because of their dry elegance and stamina. Montrachet holds a place among France's dry white wines comparable to that of Château Yquem among her sweet white wines. Chablis, pale golden with a glint of green, is grown in a special district of its own, northwest of the Côte d'Or.

South of the "Slope of Gold," the Macon region produces red and white Burgundies, of which the most distinguished is white, dry Pouilly-Fuissé. Further south again extends the Beaujolais region with its popular red Burgundies, rather light in body, which are the standard table wines of the nearby city of Lyon.

Champagne.—This was the first sparkling wine ever made. The delimited Champagne district, lying east of Paris, is a great bed of chalk, rucked with hills on the slopes of which grow Pinot vines identical in breed with those of Burgundy. Through it flows the Marne, dividing "The Slope of the Whites" from the black grape areas, which are more numerous, more varied. Were natural pigments utilized instead of withdrawn, this would be predominantly a region of red wines; and such it was for centuries, with kings and popes maintaining purchasing agents at Ay, near Epernay, central town of the present district. Some red wine, non-sparkling, is made even today. Of the modern industry of sparkling Champagne, which had its beginnings in the 17th century, the commercial capital is Reims, whose ramifying cellars, hewn deep in the solid chalk, total more than a thousand square miles. Epernay's underground aggregation ranks next in magnitude.

What seems to American eyes an anachronism is the practice of pressing the grapes in great presses instead of putting them through crushers. However, only the juice squeezed out by the first three pressings is used for Champagne of repute. Transported in hogsheads from the press houses in the various vineyard areas to company headquarters, this juice is given a dose of sugar and allowed to ferment with a wisp of straw inserted with each bung. The new wines thus made are immediately tasted and appraised as to their qualities and characteristics. Verdicts arrived at are the basis on which the blend—*cuvée* (from *cuve,* a vat)—is formulated. A typical *cuvée* would be a balanced combination of wines from the "Slope of the Whites," from riverside black Pinots, and from the "Big" and "Little" uplands called "Mountains"; plus old wines for enrichment of bouquet.

Early in April the blended wine is bottled with a fresh priming of sugar for its second fermentation, which then ensues, leaving it encumbered with sediment, to be coaxed down into the neck by many shakings and turnings and ousted explosively. This clarification and disgorging is deferred, however, until the wine has had four or five years of aging in cool tunnels, restacked from time to time so that any leaky corks are detected and sediment prevented from adhering too firmly to down-sides of bottles.

Final dosage with sugary liqueur is slight for "Brut" type (meaning Champagne *au naturel*); heavier for sweeter Champagnes. "English *Cuvée*" or "English Market" denotes a premium quality blend with minimum dosage. Generally speaking, the finest of Champagnes of the best vintage years travel light as regards sugar. By contrast, the Victorian world drank Champagne which was sweet as soda-pop. And 18th century England drank "grey wines" of Champagne lacking the benefits of clarification.

Alsace.—Alsatian wines—the Rhine wines of France—are known by the names of their grapes which they bespeak in their bouquets. The choicest grape is the Gewürztraminer, fruity yet delicate, with a hint of sweetness. The Traminer has a pronounced bouquet; the Sylvaner discloses a subtle raspberry taste; the Riesling is dryly fruity. The excellent rosé wines are known as *vins gris.*

Other French Wines.—Along the steep banks of the rushing Rhône are the classic vineyards of rich purple Côte Roti ("roasted slope"); Hermitage, yielding noble red wines and even nobler whites; Châteauneuf-du-Pape, ancient red wine blended from many grape varieties; Tavel, world's most famous *vin rosé.*

In the lazy Loire Valley the twin regions of Anjou and Touraine produce a host of wines which, though not rated as great, are very agreeable. Hillside caves around Saumur in Anjou serve as cellars for the champagnizing of wines which formerly masqueraded as authentic Champagnes but now sell on their own merits. Touraine's best known wine, Vouvray, may be either non-sparkling or semi-sparkling, and in hue either golden or rose.

ITALY

Italians love the vine and the vine loves Italy, flourishing in every region and festooning the trees in those where other crops have the field. If such double-duty areas were counted as vineyards, the grand aggregate, embracing a multitude of grape varieties, would exceed the vinelands of France; annual production, however, averages 200 million gallons less. Per capita consumption: 34 gallons.

Though Italian wines, by and large, are at their best in their immedaite localities, quite a number have become familiar in America as accompaniments of Italian food. Chianti, popularly regarded as the typical Italian wine, is actually a delimited product of Tuscany made in the Chianti Classico district between Siena and Florence. White Chianti, less known across the Atlantic than the robust red, is equally good; both benefit from the picturesqueness of the straw-upholstered bulbous bottle. Other important wines are Piedmont's Barolo, Barbera, Barbaresco, Grignolino, and Nebbiolo (red wines, the last named both still and sparkling); Lombardy's red Inferno and Valtelina, and red and white Frecciarossa; Venetia's soft white Soave and ruby Valpolicella; Umbria's white Orvieto, both dry and semi-sweet, in bottles similar to those of Chianti but more squat; Latium's re-

freshing Frascati and storied "Est Est Est" of Montefiascone; golden Lacryma Christi of the slopes of Vesuvius. Sicily, with more than half a million acres under vines, is noted for the fine dry Corvo of Casteldaccia near Palermo, luscious Muscatels, and dark sweet fortified Marsala—one of the world's distinctive dessert wines, much used in Italian cookery.

Italy's sparkling wines are produced principally in Piedmont by a deep-cellared industry clustered about the town of Asti whose name has been carried far and wide by lively Muscat-fragrant Asti Spumante. The nearby city of Turin is the capital of the vermouth industry, utilizing southern wines and aromatizing them with herbs and spices in accordance with the closely guarded formulas of the various firms.

SPAIN

Spain's wine abundance averages half a billion gallons a year, most of it consumed within the year by the Spaniards themselves. A celebrated exception is sherry, named for the town of Jerez (pronounced hâ-rāth') in Andalusia. The sherry vineyards are embraced in a gently undulating area which bulges into the Atlantic between the mouths of the Guadalquivir and the Guadalete rivers, just north of Cadiz. Here under scorching sun, with winds bringing additional heat from Africa, the Palomino grape draws finest flavor from white soil (*albaritza*), composed of chalk, magnesium, clay, and lime. In sandy soil, the yield is larger but quality lower; in reddish clay, it derives more iron.

At vintage time the gathered grapes are spread upon straw mats in the sun long enough to evaporate any moisture from dew or rain. In the pressing trough a layer of grapes is sprinkled with powdered *albaritza* soil, and covered with another layer of grapes, and so on, assuring the necessary amount of cream of tartar. The first pressing elicits 90 per cent of the juice. The remaining 10 per cent, obtained by a second pressing, is not used for Sherry. Drawn off into oaken butts of 165 gallons, the wine, as it ferments, develops its own character in its own way, a single pressing often yielding divergent qualities despite identical care given. Gradings are one *raya* (stroke), meaning finest; two *raya,* below it; three *raya,* just passable. The finer and paler the wine, the smaller the fortifying dose of brandy.

Brought to one of the *bodegas* (wine establishments) in Jerez, the butts are left exposed in the courtyard with their bungs open to encourage the second fermentation known as the "flowering" which, caused by the curious film of yeast that floats on the surface of the wine, imparts the distinctive taste common to all Spanish Sherries.

Sherry is invariably a blended wine—traditionally a product of the *solera* system whereby casks of old wines are partially drawn upon for bottling, and replenished with kindred wines of less age. Many of these old *soleras* were started more than a century ago and by such replenishment might well go on for another century.

Sherry types range from the pale disembodied dryness of Manzanilla and still paler Fino to the dark sweet richness of Brown Sherry. Amontillado is nutty dry Sherry "in the manner of Montilla," the latter being a mountain wine from near Cordova, less potent than its emulator. Contrastingly luscious P.X., much used in blending, is the fortified but unfermented juice of Pedro Ximenez grapes sun-baked till they are raisiny. Without P.X. and without *vino de color* (boiled-down grape juice), all Jerez Sherries would be dry.

Spain's leading sweet wine is dark, rich Malaga, made from P.X. and from Muscats. Of Spanish table wines, those met with in America are chiefly the red and white Riojas of Navarre patterned after Bordeaux types and made from the same French grape varieties.

Canary wine, once as famous as any wine in all Hispania, faded into history with the destruction of the Canary Islands' vineyards by a fungus blight in the latter half of the 19th century.

PORTUGAL

Wines are Portugal's chief industry, averaging nearly 200 million gallons a year, of which some 60 million gallons are wines for export. In monetary value, Port wine heads the list.

Roots of vines in the delimited district of the Upper Douro, where this *vinho do Porto* is grown, run ten and twelve feet deep into the soil of terraces so rocky that planting often involves blasting. Equally deep run the commercial roots of the Port wine firms that call Oporto their headquarters but maintain their vast sprawling wine lodges in Vila Nova de Gaia across the bridge from that ancient fortress-city, guardian of the Douro canyon's mouth.

If allowed to ferment completely as Sherry does, the wine, too, would be dry. Instead, when fermentation reaches a point where natural grape sugar and natural grape acidity nicely offset each other, it is halted with brandy. Subsequent doses preclude any resumption; the wine "eats its brandy" as the saying goes, but is never glutted: alcoholic strength rarely rises about 20 per cent, and the aroma an uncorked bottle gives off is fragrance of grapes, not free alcohol. Types of Port produced and shipped by the Oporto houses are:

Ruby Port, sweet and hearty. A blend of wines, predominantly young ones as the vividness of the color attests.

Tawny Port, less sweet, more delicate, subtler in bouquet. Blend of wines that have spent many years in the wood depositing pigment and developing suavity and finesse. The older the wine, the lighter the body. But no impairment of strength; old Tawnies are re-invigorated with old brandies.

Vintage Port, deep ruby hue, superbly fruity bouquet, fullest body. Wine of a specific year which was exceptionally favorable to wine quality. Kept unmixed with wines of other years and bottled (usually by the importer) in its second or third year, to acquired maturity in bin—a matter of 20 years, during which it deposits a crust, necessitating careful handling and decanting before serving. Shaken or stood upright, it would be a ruddy mudstorm.

Crusted Port, also known as *Vintage Character Port,* a blender's approximation of Vintage Port. Undated. Sold at a lower price. Binned and handled like Vintage.

White Port, golden wine, from white grapes. Used as an apéritif.

Port-type wines produced in the vicinity of Lisbon are exported as Lisbon Wine. Table wines of that area, particularly the red Collares, the white Bucellas from a Riesling grape, and the red and white Carcavelhos, have long found favor in England. America is better acquainted

with the refreshing *vinhos verdes* ("green wines") of northern Portugal as represented by crackling Monção and Amarante wines in stone bottles. The island of Pico in the Azores still grows a wine we used to obtain from its neighbor Fayal in considerable quantities.

Madeira.—Akin to Ports and Sherries but distinctive in flavor and aroma are the wines of Madeira. A Portuguese expedition sent out in 1419 by Henry the Navigator found this beautiful mountainous island (32 miles long) thickly forested; hence the name Madeira, which means "wood." To clear space for homesteads, the colonists set fire to trees, thereby starting a conflagration which burned seven years and left the southern slopes enriched with wood ash which added to the fertility of the volcanic soil. Vines were planted, notably the Malvasia of Crete, with the result that that Greek island lost its supremacy in the production of luscious wine, Venetian traders lost their monopoly of this commodity, and Shakespeare's England drank Malmsey from Madeira.

World markets did not have to be sought; ships on the way to them stopped at Madeira for fresh water, fresh meats and fruits, and carried away casks of wine, which thus became established as the favorite wine of officers' messes in South Africa, India, and the West Indies. Partiality for Madeira in the Thirteen Colonies of America was assured as early as 1663 by an ordinance of Charles II prohibiting the export of European commodities to the king's dominions except in British ships sailing from British ports. Madeira wine, exempted, came direct, at prices set solely by quality and demand. George Washington drank a pint of it at dinner daily, as did many of the men he moved among, and the Madeira decanter remained a traditional symbol more than a century after the founding of the Republic. Americans who cling to old ways and old wines still cherish it and serve it ceremonially, and Portugal's hanging garden isle still produces it in three principal types: honey-sweet Malmsey, rich medium-sweet Boal (also spelled Bual), and hardly-sweet-at-all Sercial with a definitely dry aftertaste—all of them perfected by blending and much aging in oak. Time has no terrors for great Madeiras.

GERMAN WINES

Finest are the Rhines of the Rheingau, right bank chain of multi-terraced slopes with southern exposure. This district, fifteen miles long, comprises fifty famous vineyards such as those of Marcobrunn, Schloss Reinhardshausen, Steinberg, Schloss Vollrads, Rüdesheim, and Schloss Johannisberg—supreme. Assmannshausen's vineyards, growing the sole red wine, end the series downstream; those of Hochheim (a short way up the inflowing Main) begin it. Hochheim is responsible for the origin of the name "Hock," coined by 18th century British consumers as a general designation for Rhine wine, till then called "Rhenish." Rheingau wines, generous in bouquet and flavor, have a note of firmness that bespeaks the stamina of long life. Since alcoholic strength is 12 per cent at most, the power can only come from character.

Across the river, the Rheinhesse (Hessian Rhine) region, extending down from Mainz, has no such long-keeping greatness to offer, but many that softly ingratiate, especially Niersteiner with its delicate elegance, and Oppenheimer with its grapey riches. Demand for Liebfraumilch has evoked numerous and various creations sold under that designation, which any Hessian vintner may employ. The true wine is Liebfrauenstift, produced by the Liebfrauenkirche near Worms.

The large Palatinate district, adjoining on the south, has Deidesheimer, Forster, and many other agreeable wines. Wurtzburg has its refreshing Steinwein in the traditional "goat's bag" bottle. The Moselle region has a roster of light flowery enchanters, with Bernkasteler Doktor the finest, and Piesporter Goldtröpfschen not far below. The Saar has Scharzhofberger, light golden wine of marked breeding.

WINES OF OTHER COUNTRIES

Switzerland's wines, more democratic than aristocratic, are produced by 20 of the 22 cantons, total gallonage about matching Germany's. Among the favorites are Neuchâtel's crisp dry whites and vigorous red Cortaillod, rivaled by Vaud's white Dézaley and the white Fendant and red Dôle of Sion in Valais.

Austria's best known vineyards, of Vöslau (white, red), are close by Vienna; three other vineyards (white) are within the city limits. Hungary, famous for Tokay, produces it at the foot of the Carpathians from Furmint grapes, a portion of which must be overripe and honey-sweet. The more tubs of overripe grapes per cask, the choicer the Tokay. Tokay Szamorodni ("Natural") is made for table use. Eger, nearby, produces the noted "Bull's Blood"; best whites are those of Lake Balaton. National total, 80 million gallons. Bulgaria and Rumania make and drink many good wines. Russia claims large production, chiefly in the Caucasus and Crimea. Greece clings to the ancient practice of tarring the storage jar but spares sweet Mavrodaphne.

Algeria's mass production vineyards yield nearly 300 million gallons of reds and whites which, because of the hot climate, are more heady and fiery than European wines made from the same grapes. Nearly all are shipped to Southern France for use in vermouth and apéritif wines and for strengthening lighter *vins ordinaires*. Tunisia and Morocco produce similarly for this same bulk market.

British South Africa produces some 60 million gallons made up of wines emulating Bordeaux, Burgundy, and Rhine types. Constantia, rich red dessert wine, has long been popular in England. Australia produces 30 million gallons of wines patterned after the best known European types. Canada, despite handicaps of northern climate, produces 6 million gallons, consumed within the Dominion.

Chilean wines, well liked in the United States, are from European grape varieties grown in volcanic soil. Riesling emulations of Rhine wines, bottled in squatty flasks similar to those of Germany's Steinwein, are particularly successful. Chile's production averages nearly 60 million gallons. Though Argentina produces three and a half times as much, few Argentine wines come to North America.

UNITED STATES

The land that Leif Ericson had reported as being "Wineland the Good" was destined to baffle, until nearly eight centuries later, all attempts at wine making. Colonists found grapes growing in profusion and climbing up through

the tops of the tallest trees of the virgin forests, but these were New World grapes with an unfamiliar taste.

An early governor of the Virginia settlement, Lord De La Warr, made a plea in 1616 that these "naturall vines be planted, dressed, and ordered by skilled vinearoons" so that a civilized grape, suitable for wine, might be evolved from them. In response, French vine dressers were sent over, bringing a collection of France's best grape varieties. The Colonial Assembly in Jamestown passed an act compelling every householder to plant ten cuttings and learn the art of dressing a vineyard. Results being meager, a bounty of 10,000 pounds of tobacco was offered to any colonist who produced 500 gallons of drinkable wine. But the European vines did not thrive, nor were the possibilities of wild native varieties as yet envisioned.

Similar frustrations befell endeavors in Carolina and Georgia, in Massachusetts and her great eastern province, now the state of Maine, and in Rhode Island. Pinots set out on the slopes of Monticello by Thomas Jefferson all died.

Meanwhile in Spain's colony of California, Franciscan padres had planted vines around their missions, first at San Diego in 1769 and then successively at other points along the coast up to San Francisco. They used a special grape which they had brought along either in the form of seeds or cuttings, probably via Mexico. Today we call it the Mission. The fact that it was a variety of the European grape species *Vitis vinifera* and that it thus throve in California soils of different kinds, in diverse localities, and that the California climate was beneficial to it, seemed proof that other varieties of *Vitis vinifera* would grow there.

Accordingly, about 1824, one Joseph Chapman set out 4,000 vines at the Pueblo of Los Angeles; in 1831 he was followed by a Frenchman named Jean Louis Vignes from Bordeaux who started a commercial vineyard approximately where the Los Angeles Union Station now stands. In 1833 he produced what records indicate was the best wine and brandy in California at the time. A Californian of Hungarian birth, Agoston Haraszthy de Mokcsa, known as "Count" Haraszthy, prevailed upon Gov. John G. Downey to send him to Europe in 1861 to select the widest possible variety of cuttings for experimentation. Spending five months visiting every important European wine district, he purchased more than 100,000 cuttings of about 1,400 varieties, many of which were planted in his vineyard at Sonoma, and the rest sold to growers in all sections of the state. Nowadays similar experimentation is done on an individual basis, or in cooperation with the Agricultural Experiment Station of the College of Agriculture of the University of California, which has been of invaluable assistance to the wine industry.

The American industry was afforded an opportunity for expansion of exports when, in the 1870's, the vineyards of Europe were devastated by a dread insect pest, the phylloxera, which had crossed the Atlantic from the eastern seaboard of the United States. Robert Louis Stevenson, thinking of well-nigh wineless Europe as he viewed the prospering vines in Napa Valley, predicted: "The smack of California earth shall linger on the palate of your grandson." But suddenly in 1874, the phylloxera arrived in California, wreaking destruction as it had done in the vineyards abroad. The destroyer was conquered by replanting the vineyards of California, and of Europe as well, with *Vitis vinifera* cuttings budded onto American phylloxera-resistant roots.

East of the Rockies, it was finally recognized that *Vitis vinifera* does not thrive under Eastern conditions. So growers concentrated their ingenuity on breeding and improving the "primitives," crossing them with carefully nursed varieties from abroad. The outcome was hundreds of new varieties and sub-varieties, each with individual characteristics, and many embodying new discoveries in flavor. How the Catawba originated is not known. A resident of the District of Columbia, John Odlum, obtained cuttings of this vine in nearby Montgomery County, Maryland, in 1823, and gave them to Nicholas Longworth of Cincinnati. Longworth developed Catawba into the leading grape of America and with it made the Cincinnati region the most important grape-growing center on the entire continent at that time. His Catawba champagne inspired a poem by Longfellow.

The Delaware, discovered on two farms in Ohio in 1849, became a staple of the whole Eastern wine industry, and one of the principal grapes of New York's Finger Lakes district and the Sandusky area of Ohio. The South's aromatic Scuppernong is a domesticated primitive of the Muscadine sort. The Isabella was discovered in South Carolina in the 18th century, the Elvira in Missouri in 1863. The Norton was a Virginia seedling. The Concord came from Concord, Mass. With these and many other varieties, the Eastern vintners have a full set of "native" flavors for their wines, both still and sparkling.

California, however, is the principal producer, turning out nearly 90 per cent of the nation's total gallonage. Here vineyards are less subject to late frosts and other weather hazards, and her range of climates and soils allows scope for greater diversification. A company may produce dry table wines in one of the valleys that cluster around San Francisco Bay, and may at the same time produce appetizer and dessert wines in the sun-baked Fresno area. Cooperatives maintain branch wineries in a number of areas, catering chiefly to the popular price market.

American willingness to depart from Old World patterns when the American palate so dictates, is manifested by the increasing production of sweet wines of table-wine strength, and fruit wines (made chiefly in the East and Northwest) which are equally sweet and moderate in alcohol.

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LAWTON MACKALL.

WINEBRENNER, wīn'brĕn-ẽr, **John,** American clergyman, founder of the denomination known as the "Church of God": b. Frederick County, Md., 24 March 1797; d. 12

Sept. 1860. He was ordained a minister of the German Reformed Church in 1820, and was called in the same year to the Salem church, Harrisburg, Pa. He retained that charge until 1827 when his outspoken attitude against slavery and the traffic in intoxicating drinks led to his being asked to withdraw, and in 1828 he ceased to be connected with the Reformed Church. In October 1830 he established the denomination called the "Church of God," whose members also became known as Winebrennerians. See CHURCHES OF GOD IN NORTH AMERICA.

WINESBURG, OHIO, a series of 23 short stories by Sherwood Anderson (q.v.), published in 1919.

In a preliminary sketch the author explains his controlling point of view toward the chief characters in the stories: "It was the truths that made the people grotesques. The moment one of the people took one of the truths to himself, called it a truth, and tried to live his life by it, he became grotesque and the truth he embraced became a falsehood." Described in psychological rather than philosophical terms, Anderson's "grotesques" represent people who have been forced out of the focus of normality by oddities, repressions, or frustrations which, in time, take control and find overt expression through eccentric, explosive, and tragic acts.

Hands, for example, the first story of the group, tells of Wing Biddlebaum, a gifted teacher, whose innocent passion for touching and caressing everything and everybody is misinterpreted, costing him his rightful vocation in life. *Queer* is the story of Elmer Cowley, rendered queer by his obsession with the idea that he is thought queer by others. *Death* presents the essentials of an hysterically intense, repressed, yet significant emotional relationship between one of Winesburg's doctors, his patient, Elizabeth Willard, "a tired, gaunt old woman at forty-one," and her son George. Through her death, the son achieves a sudden, intuitive understanding of his mother's warped life.

Sherwood Anderson's abrupt, intense, and non-realistic technique blends with effective peculiarity in these stories, which resemble dream states.

WINFIELD, city, Kansas, and Cowley County seat; altitude 1,114 feet; on the Walnut River; 39 miles southeast of Wichita; on the Atchison, Topeka and Santa Fe; St. Louis-San Francisco; Missouri Pacific railroads; has a municipal airport. Cowley County is fertile farm country, growing wheat, alfalfa, corn and kaffirs, and raising cattle, hogs, and poultry. City establishments process dairy, poultry, and meat products, prepare stock feeds, and manufacture gas burners and oilfield equipment. Winfield has a Carnegie library and public and parochial schools, and is the seat of St. John's College (Lutheran, junior college) and Southwestern College. St. John's has a historical museum. Southwestern, with its library, its courses in art appreciation, and its musical organizations featuring an annual presentation of Mendelssohn's *Elijah,* contributes to the cultural life of the city. The high school has a collection of paintings, and there is a civic music association. Outside the city limits is a state school for mentally subnormal persons. The county fair is held each August in Fairground Park. Winfield was settled and incorporated in the 1870's, becoming a city of the third class in 1873; second class, 1879. Commission-manager government was adopted in 1923. Pop. (1950) 10,264.

WING, an organ of flight. In birds, the wings consist of the bones of the fore limbs, specially modified to form a support and axis, while attached to this skeleton are the muscles moving the limb (see ORNITHOLOGY), externally clothed with strong flight feathers or "wing quills." (See FLIGHT.) In the bat the wing consists of an expansion of the skin, supported on four of the fingers, which are extremely long. This leatherlike membrane, or "patagium," extends from the fore limbs to the hind limbs, and in many cases between the hind limbs and tail as well. In such mammalia as the flying foxes, flying squirrels, flying phalangers, and in the lizards known as flying dragons the wing is a mere expansion of skin, extending along the sides of the body, often connecting hind and fore limbs, and serving as a parachute to sustain the animals in their flying leaps from tree to tree, but in no sense serving as an organ of true flight. In insects the wing is formed of two delicate skin layers, supported on hollow tubes or *nervures,* placed in communication with the respiratory or breathing system. The wings of insects become thus related to respiration, and by their movements probably aid in the diffusion of air through the breathing tubes.

WINGATE, George Wood, American lawyer: b. New York City, July 1, 1840; d. Brooklyn, N. Y., March 22, 1928. He served with the 22d New York Volunteers during the Civil War. In 1867, he originated systematic rifle practice for the instruction of the National Guard. Four years later, he was instrumental in organizing the National Rifle Association of America and was its president for 25 years. He published *Wingate's Manual of Rifle Practice* (1872).

WINGATE, Orde Charles, British army officer: b. the Himalayas, Feb. 26, 1903; d. Burma, March 24, 1944. He was educated in England and was graduated from the Sandhurst Military College. In 1936, as a captain, he distinguished himself with small-band tactics when he successfully disposed of marauding Arabs in the Haifa-Mosul pipeline area of Palestine. In 1941 Wingate was sent to Ethiopia where he organized 1,000 Sudanese and 2,000 Ethiopian troops. This force disposed of 40,000 Italians mainly by nocturnal forays.

In 1942, as brigadier general, he was summoned to India. His new command consisted of Gurkhas, Kachins, Shans, and Burmese added to a second-line Lancashire Regiment; he constantly took these troops into the Assam jungle for training. In February 1943, he led his eight columns of Chindits or "Wingate's Circus" across the Chindwin River in a three-months' successful campaign, ambushing the Japanese, and destroying communication and transportation 300 miles to the rear.

One year later General Wingate was killed in an airplane crash in the Burmese jungle.

WINGED BULL, *in architecture,* a decoration of frequent occurrence in ancient Assyrian

temples, where winged human-headed bulls and lions of colossal size usually guarded the portals.

WINGED LION, the symbol of the evangelist St. Mark, which was adopted as the heraldic device of the Venetian Republic. A celebrated bronze figure of the winged lion of St. Mark surmounting a magnificent red granite column, formed out of a single block, stands in the Piazzetta of St. Mark at Venice.

WINGHAM, Canada, town in Huron County, Ontario, on the Maitland River, 110 miles northwest of Toronto; on the Canadian National and Canadian Pacific railways. Manufactures include phonograph and radio cases, gloves, upholstery, stoves, salt, flour and lumber. It is a shipping center for grain, and has a business college, a hospital, a public library, and a park. Pop. (1951) 2,030.

WINGLES, văngl, town, France, in Pas-de-Calais Department, situated in a coal mining district, 5 miles north-northeast of Lens. Industries include copper and bronze smelting, and glass and ammonia are manufactured. Pop. (1946) 8,034.

WINGSHELL, the name of several bivalve shells, which have winglike extensions of the hinge-margin. See PINNA.

WINIFRED or **WINEFRIDE, Saint,** Welsh saint: b. Holywell, Wales, c.600; d. Gwytherin, Wales, Nov. 3, 660. She was, according to the legend, a noble maiden, whose head the Prince Caractacus (Caradoc) cut off when she fled from his unholy proposals. The head rolled down a hill, and where it stopped, a spring gushed forth which afterward became a place of pilgrimage. St. Bueno, however, replaced her head and restored her to life. She survived the miracle 15 years, disciple of St. Bueno until his death, when she entered the convent of Gwytherin in Denbighshire. Her feast day is November 3.

WINKELRIED, vĭnk'ĕl-rēd, **Arnold von,** Swiss patriot. He was knight of the Swiss canton of Unterwalden, and his self-sacrificing valor is said to have decided the Battle of Sempach, July 9, 1386, against the Austrian troops under Archduke Leopold III. The Austrians were formed into a compact body which resisted the efforts of a small body of Swiss rebels drawn up in form of a wedge and rushing to the attack. When the Austrians were beginning to surround their enemies, Winkelried, seeing the desperate condition of the affair, burst from the ranks, and, grasping all the enemies' pikes within his reach and burying them in his bosom, opened a gap for his compatriots. Over his dying body his companions broke in the Austrian line and defeated their enemies, which now were handicapped by their heavy armor, with a great slaughter. The truth of this legend was much discussed, but modern research confirmed the dates and circumstances of that year, and the general belief is that the story most likely is true. A monument to Winkelried was raised at Stantz, canton of Unterwalden.

WINKLE, a local name around Long Island Sound and New York Bay for either of the large conchs (q.v.) *Fulgur* and *Sycotypus,* which are extremely common and very destructive to cultivated oysters. Their shells were utilized by the Indians as spoons, ladles, and digging tools, and out of their central columns the inferior beads, called "white wampum," were made.

WINLOCK, Joseph, American astronomer: b. Shelbyville, Ky., Feb. 6, 1826; d. Cambridge, Mass., June 11, 1875. He was graduated from Shelby College in 1845 and in the same year became professor of mathematics and astronomy there. He was engaged as one of the computers in the office of the *American Ephemeris and Nautical Almanac* in 1852–1856 and was appointed professor of mathematics in the United States Navy in 1856. He shortly afterward returned to the office of the *Nautical Almanac* as second superintendent, and was from 1859 to 1861 at the Naval Academy at Annapolis, Maryland, in charge of the mathematical department. On the outbreak of the Civil War he resumed direction of the *Nautical Almanac.* In 1866 he was appointed to the chair of astronomy at Harvard, at the same time becoming director of the observatory at Cambridge, in which offices he continued until his death. He was elected by Congress to the National Academy of Sciences in 1863, was in charge of the expedition to Kentucky to observe the solar eclipse of August 1869, and of that to Spain in December 1870. He made numerous and important improvements in the equipment of the Harvard observatory, and his researches were of great scientific value.

WINNEBAGO, wĭn'ē-bā-gō (Algonquian, turbid water people), North American tribe of Indians, of the important Siouan stock, who are closely related to the Chiwere division (the Iowa, Oto, and Missouri), and to the Mandan. Their own name is Hochangara, people of the early (or primitive) speech. They were first mentioned in the *Jesuit Relations and Allied Documents* of 1636, but the first use of the name Winnebago occurs in the *Relations* of 1640. It is said that the Winnebagos were almost annihilated by the Illinois tribe in early days, and that the historical group was made up of the survivors of this warfare and of members of other tribes. In 1639 they were on Green Bay, Wisconsin; in 1736 they, or at least part of the tribe, resided on Lake Superior, but by 1761 they were again on Green Bay, and in 1788 had a village on a small island in Winnebago Lake. In 1822 their population was estimated at 5,800 and their country extended from Winnebago Lake southwestward to the Mississippi.

By treaty of 1825 and 1832 they ceded their lands south of Wisconsin and Fox River for a reservation on the Mississippi above the Oneonta. In 1832 one of their villages was at Prairie la Crosse. They suffered several visitations of smallpox; the third, which occurred in 1836, carried off more than a quarter of the tribe. A part of the Winnebago long remained widely distributed over their old country east of the Mississippi and along that river in Iowa and Minnesota. In 1846 they surrendered their reservation for another one above the Minnesota, and in 1856 they were removed to Blue Earth, Minnesota. Here they were mastering agriculture when the Sioux War broke out and the settlers demanded their removal. Those who had taken farms were permitted to remain, but the others were taken to Crow Creek, on the Missouri, whence they soon escaped; but their privations and sufferings were such that of

the 2,000 removed to Crow Creek, only 1,200 reached the Omaha reservation, whither most of them had fled. These survivors were assigned a new reservation on the Omaha lands, where they remain, allotted lands in severalty. They numbered in 1896 1,131 under the Omaha and Winnebago Agency, Nebraska, and 1,403 in Wisconsin. These, however, included only those on reservations. Since then many of the Winnebago have left the reservations and have become citizens of the United States, so that it is difficult to estimate their population; but it is considerably greater than in 1896.

Consult Bureau of American Ethnology, *Handbook of American Indians* (Washington 1897); Radin, Paul, *Winnebago Tribe* (New York 1923).

WINNEBAGO, Lake, lake, Wisconsin, the largest in the state. It is about 750 feet above sea level, about 30 miles long and 10 miles wide in the broadest part; area, 212 square miles. It has an abundance of fish. Its clear waters, well-wooded shores, with the cities and towns intervening, make it most attractive. On the east shore is found a curious wall made by stones being pressed against the shore at times of ice expansion. The Fox River is both an inlet and an outlet of the lake. It is navigable from its mouth at the head of Green Bay; so Lake Winnebago has steamer connections, by means of the Fox River and Green Bay, with the Great Lakes.

WINNEMUCCA, wĭn'ĕ-mŭk'à, city, Nevada, and Humboldt County seat; altitude 4,344 feet; 174 miles northeast of Reno; on the Southern Pacific, and the Western Pacific railroads. It is in mining and cattle-raising country; copper is now the principal metal mined. Here smelting is done, and cattle and sheep are shipped. Pop. (1930) 1,989; (1940) 2,485; (1950) 2,816.

WINNEMUCCA, a lake in the northwestern part of Nevada. It is in a desert valley in which is Pyramid and several other lakes. Winnemucca is 26 miles long, north to south, from two to five miles wide, and from 50 to 87 feet deep. Truckee River is the only inlet, which is also an inlet of Pyramid Lake. It has no apparent outlet. The mineral matter, chiefly salt, is 3.6 parts per 1,000.

WINNEPESAUKEE ("Beautiful water of the highland"), a division of the Pennacook confederacy of the Algonquian stock of North American Indians, formerly inhabiting the vicinity of Winnipesaukee Lake, New Hampshire.

WINNER, city, South Dakota, county seat of Tripp County, south-southeast of Pierre. A market town and shipping center for a farm region; founded after 1908 on a part of the Rosebud Indian Reservation. Pop. (1950) 3,252.

WINNETKA, wĭ-nĕt'kà, village, Illinois, in Cook County; altitude 651 feet; a north shore suburb of Chicago; on Chicago and North Western Railroad. It has manufactures of cosmetics and pharmaceuticals, and is famed for its innovations in education. The village was incorporated in 1869. Pop. (1940) 12,430; (1950) 12,545.

WINNFIELD, wĭn'fēld, town, Louisiana, and Winn Parish seat; altitude 118 feet; 99 miles southeast of Shreveport; on the Chicago, Rock Island and Pacific; Louisiana and Arkansas; Tremont and Gulf railroads. Products of the surrounding area are salt, lumber, pulpwood, cotton, tomatoes and potatoes, and rock for road-building. The town has a public library, and is the seat of the Huey P. Long Memorial Trade School. Pop. (1940) 4,512; (1950) 5,616.

WINNIPEG, city, Province of Manitoba, Canada, the capital and largest city of the province, is situated at the juncture of the Red and Assiniboine rivers in latitude 49° 54′ N., longitude 97° 08′ W., 60 miles north of the United States boundary, almost midway between the Atlantic and Pacific oceans, and at an altitude of 760 feet above sea level. The name is derived from the Cree word, "win," muddy, and "Nipee," water, the name given to the lake 40 miles north of the city.

The site of the city of Winnipeg was first discovered in 1738 by the famous French explorer Sieur de La Vérendrye (Pierre Gaultier de Varennes), on his search for the western sea. La Vérendrye built Ft. Rouge at the juncture of the two rivers. This fort was shortly abandoned and no further post was established until the North West Company built Ft. Gibraltar in 1806 and the Hudson's Bay Company a few years later built Ft. Douglas a short distance away. In 1812 the first settlers were brought from Scotland by Lord Selkirk to form a colony in and around the present site of Winnipeg on land procured from the Hudson's Bay Company for that purpose. The arrival of these settlers was bitterly resented by the North West Company and they suffered many hardships and even bloodshed until the merger of the two rival fur companies in the Hudson's Bay Company in 1821 left them at peace to develop the colony. Ft. Gibraltar was now renamed Ft. Garry and the infant settlement grew up slowly around it. In 1870, when the lands of the Hudson's Bay Company were transferred to the Canadian government and Manitoba became a province, the population of the trading post Ft. Garry was 215. In 1873 the city of Winnipeg was incorporated with 1,869 inhabitants. The completion of the Canadian Pacific Railway in 1886 began a period of remarkable growth and progress, the vast agricultural lands of the West being thrown open to settlement and the population of the city rapidly increasing until today Winnipeg is the fourth largest city in Canada. The metropolitan area of Greater Winnipeg has a population of 350,924 by the 1951 census. This is an increase of 50,987 in the ten year period 1941–1951.

The government of the city is carried on by a council composed of a mayor and 18 aldermen. The mayor is elected every two years from a vote of the entire city. Three aldermen are elected annually from each of the three wards into which the city is divided, and hold office for two years. The council is the legislative body and carries on its executive work through standing committees.

Its situation has made of Winnipeg the greatest grain center of the American continent and the financial, commercial, wholesale and manufacturing center of the middle west. It is the natural shipping place for supplies and machinery for the northern mining areas, much of which is shipped by air. Its industries are varied and include especially flourishing needle trades and meat packing industries. Its hydroelectric power, among the cheapest on the continent, which has

been developed by the Municipal Hydro-electric System and the Winnipeg Electric Company, has greatly encouraged the use of electrical power and appliances in the homes and factories of the city. Winnipeg is also a central market for horses, cattle, and hogs from the prairie regions. The St. Boniface stockyards in Greater Winnipeg, the largest in the British Empire, were opened in 1913, and now slaughtering and meat packing are the leading industries in the city. The water supply, which is adequate for a city of 1,000,000 inhabitants, is brought by an aqueduct from Shoal Lake, 85 miles away. The Winnipeg Electric Company maintains a street railway and bus service for Greater Winnipeg. During the past four years an extensive modernization program has been carried out, changing most of the street car lines to trolley and motor bus service.

Winnipeg is the railway center of Western Canada. The two transcontinental systems converge here and maintain large roundhouses, machine shops and freight yards, those of the Canadian Pacific Railway being the largest individually owned freight yards in the world.

The Stevenson Airport on the outskirts of the city is the Winnipeg base of the following companies: Trans-Canada Air Lines, Northwest Airlines Inc., Canadian Pacific Air Lines Limited, Central Northern Airways, and Aircraft Services (Western) Limited. It has been called "the air crossroads of the continent."

Winnipeg is the educational center of the province, being the seat of the provincial university, the University of Manitoba, and having a complete public school system of elementary, junior and senior high schools and many private schools. There is also a public library consisting of one main library and four branches, the main library and two of the branches being gifts of the Carnegie Corporation. In music the Manitoba Musical Competition Festival, held in Winnipeg every Spring, is the largest of its kind in the British Empire.

Winnipeg is especially noted for its wide streets, its beautiful public buildings such as the Legislative Building, one of the finest pieces of architecture in the Dominion, the Civil Auditorium, the Dominion Public Building, and the two large department stores of the Hudson's Bay Company and the T. Eaton Company, Ltd., and for its large and well kept parks and golf courses. One of these parks, the Assiniboine Park, contains the only conservatory and palm house in the West and an interesting collection of native wild animals. Pop. (1951) 238,604.

A. F. Jamieson,
Chief Librarian, Winnipeg Public Library.

WINNIPEG, lake, in the Province of Manitoba, Canada, and in the district of Keewatin, lies at an altitude of 710 feet above sea level, between latitude 50° 20′ and 53° 50′ N. and longitude 96° 20′ and 99° 15′ W. It is 275 miles long, from 25 to 70 miles wide, and covers an area of 9,460 square miles. It contains a number of islands, the longest being Reindeer and Big Island embracing respectively 70 and 60 square miles. It receives the surplus waters of lakes Winnipegosis and Manitoba and discharges by Nelson River in a northeasterly direction into Hudson Bay. The principal rivers flowing into it are, from the south, Red River; from the west, Dauphin and Saskatchewan rivers; and from the east, Winnipeg. Lake Winnipeg is comparatively shallow, nowhere reaching the depth of 100 feet, a consequence being that its frequent storms are often exceedingly dangerous; this feature is augmented by its exposed condition owing to the low character of its shores which, on the south, are also very marshy. Fish in abundance are found in its waters, the white fish being widely known and valued on account of their size and flavor. It is a remnant of the ancient Pleistocene lake, Lake Agassiz.

WINNIPEG, river, in the provinces of Manitoba and Ontario, Canada, rises near Savanne in latitude 48° 47′ N. and longitude 89° 57′ W., and flows in a general westerly direction under the names of Savanne, Seine and Rainy rivers into the Lake of the Woods. After it leaves this lake it is known as Winnipeg River and follows an extremely tortuous and often turbulent course until it finally discharges into Lake Winnipeg. It is 140 miles in length.

WINNIPEGOSIS, wĭn-ĭ-pĕg-ō′sĭs, **Lake,** a lake in northwestern Manitoba, Canada, extending into Saskatchewan. It lies to the west of Lake Winnipeg (q.v.) and parallel with it; its length is 122 miles, the width 17 miles; its elevation above sea level 828 feet. It is generally shallow, the greatest depth not being over 40 feet. It receives the Red Deer and Swan rivers, and a few other smaller streams, and discharges into Lake Manitoba to the southeast, through the Water Hen River.

WINNIPESAUKEE, Lake (formerly Winnepesaukee), wĭn-ĭ-pĕ-sô′kē, New Hampshire, in Carroll and Belknap counties, 27 miles northeast of Concord. It is irregular in outline, with many inlets and islands, and is about 25 miles long and from three to 11 miles wide. Its greatest depth is about 300 feet and it is 470 feet above sea level. Its waters empty into a small stream tributary to the Merrimac River. The surrounding scenery is charming. There are several small towns upon its shores, the largest being Wolfeboro; and there are numerous summer cottages and a considerable summer resort business. It is the largest lake in New Hampshire (71 square miles).

WINNISQUAM, wĭn′ĭs-kwŏm, **LAKE,** lake, New Hampshire, in Belknap County. It enlarges from the Winnipesaukee River at Laconia, and is connected by the river and bays with Lake Winnipesaukee a few miles to the east. Its general extent is from north to south, about 10 miles, and it varies in width from one-half to two miles, the outlet by the river to the southwest.

WINNOWING MACHINE, a machine for winnowing grain by means of agitated sieves and a blower. The grain is usually introduced at the top of the machine into a hopper whence it falls on a sieve or series of sieves moving rapidly to and fro. Meanwhile a strong current of air is sent through the machine and blows out the chaff at one end. The cleansed grain is then graded by a series of sieves of different mesh and each size led to its proper chute. The early type of winnowing machines was of wood, and was moved by hand. The present-day machine, in America at least, is merely an attachment to the big power-driven threshing machines. Before the introduction of these machines the process of winnowing was slow

and laborious. It consisted in throwing up the grain by means of sieves or shovels while an air current, blowing across, carried away the chaff. Consequently winnowing was impossible on a windless day. When the first machine was introduced into Britain, by a farmer in Scotland in 1737, it met strong opposition, as interfering with the divine prerogative which alone had power over the winds. But the advantages soon overcame the prejudice whose record Walter Scott has preserved in *Old Mortality*—making Mause Headrigg speak anachronously to her mistress about "a new-fangled machine for *dighting* the corn frae the chaff, thus impiously thwarting the will o'Divine Providence, by raising wind for your leddyship's use by human art, instead of soliciting it by prayer, or patiently waiting for whatever dispensation of wind Providence was pleased to send upon the shielin-hill."

WINNSBORO, town, Louisiana, seat of Franklin Parish, 33 miles southeast of Monroe, on Turkey Creek. The city is a trade center for a rich agricultural region. There are cotton gins and compresses, sawmills, and manufactures of wood products.

Founded c.1844; the town was incorporated in 1902. Pop. (1950) 3,655.

WINNSBORO, wĭnz'bûr-ō, city, South Carolina, and seat of Fairfield County, altitude 545 feet, is served by the Southern Railway. It is 27 miles north of Columbia; it was named for Col. Richard Winn. It is situated in an agricultural area, which also produces lumber, stone and granite. At nearby Winnsboro Mills village a modern plant manufactures cord for automobile tires. The city has grade and high schools, and churches for whites and Negroes. It was settled in mid-18th century and incorporated in 1785. Pop. (1950) 3,267.

WINNSBORO, town, Texas, on the Franklin-Wood County line, 50 miles east-southeast of Greenville. It is a shipping center for cotton, and truck and dairy products, and there are lumber mills. Nearby are oil wells. Pop. (1950) 2,512.

WINONA, wĭ-nō'nȧ, city, Minnesota, and seat of Winona County, altitude 664 feet, on the Mississippi River, is served by the Chicago, Milwaukee, St. Paul and Pacific; Burlington; Green Bay and Western; Chicago Great Western; and the Chicago and North Western railroads. It is on two federal highways and one state highway. Located 40 miles east of Rochester, Winona is beautifully landscaped. From the bluffs of the river can be seen the panorama of the Hiawatha Valley. Sugar Loaf and Trempealeau Mountains are parts of the high bluffs which border the city. The river is spanned by bridges connecting the city with Wisconsin.

Industries.—Winona is the second largest hay and clover seed market in the United States. Its manufactured products include flour, millwork, meat packing, gloves, hosiery, knit goods, tire chains, medicines, tinware, malt, beer, pickles, and toilet preparations. Brick making is also a leading industry. The limestone of Winona is highly regarded by architects. It is also a shipping point for grain, hay, vegetables, lumber, and livestock.

Educational Facilities.—In addition to its public school system the city has two Catholic seminaries for girls, two business schools, a state normal school, and an art gallery. The public library has murals by Kenyon Cox. The Winona General Hospital has a nurses' training school. The principal public buildings are the government buildings, the courthouse, municipal buildings.

History and Government.—Winona was founded 1851 by Captain Orren Smith when the Indians were urged to withdraw to an island beneath the bluffs. In 1852 it was laid out as a town. It was chartered as a city in 1857. It owns and operates a water-works. Its government is by a council. Pop. (1940) 22,490; (1950) 25,031.

WINONA, city, Mississippi, seat of Montgomery County, altitude 386 feet, is served by the Columbus and Greenville; and the Illinois Central railroads. It is located on federal highways; 87 miles northeast of Jackson, in an agricultural region in which cotton and grain, beef, cattle, and milk are the chief products. It has a hickory mill, a moulding factory, and a cotton goods factory. The public school system includes separate schools for whites and Negroes. The high school was established in 1887. Pop. (1950) 3,441.

WINOOSKI, wĭ-nōōs'kĭ, city, Vermont, in Chittenden County; altitude 200 feet; on the Winooski River; 3 miles northeast of Burlington; on the Central Vermont Railroad. It is distinctly an industrial city, producing textiles, furniture, doors and sash, and screens. Settlement, in 1787, was prompted by intent to utilize the power of the falls, and the large plants of today draw power from the river. The city shares the cultural advantages of near-by Burlington. It is the seat of St. Michael's College. Formerly a village in Colchester town, Winooski was incorporated separately, as a city, in 1922. Pop. (1940) 6,036; (1950) 6,734.

WINOOSKI, wĭ-nōōs'kĭ, or **ONION,** a river in Vermont, which has its rise in the northeastern part of the state, flows southwesterly, then northwesterly, past Montpelier, breaking through the Green Mountains and enters Lake Champlain about five miles northwest of Burlington. Total length about 100 miles. In several places it has cut deep picturesque gorges, and it has several falls. The falls at Middlesex and Winooski furnish extensive water power for manufacturing. The valley of the Winooski was visited by a destructive flood in 1927. To prevent a recurrence of this disaster, three flood control dams were built on tributaries of the Winooski between 1933 and 1937.

WINSHIP, Albert Edward, American editor and author: b. West Bridgewater, Mass., Feb. 24, 1845; d. Cambridge, Mass., Feb. 17, 1933. He studied at Andover Theological Seminary, and in 1876–1883 was pastor of the Prospect Hill Church, Somerville. From 1886 he edited the *Journal of Education,* Boston. He was a member of the Massachusetts Board of Education in 1903–1909. An ardent advocate of free public education, the National Education Association elected him honorary president for life.

WINSLOW, wĭnz'lō, **Edward,** American colonial governor: b. Droitwitch, Worcestershire, England, Oct. 19, 1595; d. at sea, between Santo Domingo and Jamaica, May 8, 1655.

While making a tour of the Continent he became a member of John Robinson's Leyden congregation. He was one of the passengers in the *Mayflower,* and in the first conference with Massasoit offered himself as a hostage, and won the attachment of the Indian chief, which he increased in 1623 by curing him of a severe illness. After the death of his wife during the first winter at Plymouth he married Mrs. Susannah White, mother of Peregrine White, her husband having died in that same winter also, and theirs was the first marriage in New England. In 1623–24 he made two voyages to Europe as agent for the colony, of which he was chosen governor in 1633, 1636 and 1644. While visiting England again in 1635 as agent for the colony, he was imprisoned by Laud in the Fleet prison for 17 weeks on the charges of having taught in the church although a layman, and of having performed marriage as a magistrate. Another voyage was made by him in 1646 to answer charges against the colonists of religious persecution and intolerance. In 1649 he again visited England, was instrumental in the organziation of the society for the propagation of the gospel in New England, and was employed in various public affairs under the Commonwealth. In 1655 Cromwell appointed him one of three commissioners to superintend an expedition against the Spaniards in the West Indies, and he died before its completion. He was the author of several works, mostly controversial writings in defense of New England. The principal are 'Good News from New England' (1624); 'Hypocrisie Unmasked' (1646); 'The Danger of Tolerating Levellers in a Civil State' (1649), and 'Glorious Progress of the Gospell amongst the Indians' (1649). These have been reprinted by the Massachusetts Historical Society.

WINSLOW, Forbes Benignus, English alienist: b. London, of a Massachusetts family, August 1810; d. Brighton, Sussex, 3 March 1874. He came to this country in early life, studied medicine in New York, was graduated from the College of Surgeons, London, in 1835, and took his M.D. at Aberdeen. Having after 1830 paid special attention to the study of insanity, he opened a private asylum at Hammersmith, and later another in London, and came in time to be a supreme authority on all relating to diseases of the brain. He founded and edited the *Quarterly Journal of Psychological Medicine and Mental Pathology* (1848) and the *Medical Critic* (1861), was the juridical and president of the Medical Society of London (1853), and a member of numerous scientific bodies. He published 'The Application of Phrenology to the Elucidation and Cure of Insanity' (1831); 'Anatomy of Suicide' (1840); 'Plea of Insanity in Criminal Cases' (1843); 'Notes on the Lunacy Act' (1845); 'Softening of the Brain' (1849); 'Lethsonian Lectures on Insanity' (1854); 'Obscure Diseases of the Brain and Disorders of the Mind' (1860; 4th ed. 1868); 'Light, its Influence on Life and Health' (1867).

WINSLOW, Hubbard, American Presbyterian clergyman: b. Williston, Vt., 30 Oct. 1799; d. there, 13 Aug. 1864. He was graduated from Yale in 1825 and from Yale Theological Seminary in 1828. He was pastor of the First Church, Dover, N. H., 1828–32, and of the Bowdoin Street Church, Boston, 1832–44, and during the next 10 years was the principal of the Mount Vernon Young Ladies' Institute at Boston. He edited the *Religious Magazine* 1837–40, lectured widely on religious and secular topics, was pastor of the First Presbyterian Church, Geneva, 1857–59, and of the Fiftieth Street Presbyterian Church, New York, 1861–62. He was a voluminous writer, and among his works may be cited 'The Doctrine of the Trinity' (1831); 'Controversial Theology' (1832); 'The Appropriate Sphere of Woman' (1837), republished as 'Woman as She Should be' (1838); 'Elements of Intellectual Philosophy' (1852); 'The Hidden Life' (1863).

WINSLOW, John, American soldier: b. Plymouth, Mass., 27 May 1702; d. Hingham, Mass., 17 April 1774. In 1740 he was appointed by the council captain of a company recruited in Boston for the expedition against Cartagena (q.v.); and in June 1754 sailed in the provincial ship *Massachusetts* to build a fort on the Kennebec. This he began on a point half a mile below the Teconick Falls, where it was finished by William Lithgow in the next year. With Scott he was a commander of the 1,800 troops sent by New England in 1755 to remove the French from the posts established on the Bay of Fundy. The French forts at Beauséjour and Gaspereau were taken, and on 11 August Winslow, then with rank of lieutenant-colonel, and in command at Mines, was instructed to remove the Acadians in his vicinity, a task which he described to the French inhabitants as «very disagreeable.» He strictly followed his orders, however, as «it is not my business to animadvert.» In 1756 he was appointed to command the campaign on Lake Champlain, holding now the grade of major-general, and was stationed at Fort William Henry. He led another expedition to the Kennebec in 1758–59, and subsequently was chief justice of the Court of Common Pleas for Plymouth County and a member of the legislature and the council. He was associated with Samuel Adams in the preparation of documents regarding the Stamp Act troubles.

WINSLOW, John Ancrum, American naval officer: b. Wilmington, N. C., 19 Nov. 1811; d. Boston, Mass., 29 Sept 1873. He was appointed midshipman in the navy in 1827, was promoted lieutenant in 1839, and served in the Mexican War, participating in the expeditions against Tabasco, Tampico and Tuspan. He was made commander in 1855, in 1861 joined the Mississippi flotilla, and in 1862 was commissioned captain. In 1863–64 he was in command of the steamer *Kearsarge,* assigned to the special duty of pursuing the Confederate privateer *Alabama.* On 14 June 1864 he found the *Alabama* off Cherbourg, France, and blockaded her in that harbor until 19 June, when Captain Semmes notified Winslow of his intention to fight. The *Kearsarge* steamed seven miles out from shore in order to be on neutral waters, and then turned to meet the privateer. The *Alabama* fired the first shot, and the battle continued for an hour and a half, the vessels fighting in circles, which brought

them constantly closer until the distance between them was but 600 yards. The *Alabama* then began to sink and raised the white flag. Winslow numbered but three killed and wounded out of his crew of 163 officers and men, and took 65 prisoners. It was the most important sea fight of the war between two ships, and Captain Winslow received a vote of thanks from Congress, and was promoted commodore, his commission dating from the hour of his victory. He was in command of the Gulf Squadron in 1866–1867, was promoted rear admiral in 1870, and was commander in chief of the Pacific Squadron in 1870–1872.

WINSLOW, Josiah, American colonial governor, son of Edward Winslow (q.v.): b. Marshfield, Mass., 1629; d. there, Dec. 18, 1680. From the command of the Marshfield military company in 1652 he rose to the rank of major and commander in chief of the forces of the Plymouth colony in 1658. He was chosen deputy to the general court in 1653, and was one of the commissioners of the united colonies from 1658 to 1672. He was assistant governor of the Plymouth colony for several years prior to 1673, and from that date until his death was its governor, the first native-born governor in America. During King Philip's War he was ex officio, and, according to rank, general in chief of the entire army of the united colonies. He wrote a poem commemorative of Governor Bradford, which may be found in George Morton's *New Englands Memoriall* (1669).

WINSLOW, Miron, American missionary: b. Williston, Vt., Dec. 11, 1789; d. Capetown, Cape of Good Hope, Africa, Oct. 22, 1864. He was graduated from Middlebury College, Vermont, in 1815, and from Andover Theological Seminary in 1818. He went as a missionary of the American Board to Ceylon 1819, and continued in the mission field for 44 years. He founded the Madras mission 1836; was president of the native college at Madras 1840; translated the Bible into Tamil 1835, and published *Comprehensive Tamil and English Dictionary of High and Low Tamil* (1862), a great work, containing over 67,000 Tamil words, the most complete of its time.

WINSLOW, William Copley, American Egyptologist, son of Hubbard Winslow (q.v.): b. Boston, Mass., Jan. 13, 1840; d. there, Feb. 2, 1925. He was graduated at Hamilton College, Clinton, N. Y., and at the General Theological Seminary, New York, in 1865. He took orders in the Episcopal Church, was rector of St. Luke's Church, Lee, Mass., 1867–1870, and in 1883 became secretary of the Free Church Association in the Episcopal Church. He was assistant editor of the New York *World* 1862–1863, and of the *Christian Times* 1864–1865. He founded the American branch of the Egypt Exploration Fund in 1883, and served until 1903 in some official capacity. He wrote *Israel in Egypt* (1883); *The Store City of Pithom* (1885); *A Greek City in Egypt* (1887); *The Egyptian Collection in Boston* (1890); *The Pilgrim Fathers in Holland* (1891).

WINSLOW, wĭnz'lō, city, Arizona, in Navajo County, altitude 4,832 feet, is served by the Santa Fe Railroad. It has an airport and is on a federal highway, with bus connections to all parts of the country. Located 58 miles east of Flagstaff in a stock-raising area, it is a railroad center with lumber mills. Situated near the Painted Desert and the Petrified Forest, Winslow is a tourist resort. First settled in 1882, it was incorporated as a town in 1900, and as a city in 1926. It has the common council form of government. Pop. (1950) 6,518.

WINSLOW, town, Maine, in Kennebec County; altitude 160 feet; at the confluence of the Kennebec and Sebasticook rivers; 18 miles northeast of Augusta; on the Maine Central Railroad. It is industrially connected with Waterville across the river. The Block House, built in 1754, is still in excellent condition. The town was incorporated in 1771. Pop. (1950) 4,413.

WINSOR, wĭn'zẽr, **Justin,** American historian and librarian: b. Boston, Mass., Jan. 2, 1831; d. Cambridge, Mass., Oct. 22, 1897. He was educated at Harvard, and subsequently studied at Paris and Heidelberg. He was superintendent of the Boston Public Library 1868–1877, and librarian of Harvard 1877–1897. He published *History of the Town of Duxbury* (1849); *Bibliography of Original Quartos and Folios of Shakespeare* (1876); *Reader's Handbook of the American Revolution* (1879); *Memorial History of Boston* (edited 4 vols., 1880–1881); *Narrative and Critical History of America* (edited 8 vols., 1884–1889), his most scholarly achievement; *Christopher Columbus* (1891); *Cartier to Frontenac* (1894); *The Mississippi Basin: The Struggle in America between England and France* (1895); *The Westward Movement* (1897). He ranked as the highest authority on the early history of North America.

WINSTED, wĭn'stĕd, city, Connecticut, in Litchfield County; altitude 765 feet; is served by the New York, New Haven and Hartford Railroad, and one federal and one state highway. Situated on the Still and Mad rivers, it is 8 miles north of Torrington, and is a commercial and industrial center. The Mad River furnishes considerable water power. Scythes and clocks have been made here for nearly 150 years. Other products are fishing tackle, electrical equipment, wood and paper boxes, edge tools, pins, wire, spool silk, hosiery, and knit goods. Here are the Gilbert School (endowed by W. L. Gilbert, clock manufacturer), the Memorial and Gilbert School libraries, the Litchfield County Hospital of Winchester, and the William L. Gilbert Home for Dependent Children. Winsted is called the Laurel City from the luxuriant mountain laurel nearby. It is a popular resort; trout fishing, boating, shooting, skiing, and auto racing on ice are local sports. Settled in 1758, the township of Winchester was incorporated in 1771. Winsted, its principal village, was incorporated as a borough in 1858, and town and borough governments were consolidated in 1917. It has a commission government. Pop. (1950) 8,781.

WINSTON, wĭn'stŭn, **John Anthony,** American politician: b. Madison County, Ala., Sept. 4, 1812; d. Mobile, Ala., Dec. 21, 1871. He was educated at Lagrange College, Alabama, and at the University of Nashville, Tennessee, and subsequently engaged as a cotton planter and com-

mission merchant. He was elected to the state Assembly in 1839–1840 and in 1842; to the state Senate in 1843, serving until 1852, and was president of that body in 1845–1848. At the Baltimore convention of 1848 he was the recognized leader of the Alabama Democracy, and in 1853–1856 was governor of his state. He was the first native-born governor of Alabama, and by his refusal to sign certain bills for aiding railroad companies by state loans he gained the title of the "veto governor." His course was sanctioned, however, by the people, as he was re-elected in 1855, and his measures were sustained by the legislature in the following session. He was a delegate to the Charleston convention of 1860 and opposed secession, but later became a colonel in the Confederate Army. He commanded a brigade in the Peninsular campaign, and was conspicuous for gallantry at Seven Pines, but his health compelled his retirement from the army soon afterward, and he took no further active part in the war. He was a member of the state constitutional convention in 1865, and in 1866 was elected to the United States Senate, but was refused admission.

WINSTON, N. C. See WINSTON-SALEM.

WINSTON-SALEM, wĭn'stŭn sā'lĕm, city, North Carolina, and seat of Forsyth County, altitude 884 feet, is served by the Norfolk and Western, and Southern railroads. It has an airport; and is on eight federal and three state highways. It is situated 68 miles north-northeast of Charlotte. It is a great tobacco market located in a region famous for its tobacco. The leading industry of the city is the manufacture of cigarettes and other tobacco products. It also has large knitting mills manufacturing men's and boys' underwear and hosiery. Other manufactures include electronic equipment, woolen blankets, textiles (especially dyeing and finishing), air-conditioning equipment, furniture, and dairy products. Manufacturing is mostly concentrated in Winston, the newer city. The older part, Salem, is mainly residential.

Educational Facilities.—The city has 16 public elementary schools, and four public high schools. Three colleges located in the city are Salem College, for women, founded in 1772; Bowman Gray School of Medicine of Wake Forest College; and Winston-Salem Teachers College, a coeducational Negro institution. There are also two business colleges, and trade schools. The city's three hospitals are the City Memorial, Kate Bitting Reynolds Memorial, and North Carolina Baptist. There are numerous recreational areas and parks.

Places of Interest.—There are many old buildings of the Moravian period: The Brothers' House (1769), now a Church Home; Salem Tavern (1784); The Sisters' House (1786), part of Salem College; the old Boys' School (1796), now the Wachovia Historical Museum; and the Home Moravian Church, built in 1800, with a graveyard called God's Acre famous for its Easter sunrise services.

History and Government.—Salem was founded in 1766 as a Moravian church community by a group of Moravians who came from Pennsylvania in 1753. Nicholas Ludwig Zinzendorf (q.v.), patron of the Moravian Church, selected the name Salem, meaning "peace." In 1849 some land, just north of Salem, was bought from the Moravian congregation to be the seat of the newly-created Forsyth County. In 1851 the legislature gave it the name of Winston, in honor of Major Joseph Winston of Kings Mountain fame. The old city of Salem and the new city of Winston were consolidated in 1913. It is governed by a mayor and board of aldermen under the city-manager form of government. Pop. (1940) 79,815; (1950) 87,811.

WINT, Peter de. See DE WINT, PETER.

WINTER, wĭn'tĕr, SIR **James Spearman,** Canadian statesman: b. Lamaline, Placentia Bay, Newfoundland, Jan. 1, 1845; d. Toronto, Oct. 6, 1911. He was called to the bar in 1867 and was notably successful in his profession. He served in the Newfoundland House of Assembly in 1874–1889, was its speaker in 1877–1878, solicitor general in 1882–1885, and attorney general in 1885–1889. He was a judge of the Supreme Court of Newfoundland in 1893–1896; and in 1897–1900 he was premier. He represented Newfoundland at the Washington Fisheries Conference in 1887–1888; and in 1890 and 1898 he was a delegate to the London conferences in regard to the French Treaties question. He was also a member of the Anglo-American International Conferences at Quebec and at Washington in 1898.

WINTER, John Strange. See STANNARD, HENRIETTA.

WINTER, vĭn'tĕr, **Peter von,** German composer: b. Mannheim, Germany, about 1754; d. Munich, Oct. 17, 1825. Although practically self-taught, he became in 1776 the director of the Munich court theater. His most popular work, *Das unterbrochene Osterfest,* was produced in 1796 at Vienna whence he returned to Munich in 1798. In London he met great success with *Calypso* in 1803; *Proserpina* in 1804; and *Zaïra* in 1805. His last opera, *Sanger und Schneider,* was produced at Munich in 1820. Winter also composed some impressive sacred music, including a number of masses.

WINTER, wĭn'tĕr, **William,** American author and dramatic critic: b. Gloucester, Mass., July 15, 1836; d. June 30, 1917. He was graduated from the Harvard Law School in 1857, was admitted to the Suffolk County bar, but never practiced, preferring to devote his time to literature. He published in 1854 a book of verse, *The Convent, and Other Poems;* and was for a time a successful lyceum lecturer. From 1860 he was a contributor to the *Saturday Press* and other New York periodicals; for several years was assistant editor of the *Albion;* and in 1865 became dramatic reviewer for the New York *Tribune* for which he continued to write until 1909. He was at one time also managing editor of the New York *Weekly Review;* and he was a frequent contributor to leading magazines and reviews. In addition to his criticism, he became known also for his biographical studies, and his sketches of travel abroad and historic foreign localities. He wrote further *The Queen's Domain, and Other Poems* (1856); *My Witness* (1858), poems; *Thistledown* (1878), poems; *Poems,* complete edition (1881); *The Jeffersons* (1881); *English Rambles* (1884); *Henry Irving* (1885); *Stage Life of*

Mary Anderson (1886); *Shakespeare's England* (1888–1910), chapters of travel and historical study; *The Wanderers* (1889–1892); *Gray Days and Gold* (1891), and *Old Shrines and Ivy* (1892), essays on England; *Shadows of the Stage* (1892–1895); *The Life and Art of Edwin Booth* (1893), and *The Life and Art of Joseph Jefferson* (1894); *A Wreath of Laurel* (1898); *The Theatre and the Public* (1905); *Over the Border* (1911); *Vagrant Memories* (1915); *The Life of David Belasco* (1918). He also edited (1881) the works of Fitz-James O'Brien (q.v.), and *The Shakespearean and Miscellaneous Plays of Edwin Booth* (1899). *Poems of William Winter* appeared in 1909.

WINTER, one of the four seasons, the coldest of the year. Astronomically considered, winter begins in northern latitudes when the sun enters the sign of Capricorn, or at the solstice about December 21 and ends at the vernal equinox in March; but in its ordinary sense it is taken to include the months of December, January, and February.

WINTER CHERRY, a solanaceous herb of the genus *Physalis alkekengi* of the south of Europe, cultivated for its ornamental fruit. It is a downy perennial, with semidecumbent stems and broad deltoid leaves. The axillary, solitary flowers have campanulate five-lobed whitish corollas. The calyces are also five-toothed and campanulate, but in fruit become inflated so that they are like miniature membranous balloons surrounding a pulpy, globose, cherrylike berry, which is edible, well flavored, and acidulous, serving chiefly for preserves. These fruit-bladders are of a bright scarlet hue, and glow far into the winter. They will even keep their color for some time when cut. The plants are also known as alkekengi, bladder herb, and strawberry tomato.

WINTER PARK, city, Florida, in Orange County; altitude 100 feet; on U.S. Highway No. 17, is served by the Atlantic Coast Line Railroad. It is located five miles northeast of Orlando. It is an educational and winter resort; many of its residents are retired professional people. Winter Park is the home of Rollins College, founded 1885, a coeducational institution. The city has a modern school system and a public library. The college library also is open to the public. There are many social and cultural activities which include the Beal-Maltbie Shell Museum, the Mead Botanical Gardens, and the Kraft Azalea Gardens. Chartered in 1887, and incorporated as a city in 1925, it has the mayor-council-city manager form of government. Pop. (1950) 8,250.

WINTERBERRY. Several members of the genus *Ilex*, of the holly family, are known by this name, including the inkberry (q.v.). They are all native to eastern North America, but the species commonly indicated by the name is the black alder (*I. verticillata*), an arborescent shrub, common in swampy places and along the banks of streams, often overhanging the water. The acute, oval leaves turn black in autumn, and the axillary cymes of tiny polygamodoecious, whitish flowers, are succeeded by brilliant scarlet berries, that are as large as a pea, and are so crowded on the bare branches as to appear verticillate. They remain on the shrub all winter, and twigs are often sold by city florists for winter decoration. The bark of the winterberry is tonic and astringent, and in infusion has been employed as a lotion for dressing ulcers. The smooth winterberry (*I. laevigata*) is a handsome shrub at all seasons and is similar to the black alder, but has larger stalked drupes, is of a more orange tint, less crowded, and ripens earlier.

WINTERGREEN, a name applied to several ericaceous plants which retain their foliage over winter. In eastern North America, the aromatic little *Gaultheria procumbens* (see GAULTHERIA) is generally the plant referred to by this name. It is a low shrub, barely six inches high, found in rocky woods, with creeping stems, half hidden, from which arise erect reddish branches, bearing ovate, glossy, leathery leaves. These are serrate with bristly tipped teeth and are gathered in a tuft at the top of the slender stalk, the fleshy, white or pinkish, urn-shaped flowers nodding underneath. The fruits are bright scarlet, mealy, and spicy in flavor; and are really enlarged fleshy calyces which have enclosed the seed-capsules and assumed the form of a berry. They are sometimes called checkerberries, and remain throughout the winter. The whole plant is aromatic in taste, and is frequently eaten, foliage, berries and all. The spiciness is due to the volatile oil of Gaultheria which is a stimulant, astringent and diuretic drug, but is chiefly used for flavoring, confectionery or pharmaceutical preparations. It is a commercial product distilled from the wintergreen where it is plentiful, or from the sweet birch (*Betula lenta*). The various members of the genus *Pyrola* are called wintergreen, such as the round-leaved wintergreen, a common plant with a few orbicular or oval, long-petioled, coriaceous leaves. The flowers are somewhat like those of the lily of the valley, and are fragrant. The spotted wintergreen (*Chimaphila maculata*) is another plant found in shady woods. It has a decumbent stem, sending up slender branches, which bear a few lanceolate leaves mottled with white, and several white flowers, tinged with purple. Still another wintergreen is the chickweed-wintergreen (*Trientalis americana*), a spring blooming herb, with a dainty, white, starry blossom, poised above a whorl of foliage like tiny peach leaves.

WINTERHALTER, vĭn'tĕr-häl-tĕr, **Franz Xaver,** German portrait painter: b. Menzenschwand, near Saint Blasien, April 20, 1805; d. Frankfort-on-the-Main, July 8, 1873. He was educated at the academies of Munich and Carlsruhe, and also studied a while in Italy. In 1834 he established himself in Paris, where he obtained the patronage of Louis Philippe, and of many persons of note.

WINTER'S BARK, the cortex of an evergreen magnoliaceous shrub (*Drimys winteri*) of the mountains of South America. In commerce this bark is quilled or curved, gray outside, brown internally. It has a peculiar aromatic odor, a very pungent and astringent taste, and serves as a tonic, stimulant and antiscorbutic drug. Paratudo bark is a variety of winter's bark. There are many substitutes for the drug, and much of the winter's bark of commerce is obtained from the West Indian *Cinnamodendron corticosum* and *Canella alba.*

WINTER'S TALE, The. *The Winter's Tale* by William Shakespeare was probably

composed, and certainly performed, in 1611; is first known to have been published in the First Folio of 1623; and by all evidence belongs, with 'Cymbeline' and 'The Tempest,' to Shakespeare's latest work. In closely packed and elliptical language, and in verse which tends to break down into prose under the strain of its matter, each play of this group exhibits various and contrasting, even incongruous, materials, loosely linked together to produce from an unhappy and unpromising beginning a romantically happy close. From storm and shipwreck and exile, from slander upon women's virtue, from tyrannical usurpation, lust, and rage, from foul-mouthed charges and unmotived and almost pathological jealousies and conspiracies, from the death or exposure of children, such «dramatic romances» move on through idyllic love-scenes and lucky voyages to the happy marriage of lovers, the reconciliation of enemies, and the restoration of children and of thrones. These closing works of Shakespeare were perhaps the outcome of a golden sunset mood — the mood which Dowden named «On the Heights»; but they are more likely to have been affected by externals — the vogue of Beaumont and Fletcher's dramatic romances in particular, and more generally by the prevalent Alexandrianism of contemporary taste, which preferred a staccato succession of fortuitous events, contrasted, surprising, picturesque and idyllic, to any closely knit dramatic structure or well-marked connection of action with motive, of scene with scene and of cause with effect.

Satisfying this taste there was present in Elizabethan literature a new ingredient, the Greek prose romances, which the Renaissance had made accessible in editions and translations — the 'Æthiopica' of Heliodorus, the 'Clitophon and Leucippe' of Achilles Tatius, and the 'Daphnis and Chloë' of Longus. Matter from one or more of them had been used by Sir Philip Sidney in his 'Arcadia' and by Robert Greene in several prose tales. From one of these — 'Pandosto; The Triumph of Time' (1588, 1607, 1609; often afterward reprinted as 'Dorastus and Fawnia'), Shakespeare in turn took nearly the whole plot of 'The Winter's Tale.'

'Pandosto' is certainly compounded of many simples; and nearly all come from one or another of the Greek romances. Heliodorus gives a hint for Greene's jealous king, and supplies outright his trial-scene, oracle, exposure of child with tokens, finding of child, and restoration of child to a father who, not knowing her, is about to condemn her to death; Achilles Tatius gives the imprisonment and brutal wooing of a maiden by a would-be lover; Longus gives rich details of the exposed child's rearing among the shepherds. 'Pandosto' is a réchauffé of Greek fiction, with all its diversity, loose motivation and fortuitousness.

Most of the foregoing material, taken by Greene from the Greek romances, is in 'The Winter's Tale.' The matters which Shakespeare has discarded are all among those which Greene added — the Queen's death, the King's wooing of his own daughter, the King's suicide. Shakespeare saves Hermione to be restored as a statue come to life; and his Leontes does not woo Perdita or kill himself. Such changes bring the play still nearer to the Greek romance type; other changes, again, substitute genuine motive and causation for the mere coincidences with which Greene was content; while still others make it probable that for pastoral material Shakespeare went behind Greene directly to a Greek romance. viz., Angel Day's English version (1587) of 'Daphnis and Chloë.' The Greek romances thus, both mediately and immediately, are important «sources» of 'The Winter's Tale.' In fact, this play stands as the typical representative of the Greek romance tradition in English drama.

The dramatic structure of 'The Winter's Tale' is what might be expected of such a tradition. Leontes' jealousy, for example, is not only without justification, but — unlike Othello's — without plausible motive or cause. Again, between Act III and Act IV the play breaks in two: in time there is a lapse of 16 years; in place a shift from Sicilia to Bohemia; in action a complete transference of interest to the affairs of the younger generation. And again at the end the scene shifts back to Sicilia; Perdita's «recognition» and her betrothal to Florizel occur off-stage and are only reported; while the chief interest is finally shifted back again to the restoration of Hermione. Sir Philip Sidney's 'Defence of Poesy' gave by anticipation an amusing censure of the type; and even the most liberal of modern dramaturgists — one who is not in the least under the spell of rules or «unities» — is severe upon these shifts. It is as if Shakespeare had set out to exemplify to the full not only «romantic» content but «romantic» structure.

Yet 'The Winter's Tale' is charming — charming just so far as it is not a type of anything, but is mere Shakespeare. For, as usual, Shakespeare has transmuted his tradition and has added fresh delights. His pastoral is an idyll of the world's springtime — its pure gold foiled just enough by Autolycus's roguery; nothing in all the great gallery of Shakespearean character surpasses in finish and reality Autolycus or the loyal Paulina; nothing in the tragedies is grander than the grand emotional play of the statue scene. What we remember of 'The Winter's Tale' is Perdita's daffodils and Autolycus' patter, Paulina's plain speaking, and above all, Hermione, every inch a queen, moving like some celestial luminary through all her noble phases, from ascendency, past crooked eclipses, back into the main of light.

'The Winter's Tale' was performed in 1611, in 1612–13, 1624 and 1634; but when revived in 1741, «it was announced as not having been played for nearly 100 years.» Morgan's version of it, performed in 1754, was superseded in 1756 by Garrick's ('Florizel and Perdita'), which continued to be performed as late as 1796. Kemble revived the original at Drury Lane in 1802, playing Leontes to Mrs. Siddons's Hermione; and Charles Keene gave it in 1856 as a Greek play. Among celebrated Hermiones have been Helen Faucit (1847); Mary Anderson (1887), who played the double rôle of Hermione and Perdita; and Ellen Terry (1906).

For the less familiar views offered above consult Thorndike, Ashley H., 'The Influence of Beaumont and Fletcher on Shakespeare'

(New York 1901); Baker, George Pierce, *The Development of Shakespeare as a Dramatist* (New York 1907); Wolff, Samuel Lee, *The Greek Romances in Elizabethan Prose Fiction* (New York 1912); Matthews, Brander, *Shakspere as a Playwright* (New York 1913).

SAMUEL LEE WOLFF.

WINTERSET, wĭn'tĕr-sĕt, city, Iowa, and seat of Madison County; altitude 1,129 feet; on the Chicago, Rock Island and Pacific Railroad, one federal and one state highway; 35 miles southwest of Des Moines. It is in a region which produces wheat, corn, hay, livestock, and ships farm and dairy products. It has large stone quarries, a stone-crushing plant, monument works, paper clip factory, and creamery. There are several old covered bridges over nearby streams. A monument commemorates the first Delicious apple tree. It has a mayor and council. Pop. (1950) 3,570.

WINTERTHUR, vĭn'tĕr-tōōr, Switzerland, commune in the canton of Zurich, 12 miles northeast of Zurich. It has a fine city hall, a number of fine churches, a gymnasium, and a museum of natural history. Its manufactures include machinery, locomotives, silk and cotton goods, textiles, soap, beer, and flour. Pop. (1950) 66,971.

WINTHER, vĕn'tĕr, **Christian** (in full RASMUS VILLADS CHRISTIAN FERDINAND WINTHER), Danish poet: b. Fensmark, Zealand, Denmark, July 29, 1796; d. Paris, France, Dec. 30, 1876. He was educated at the University of Copenhagen, and became immediately popular on the appearance in 1828 of his first volume of poems. He was one of the truest interpreters of the Danish national character. Some of his numerous publications are *Sang og Sagn* (*Song and Legend,* 1841); *Lyriske Digte* (*Lyrical Poems,* 1849); *Nye Digte* (*New Poems,* 1850); *Hjortens Flugt* (*The Flight of the Hart,* 1855), a lyric romance of the Danish Middle Ages, his greatest work.

WINTHROP, wĭn'thrŭp, **Beekman,** American government official: b. Orange, N. J., Sept. 18, 1874; d. Nov. 10, 1940. He was graduated from Harvard University in 1897 and was admitted to the bar in 1899. In 1900 he went to the Philippine Islands as private secretary to the governor, William H. Taft, whom he later served as assistant executive secretary and as acting executive secretary; and in 1903–1904 he was a judge of the Court of First Instance. He was governor of Puerto Rico in 1904–1907, assistant secretary of the treasury in 1907–1909; and assistant secretary of the navy in 1909–1913. Afterward he engaged in banking in New York.

WINTHROP, Fitz-John (real name JOHN WINTHROP), American colonial governor, son of John Winthrop (1606–1676, q.v.): b. Ipswich, Mass., March 14, 1638; d. Boston, Mass., Nov. 27, 1707. He studied at Harvard and afterward in England, where he served in the army of the Protectorate until the Restoration. Returning to Connecticut in 1663 he was elected to the assembly in 1671, served as major in King Philip's War, and in 1686 as a member of the council of Governor Andros. He was a magistrate in 1689, major general commanding the expedition against Quebec in 1690, Connecticut agent at London 1693–1697, and governor of Connecticut from 1698 until his death.

WINTHROP, James, American jurist, son of John Winthrop (1714–1779, q.v.): b. Cambridge, Mass., March 28, 1752; d. there, Sept. 26, 1821. He was graduated from Harvard in 1769, was librarian there 1772–1787, and for several years was chief justice of the Massachusetts Court of Common Pleas, and register of probate.

He published *An Attempt to Translate the Prophetic Part of the Apocalypse into Familiar Language* (1794); and *Systematic Arrangement of Prophecies relating to Antichrist* (1795). His library was bequeathed to Allegheny College, Meadville, Pa.

WINTHROP, John, American colonial governor: b. Edwardston, near Groton, Suffolk, England (O. S.), Jan. 12, 1588; d. Boston, Mass. (O. S.), March 26, 1649. He studied at Trinity College, Cambridge, was bred to the law and, according to the testimony of Cotton Mather, was commissioned at 18 a justice of the peace. His earlier years were spent on his estate of Groton Manor, but his Puritan tendencies and the current of his political sympathies presently interested him in plans for colonization in America. When in 1629 a charter was obtained creating a corporation under the name of the "Governor and Company of the Massachusetts Bay in New England," the piety, learning and talents of Winthrop led to his election as governor. Converting his hereditary estate, yielding an annual income of £600 or £700, into money, he set sail in the *Arabella* from Yarmouth in March 1630, with a company of about 900 persons. On the voyage he composed a small treatise, entitled *A Model of Christian Charity.* On June 12 (O. S.) they arrived at Salem, Mass., and the government was immediately transferred to him by Endicott, who had been the acting governor for two years by authority of the London company, before the transfer of the charter to New England. He was re-elected every year until 1634, when his popularity had somewhat declined, partly on account of his long continuance in office. In 1636, when Sir Henry Vane was elected governor, Winthrop was chosen deputy governor, and during this and the following year occurred the celebrated controversy in regard to Mrs. Hutchinson (q.v.) and her doctrines. In this matter Vane and Winthrop were on opposite sides, and in the election of 1637 the latter was chosen governor over Vane. The inhabitants of Boston, however, were friendly to Vane and Mrs. Hutchinson, and Winthrop was at first slighted by his neighbors. Subsequently he engaged in a controversy with his defeated opponent in regard to the alien law passed by the general court. He was re-elected every year until 1640; and in 1642 the troubled state of the colony induced the settlers to call him again to the head of the government. He was again elected in 1643, in the two following years was made deputy governor, and in 1646 governor again, which office he continued to hold the remainder of his life. In his principles Winthrop was opposed to an unlimited democracy; and when the people of Connecticut were forming a government, he wrote them a letter in which he said that "the best part of a community is always the

least, and of that best part the wiser part is always the lesser.» But he was attached to civil liberty, disinterested, pure and conscientious. «It would be erroneous,» says Palfrey, in speaking of the Commonwealth of Massachusetts, «to pretend that the principles upon which it was established were an original conception of Winthrop's mind; but undoubtedly it was his policy, more than any other man's, that organized into shape, animated with practical vigor, and prepared for permanency, those primeval sentiments and institutions that have directed the course of thought and action in New England in later times.» Winthrop kept a journal containing an account of the transactions in the colony down to the year 1649. The first two books were first published in 1790, and the manuscript of the third, which was for a long time lost, was found in 1816 in the tower of the Old South Church. The three were published in a revised edition, entitled 'The History of New England from 1630 to 1649' (with notes by James Savage, 1825–26). Consult 'Collections of the Massachusetts Historical Society' (3d series, Vols. IX and X); Earle, A. M., 'Margaret Winthrop' (New York 1895); Twitchell, J. H., 'John Winthrop' (in 'Makers of America Series,' New York 1891); Whitmore, 'Notes on the Winthrop Family and its English Connections' (1864); Winthrop, R. C., 'Life and Letters of John Winthrop' (Boston 1864–67).

WINTHROP, John, American colonial governor, son of Gov. John Winthrop, of the Massachusetts Bay Colony: b. Groton Manor, Suffolk, England, 12 Feb. 1606; d. Boston, Mass., 5 April 1676. He was educated at Bury Saint Edmund's Grammar School, at Trinity College, Dublin, and at the Inner Temple, London, where he studied law. He obtained a commission in the army, and served with Buckingham in the expedition for the relief of the Huguenots near La Rochelle, France, in 1627, went in the following year to Turkey as an attaché of the British embassy, traveled in various countries of Europe, in 1631 joined his father in Massachusetts, where he became governor's assistant, and in 1633 settled at Ipswich, of which he was one of the principal founders. Obtaining a commission under a grant to the Earl of Warwick, he founded Saybrook, at mouth of the Connecticut River, in 1635, built there a fort, and was made titular governor. In 1645 he removed his family from Boston to Pequot Harbor, and in the following year founded New London. After the union of Saybrook with Connecticut he became a magistrate of the increased colony (1651), and from 1657 to the end of his life served almost continuously as its governor. He was bearer to Charles II (1662) of a loyal address from the Connecticut government, and received from the king a suitable charter for the colony. Under an equally favorable charter he secured the union of the Connecticut and New Haven colonies. He was one of the commissioners of the United Colonies of New England in 1675. A student of physics and chemistry, through his scientific attainments he became a member of the Royal Society, to whose 'Transactions' he was a contributor. Consult Waters, T. F., 'Sketch of the Life of John Winthrop, the Younger' (Cambridge, Mass., 1899).

WINTHROP, John, American physicist, great-grandson of John Winthrop (1588–1649) (q.v.): b. Boston, 19 Dec. 1714; d. Cambridge, Mass., 3 May 1779. He was graduated from Harvard in 1732, and from 1738 until his death was Hollis professor of mathematics and philosophy there. He was one of the most important American scientists of the 18th century and exercised much influence upon the scientific thought of his contemporaries, in particular upon Franklin and Count Rumford (q.v.). He noted the transits of Mercury in 1740 and 1761, going to Newfoundland in the latter year for this purpose in a vessel supplied by the Massachusetts Province. He twice declined the presidency of Harvard, was for some years a judge of probate for Middlesex County, and was a member of the governor's council 1773–74. He was a prominent advocate of political liberty. He published 'Lecture on Earthquakes' (1755), and is sometimes claimed as the founder of the science of seismology. He published 'Answer to Mr. Prince's Letters on Earthquakes' (1756); 'Account of Some Fiery Meteors' (1755); 'Two Letters on the Parallax and Distance of the Sun as deducible from the Transit of Venus' (1769).

WINTHROP, Robert Charles, American political leader: b. Boston, Mass., 12 May 1809; d. there, 16 Nov. 1894. He was graduated from Harvard in 1828, studied law with Daniel Webster, and was admitted to the bar in 1831. He soon became active in political life, allying himself with the Whig party, and in 1834 was elected to the Massachusetts legislature, where he served five years, being speaker of the house for three years. In 1840–50 he was a member of Congress, and in 1847–49 speaker of the House of Representatives. In 1850, on Webster's resignation from the Senate, Winthrop was appointed his successor for the unexpired term, but in 1851 failed to secure election to the Senate. In 1851, as Whig candidate for governor, he received a plurality of votes, but the constitution at that time required an absolute majority for election; the election, therefore, went to the legislature, where he was defeated. During his term in Congress he had shown himself a conservative, and though opposed to the extension of slavery, and to the Mexican War, he had no sympathy with the extreme abolitionists, and desired compromise between North and South. His defeat was due, therefore, to a coalition between the Free-Soilers and the Democrats in the Massachusetts legislature. After the Whig party dissolved, he took no prominent part in political work; he did not join the Republican party, but occasionally spoke in behalf of the Democrats, though not actively affiliated with them. He made frequent public addresses on various national anniversaries and occasions, being the chief speaker at the laying of the cornerstone of the Washington Monument in 1848, and on the completion of the work in 1885. He was president of the Massachusetts Historical Association for 30 years, and had a leading part in the organization and direction of the Peabody Education Fund (q.v.). He wrote 'Life and Letters of John Winthrop' (1864–67); 'Washington, Bowdoin and Franklin' (1876); 'Memoir of Henry Clay' (1880).

Consult Winthrop, R. C., Jr., *A Memoir of Robert C. Winthrop* (Boston 1897).

WINTHROP, Theodore, American soldier and novelist: b. New Haven, Conn., Sept. 28, 1828; d. Big Bethel, Va., June 10, 1861. He was graduated at Yale in 1848; traveled extensively in Central and South America; studied law at St. Louis; was admitted to the New York bar in 1855; and joined the Seventh New York regiment in 1861. The *Atlantic Monthly* from June to September of that year contained sketches which he had written of early war scenes. He was killed at the head of an assaulting column of Northern troops at Big Bethel. He left completed material for five volumes of novels and essays: *Cecil Dreeme* (1861); *John Brent* (1862); *Edwin Brothertoft* (1862); *The Canoe and the Saddle* (1863); and *Life in the Open Air and Other Papers* (1863). These passed through many editions, and were reprinted in the *Leisure-Hour Series,* with the addition of his *Life and Poems,* edited by his sister, Laura Winthrop Johnson (New York 1884).

WINTHROP, wĭn'thrŭp, town, Maine, in Kennebec County; altitude 200 feet; 10 miles west of Augusta; on the Maine Central Railroad. It has oilcloth factories, a woolen mill, and is a supply center for summer vacationists. There is a high and elementary school. The town, consisting of several villages, was first settled in 1765 on Pondtown Plantation. The oilcloth industry was begun in Maine in 1830 by Ezekial Bailey of Baileyville, one of the villages. Pop. (1940) 2,508; (1950) 3,026.

WINTHROP, town, Massachusetts, in Suffolk County; altitude 36 feet; on Boston Harbor; 6 miles northeast of Boston by highway; has rapid transit connection with Boston; and is served by the East Boston airport. Situated on the peninsula enclosing Boston Harbor on the north and east, it is a residential suburban community, with no major industries. It has junior and senior high schools, and a public library. Several yacht clubs have headquarters here. Settled in 1634 and named for Governor John Winthrop, it was incorporated in 1852, upon being separated from North Chelsea. Winthrop has representative town government. Pop. (1950) 19,496.

WINTHROP COLLEGE, formerly known as Winthrop Normal and Industrial College of South Carolina, an educational institution for white women, founded at Rock Hill, S. C., in 1886. It gives normal and industrial training and is supported by state appropriations, but about one half of its property, which is valued at nearly $1,000,000, has come from other sources than state funds. It admits girls of 15 years or over. Its enrollment (1951–1952) was 1,567 students, and its staff numbers 118. It conducts a summer school. There are 92,000 volumes in the library. Tuition fees are kept low, and living expenses are extremely moderate. The buildings, equipment, and grounds are valued at more than $4,000,000.

WINTON, wĭn't'n, borough, Pennsylvania, in Lackawanna County; altitude 872 feet; 9 miles northeast of Scranton; on the Delaware and Hudson, and the Delaware, Lackawanna and Western railroads. It is chiefly occupied in coal mining. It was incorporated in 1877. Pop. (1940) 7,989; (1950) 6,280.

WINTUN, wĭn-to͞on' ("people," "Indians"), a group of tribes, which, with the Patwin group, form the Wintun linguistic stock of North American Indians. The habitat of the stock is northern California from Mount Shasta, including the headwaters of the Sacramento and the drainage of McCloud River; thence southeastward along the Sacramento Valley to the mouth of Chico Creek, from which point to its mouth the Sacramento forms the southeastern boundary. On the west the Coast Ranges intersect the territory of the Copehan stock, the westernmost limit of which extends almost to the south branch of Trinity River, about latitude 40° 30′ N. From the latitude of Cape Mendocino the Coast Ranges form the western boundary as far as John's Peak, whence it extends in an irregular line southeastwardly to San Pablo Bay. The tribesmen live largely by fishing, although various roots, nuts, berries, farinaceous seeds and clover blossoms form part of their subsistence. They are fond of water and are constant bathers in the streams that drain their country. Salmon are caught with spears, in the use of which they are exceedingly expert. Their weapons were formerly bows and arrows, and slings. They were indifferent hunters, but were successful in ensnaring deer in traps of their own construction. The population of the score or more of tribes forming the stock is not known, only the Nomlaki and the Wailaki being officially recognized. These are under the Round Valley Agency and are small in number.

WIRE, Manufacture of. At the present time all wire is made by the drawing process, and while permitting the production of a much thinner wire than could be obtained from the rolls, it also gives a wire of greater tensile strength, so much so that the smaller the size to which the wire is drawn down, the greater is its ultimate breaking strength per square inch. The breaking strength of English piano wire ranges from 225 pounds for No. 12 music wire, which is 0.029 inch in diameter, to 650 pounds for No. 22, which is 0.052 inch in diameter, indicating an ultimate tensile strength ranging from 300,000 to 240,000 pounds per square inch. This wire shows a content of carbon, 0.570 per cent; silicon, 0.090 per cent; sulphur, 0.011 per cent; phosphorus, 0.018 per cent; and manganese, 0.425 per cent.

In the past all classes of iron wire were made entirely from wrought iron and required very careful preparation of the raw material to insure toughness and high tensile strength; but, with the discovery of the Bessemer and the open-hearth converting processes, and the consequent lowering of the cost of production accompanied by an enormous increase in the strength of the raw material, wrought iron was quickly supplanted by mild steel. The great increase in the strength of steel wire over that of wrought iron may be better appreciated from the following statement of facts: The ultimate tensile strength of the best bright, hard-drawn wrought-iron wire is about 70,000 pounds to the square inch, while that of ordinary Bessemer steel is 80,000 pounds, and that of open-hearth steel is 120,000 pounds to the

square inch. In the special grades of wire manufactured from high carbon, open-hearth steel, the values range from 200,000 pounds to 340,000 pounds per square inch.

A description of the process of manufacture may be begun with the billets. The bulk of the wire of commerce is made from Bessemer steel billets, while open-hearth billets are worked up into rods for the manufacture of chain, for special grades of wire and for various finished products requiring great tensile strength. The reduction of the billets to the rods which are the raw material of the wire-drawer is done by a rolling-mill (q.v.). The billets are generally stored near the continuous heating furnaces located at the upper end of the rod mill. In the larger plants, when the mill is in full operation, four furnaces are continually at work, with a fifth held in reserve. The billets, which are 4 × 4 inches in section, and 36 inches in length, are fed into the furnace transversely, side by side, and are pushed through the furnace door by a hydraulic charging machine. After they have been heated to the right temperature for rolling, they are pushed out, one after the other, through the rear door of the furnace on to a conveyor which takes them to the rod mill, where they are passed through the roughing rolls. This mill consists of eight pairs of rolls, and by its operation reduces the billet from its section of 4 × 4 inches to a rod of three-fourths of an inch square and of great ultimate tensile strength. The alternate pairs of rolls are provided with different shaped grooves so as to press the rods into shapes alternately square and oval, oval and round, etc., thus working the metal thoroughly and improving its qualities. In the eighth pair of rolls the grooves are one-fourth of an inch square, and from them the rods are carried to the finishing mill where they are given 10 more passes and brought down to the required dimensions.

The finishing mill lies at right angles to the roughing mill with its 10 pairs of rolls arranged side by side. As the rods issue from one pair of rolls, they are seized with a pair of tongs by workmen who bend them around and feed them into the next pair. The rapid increase in length is accommodated by the increased speed of the successive pairs of rolls, that of the 10th pair being about 1,350 feet per minute, or about 15 miles per hour. The entire operation of rolling down the billet to a finished rod one-fourth inch square and about a quarter of a mile long, is accomplished in one heat. The smallest size of rod produced in the rolling mill is three-sixteenths of an inch in diameter. As the rods issue from the last pair of rolls, their ends are seized and attached to the drums of the reels on which they are wound into coils of convenient size, and then dropped upon a conveyor, by which they are carried to the wire mill. In the wire mill, the coils are thoroughly cleaned of scales, oil and dirt by being placed in wooden tanks containing a weak solution of sulphuric acid. They are then placed in lime, and then in the bakeries and dried thoroughly. Up to this point the product is technically known as "rods," and only after it has been drawn to a smaller diameter, at least to one-fifth of an inch, is it known under the commercial designation of "wire."

The wire-drawing machine consists of a stout bench upon which is mounted a cast-iron drum, around which the wire is wound as it is drawn through the dies. In drawing, the coil of rod is placed on a spool fastened to the floor of the shop near the end of the bench, and the end of the wire having been swaged down, it is inserted in the larger end of the hole in the die-plate, passed through and caught by the tongs attached to the drum which is revolved until the entire coil has been drawn down. The die-plate is a heavy block of cast steel in which are set several dies of various sizes, the latter made of the hardest chrome steel. The hole in the die is conical, the smaller end being the size to which the wire is drawn. In forming the die this opening is made smaller than required and enlarged to the correct size by driving a suitable punch into it — the compression thus exerted increasing the hardness of the drawing surface in the die. The sockets in the die-plate into which the dies are set are slightly conical and as the dies wear to a point at which the wire becomes too large, the dies are driven further into the die-plate, thus reducing the opening and are again sized with the punch. Once started the speed of the drum must be constant or the wire will be of uneven diameter, becoming slightly smaller when the mill is stopped.

Drawing is by the wet or dry process. The latter is used in drawing from No. 6 (B.W.G.) to No. 18, the lubricant employed being tallow and talc. The former is used for the higher numbers, the lubricant being a mixture of meal, flour and water. By some wire-drawers the efficacy of stale beer is highly praised. After being drawn through several successively smaller dies the wire becomes hard and has to be annealed before the process can be continued. The annealing is followed by pickling, washing and beating to free it from scale. No. 6 wire can be drawn down to No. 11 in three passes, but from No. 14 down to No. 22 requires seven passes. To reduce the rod one-fifth of an inch in diameter to wire of one-twenty-fifth of an inch in diameter requires 12 drawings and three annealings. The speed at which the wire is drawn through the dies varies with its size and the kind of metal used — from 12 inches to 45 inches per second. Steel wire averages a speed of about 800 feet per minute; iron and brass, 1,000 feet per minute; and copper and silver about 1,200 feet per minute. For the very finest wire the dies are of diamond or ruby.

In drawing wire the centre or core of the metal rod is pulled forward, the outer surface being held back by the friction of the die. The consequence is that a series of strains is set up in the wire which seriously affect its strength and this condition is removed by placing the coils in the annealing pots, where they are carefully sealed with sand to exclude the air, and are then exposed to a steady heat for a period of eight or nine hours. Of the total finished product taken out of the annealing pots, a portion is ready for the market without any further treatment; a portion is galvanized; but a considerable portion is converted into wire-cloth, wire nails and barbed wire. See NAILS.

Not all wire manufacture, however, is as

TABLE SHOWING THE DIAMETERS IN DECIMALS OF AN INCH OF THE "NUMBERS" OF WIRES IN CURRENT COMMERCIAL GAUGES.

COMMERCIAL NUMBERS	American or Brown & Sharpe	Birmingham, or Stubs' Iron Wire	Washburn & Moen, American Steel and Wire Co. and Roebling Iron Wire	Trenton Iron Co.	British Imperial	Stubs' Steel Wire	Washburn & Moen, American Steel and Wire Co., and Roebling Steel Wire	American Steel and Wire Co., Music Wire
0000000	.....	.....	0.4900	.....	0.5000	.....	.....	.....
000000	0.58000	.....	0.4615	.....	0.4640	.....	0.4600	0.004
00000	0.51650	0.500	0.4305	0.4500	0.4320	.....	0.4300	0.005
0000	0.46000	0.454	0.3938	0.4000	0.4000	.....	0.3930	0.006
000	0.40960	0.425	0.3625	0.3600	0.3720	.....	0.3620	0.007
00	0.36480	0.380	0.3310	0.3300	0.3480	.....	0.3310	0.008
0	0.32490	0.340	0.3065	0.3050	0.3240	.....	0.3070	0.009
1	0.28930	0.300	0.2830	0.2850	0.3000	0.227	0.2830	0.010
2	0.25760	0.284	0.2625	0.2650	0.2760	0.219	0.2630	0.011
3	0.22940	0.259	0.2437	0.2450	0.2520	0.212	0.2440	0.012
4	0.20430	0.238	0.2253	0.2250	0.2320	0.207	0.2250	0.013
5	0.18180	0.220	0.2070	0.2050	0.2120	0.204	0.2070	0.014
6	0.16200	0.203	0.1920	0.1900	0.1920	0.201	0.1920	0.016
7	0.14430	0.180	0.1770	0.1750	0.1760	0.199	0.1770	0.018
8	0.12850	0.165	0.1620	0.1600	0.1600	0.197	0.1620	0.020
9	0.11440	0.148	0.1483	0.1450	0.1440	0.194	0.1480	0.022
10	0.10190	0.134	0.1350	0.1300	0.1280	0.191	0.1350	0.024
11	0.09070	0.120	0.1205	0.1175	0.1160	0.188	0.1200	0.026
12	0.08080	0.109	0.1055	0.1050	0.1040	0.185	0.1050	0.029
13	0.07200	0.095	0.0915	0.0925	0.0920	0.182	0.0920	0.031
14	0.06410	0.083	0.0800	0.0800	0.0800	0.180	0.0800	0.033
15	0.05710	0.072	0.0720	0.0700	0.0720	0.178	0.0720	0.035
16	0.05080	0.065	0.0625	0.0610	0.0640	0.175	0.0630	0.037
17	0.04530	0.058	0.0540	0.0525	0.0560	0.172	0.0540	0.039
18	0.04030	0.049	0.0475	0.0450	0.0480	0.168	0.0470	0.041
19	0.03590	0.042	0.0410	0.0400	0.0400	0.164	0.0410	0.043
20	0.03200	0.035	0.0348	0.0350	0.0360	0.161	0.0350	0.045
21	0.02850	0.032	0.0317	0.0310	0.0320	0.157	0.0320	0.047
22	0.02530	0.028	0.0286	0.0280	0.0280	0.155	0.0280	0.049
23	0.02260	0.025	0.0258	0.0250	0.0240	0.153	0.0250	0.051
24	0.02010	0.022	0.0230	0.0225	0.0220	0.151	0.0230	0.055
25	0.01790	0.020	0.0204	0.0200	0.0200	0.148	0.0200	0.059
26	0.01590	0.018	0.0181	0.0180	0.0180	0.146	0.0180	0.063
27	0.01420	0.016	0.0173	0.0170	0.0164	0.143	0.0170	0.067
28	0.01260	0.014	0.0162	0.0160	0.0148	0.139	0.0160	0.071
29	0.01130	0.013	0.0150	0.0150	0.0136	0.134	0.0150	0.075
30	0.01000	0.012	0.0140	0.0140	0.0124	0.127	0.0140	0.080
31	0.00890	0.010	0.0132	0.0130	0.0116	0.120	0.0135	0.085
32	0.00800	0.009	0.0128	0.0120	0.0108	0.115	0.0130	0.090
33	0.00710	0.008	0.0118	0.0110	0.0100	0.112	0.0110	0.095
34	0.00630	0.007	0.0104	0.0100	0.0092	0.110	0.0100	0.100
35	0.00560	0.005	0.0095	0.0095	0.0084	0.108	0.0095	0.112
36	0.00500	0.004	0.0090	0.0090	0.0076	0.106	0.0090	0.118
37	0.00450	.....	0.0085	0.0085	0.0068	0.103	0.0085	0.124
38	0.00400	.....	0.0080	0.0080	0.0060	0.101	0.0080	0.130
39	0.00350	.....	0.0075	0.0075	0.0052	0.099	0.0075	0.138
40	0.00310	.....	0.0070	0.0070	0.0048	0.097	0.0070	0.146
41	0.00280	.....	0.0066	.....	0.0044	0.095	0.0066	0.154
42	0.00250	.....	0.0062	.....	0.0040	0.092	0.0062	0.162
43	0.00220	.....	0.0060	.....	0.0036	0.088	0.0060	0.170
44	0.00200	.....	0.0058	.....	0.0032	0.085	0.0058	0.180
45	0.00176	.....	0.0055	.....	0.0028	0.081	0.0055	.....
46	0.00157	.....	0.0052	.....	0.0024	0.079	0.0052	.....
47	0.00140	.....	0.0050	.....	0.0020	0.077	0.0050	.....
48	0.00124	.....	0.0048	.....	0.0016	0.075	0.0048	.....
49	0.00099	.....	0.0046	.....	0.0012	0.072	0.0046	.....
50	0.00088	.....	0.0044	.....	0.0010	0.069	0.0044	.....

simple a process as described above. In the making of tungsten wire for electric lamps it is necessary to develop a fibrous condition in the naturally brittle metal. This is accomplished by rolling and hammering rods of the metal while it is red-hot. The operation of drawing also must be done with the hot metal. As tungsten is very hard the dies (of high-speed tool-steel) are quickly worn away. The heat and pressure at which the metal has to be drawn renders the ordinary oily or fatty lubricants of no avail and the only lubricant found effective is fine graphite. This is smeared in paste form over the rod as it passes to the die, and just before it reaches that point a flame heats the rod and its graphite ointment to a red heat, burning in the graphite to a glossy black coating which so adheres that the lubrication lasts for passes through several successive dies. For the finest sizes of tungsten wire the dies are diamonds.

Barbed wire is manufactured in various patterns. The general process may be outlined by a brief description of the machine employed in making what is known as 2-point Glidden barbed wire. Four coils of wire on reels are placed behind the machine. The wire from two of the reels serves to form the strands, while that from the other two is used to form the barbs. The two strand wires, which are larger than the other two, are led between a pair of friction wheels and pulled to a proper tension and then crossed by the other two transversely, one on each side. At fixed intervals of a few inches, according to the desired spacing of the barbs, the two barb wires are caught by a pair of revolving fingers and twisted around one of the strand wires, and at the conclusion of the twist, two pairs of shears cut the ends of the barbs diagonally into sharp points. The wires then pass into a combined winding and twisting machine, by which the two strand wires are twisted around each other, and then to the spool where it is wound up ready for the market. When once started, the operation of wire making is continuous and rapid. The barbed wire used in trench warfare has from two to four times as many barbs as that for fencing cattle and requires additional reels and cutters in its production.

Wire in its several sizes is designated by number according to a scale or "gauge," depending on its diameter. Several different gauges are in vogue in the United States and cause considerable confusion to the uninitiated. The Bureau of Standards at Washington recommends for ordinary steel wire the American Steel and Wire Company's gauge. For piano wire the bureau recommends the same company's "Music Wire Gauge." For copper wire and wire of all metals and alloys other than iron and steel the gauge in commercial use is the Brown and Sharpe wire gauge — also called the 'American Wire Gauge.' Consult Smith, 'Wire: Its Manufacture and Uses' (New York 1891); Allen, H., 'Metallurgical Manual of Iron and Steel' (London 1911); Charnock, G. F., 'Mechanical Technology' (London 1915); Kindl, F. H., 'Rolling Milling Industry' (Cleveland 1913); Mumford, J. K., 'Outspinning the Spider' (New York 1921); Underhill, C. R., 'Coils and Magnet Wire' (New York 1925); Adam, A. T., 'Wire-drawing and the Cold Working of Steel' (1925).

WIRE AND WIRE DRAWING. Wire is defined as metal elongated into a long thread-like form of thicknesses varying from one and one-quarter inches to less than 1/1000 of an inch, each size uniform throughout the piece; these threads having usually the cylindrical form, but they may be square, flat, oval or ribbed, in which case they are known as "shaped wire." The process by which wire is formed is known as drawing. Essentially, this consists in forcibly pulling a suitably prepared piece of the metal thus worked through a series of holes made in hardened steel dies set in a draw-plate and which successively diminish in diameter. In this way the cross section of the wire is gradually reduced to that of the last hole through which it is drawn; its length, meanwhile, being correspondingly and greatly increased. As a consequence, wire can be produced only from such metals as are susceptible in this way of being pulled out or extended by stretching into rods. Such metals are said to be drawable, or to have the property of ductility. This property is not to be confounded with that of malleability, namely, that in virtue of which a metal is laminable, or admits of being hammered or rolled into thin plates; since the same metal is often malleable and ductile in very different degrees. Thus, while gold possesses both these properties in an extreme, and probably in the highest known degree, iron is ductile in a degree far beyond that in which it is malleable, and with tin and lead the reverse is true. Of the familiarly known metals, the most ductile, and in the order named, are gold, silver, platinum, steel, iron, nickel, copper, brass, zinc, tin and lead; while some of the ordinarily brittle metals when made perfectly pure, as bismuth, are said to possess very high ductility. In early times metals were brought to the filamentous form only by means of beating them under the hammer into thin plates, then dividing these by cutting instruments into narrow strips, and finally rounding with the hammer and file. The earliest known mention of "wire drawers" and "wire millers," as those who produced wire by drawing were variously called, occurs in 1351 and 1360, in the histories respectively of Augsburg and Nüremberg, the previous accounts being only of "wire smiths," or those who fabricated wire with the hammer. The change from the old to the new method was accomplished, or very soon followed, by the introduction of a machine by which wire was successfully produced without direct aid of the hand; this machine, probably the invention of one Rudolf, of Nüremberg, was impelled by water power. The precious metals appear to have been the first subjected to this process — brass and iron not until some time later. White wire, or blanch iron wire, is mentioned in a list of articles not to be imported into England in 1463; and in 1484 both iron and latten (fine brass) wire are similarly named. Up to 1565 English iron wire was drawn by hand only, and was of so poor a quality that most of that used in the country, and also wool cards and other articles involving the employment of wire, were imported. As late as 1660 there was no wire mill in England; but in that year patents were granted to manufacture wire in England. In the history of United States industries the first mention of wire drawing occurs in the annals of the town

of Lynn, Mass., where it is recorded that in 1666 Nathaniel Robinson, a «wyer-drawer» petitioned the court for aid in carrying on his trade. This was refused at the time, but later the court authorized the purchase of instruments and tools for this industry and granted a bonus for its encouragement. In 1775 a wire factory was established by Nathaniel Niles in Norwich, Conn., and in 1788 a large wire mill was running in Dedham, Mass., making wire for cards and fishhooks. Pittsburgh had a wire factory in 1791. In 1834, however, there were only three wire mills in all the United States, and their total output was 15 tons for that year. It is worthy of note that one of these original three mills — that at Worcester, Mass. — is now the largest wire producing plant in the world.

The 1919 census of manufactures reported that in that year there were 108 establishments drawing wire in the United States; 66 being strictly manufacturers of wire and 42 being rolling-mills which drew wire in addition to their other business. Of the entire number 74 drew iron and steel wire; 30, copper wire; 22, brass wire; and 24, wire of other metals. Their equipment totaled 62,689 blocks and their total capacity was 4,169,467 tons of wire per annum. The 1919 output of these mills amounted to 2,554,385 tons of steel and iron wire; 220,594 tons of copper wire; 23,625 tons of brass wire; 671 tons of bronze wire; 876 tons of German silver wire; and 5,535 tons of wire of other metals. The aggregate value of the year's production was $392,601,073.

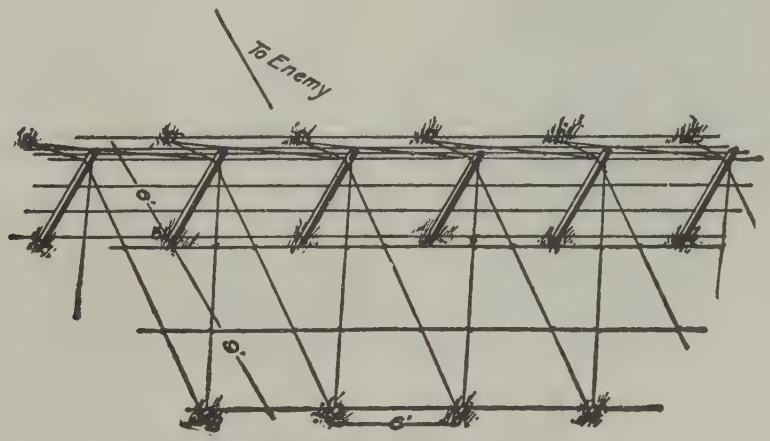
The modern system of wire drawing is described under WIRE, MANUFACTURE OF.

WIRE CLOTH, a sieve-like fabric whose woof and weft are of wire, the size of the wire, the shape and sizes of the meshes, being adapted to the uses of the completed screen, sifter, or sieve, or the character of the machine in which it is to be used.

WIRE ENTANGLEMENTS. By general consent the barbed wire entanglement has become the standard military obstacle. It was highly developed on the Western front during the European War 1914-18, the principal developments being along the line of simplifying the construction and in the use of artillery fire to open a passage for the artillery troops. In constructing «low wire entanglements,» the party should consist of 32 workers, if possible exclusive of non-commissioned officers. Form the party in two ranks and number them in threes, both front and rear ranks. The left file is not numbered. For the sake of explanation letters are given to these parties of three as follows:

ooo	ooo	ooo	ooo	ooo
B	D	F	H	K
ooo	ooo	ooo	ooo	ooo
A	C	E	G	I

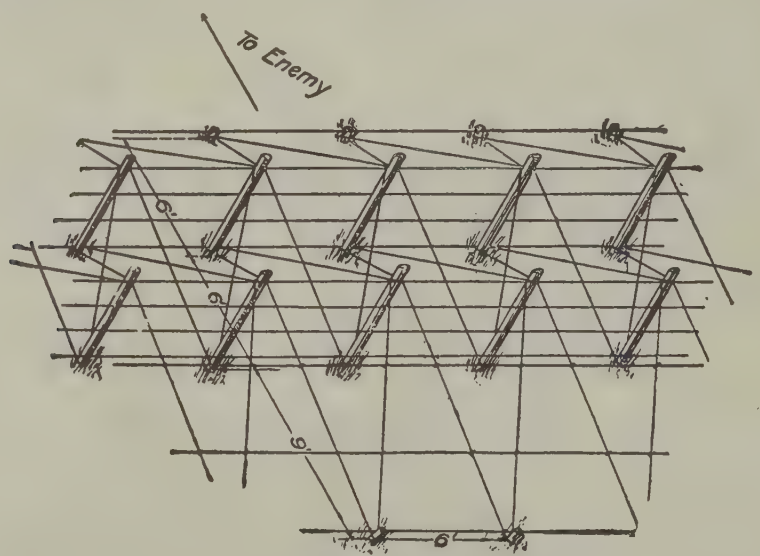
Duties of Parties.— Parties A and B go out almost simultaneously. Party A drives the first row of pickets and so needs a maul. The maul man should be tall. One man mauls, one supplies the pickets, one paces the three yards and holds the pickets for driving. Keeping close up so as not to lose the pickets, comes party B with a coil of barbed wire, a pair of wirecutters and two pairs of hedging gloves. All wire parties carry similar equipment. Starting at the anchor picket, party B runs out to the first straight wire, one man holding and uncoiling the wire, the other two taking round turns, each taking the turns on alternate pickets. About six yards behind is party C, a picket party which drives the second row of pickets, one man again mauling, one holding and pacing, one supplying pickets. This party measures the position of each picket from the front row by going to each picket in the front row, pacing one and one-half yards along the line, turning at right angles and pacing three yards and then planting the picket; this eliminates cumulative errors. Starting six yards behind C comes party D, which works on the same system as B and puts on the diagonal, keeping behind its own wire. Party E runs out the first loose wire, starting about 12 yards behind D. One man holds the coil and unwinds it. One man places the wire in position on the diagonal. The third man clips the loose wire to the diagonal. Party F comes 13 yards behind E and runs out the second straight wire, Party G drives the third row of pickets, measuring the position of each from those of the second row. Party H starts six yards behind G and puts on the second diagonal. Party I starts 12 yards behind H and runs the second loose wire. Party K starts 13 yards behind I and completes the bay with the third straight wire. The direction is kept by the men of the



Double Apron Entanglements.

left file, who provide themselves with a piece of string or tape, equal in length to the distance from the parapet to the front edge of the wire. They go out with party A. One man places himself at the foot of the parapet with one end of the string in his hand. The other runs the string out until it is taut. The man on the parapet keeps the string always perpendicular to the general line of the parapet. The other man keeps it taut and moves along with party A. Work can be done with parties of two men, but if one is hit the work is disorganized. If there are fewer parties the same party may have to do two or more parts of the work. Thus, if there are only six parties A will also do G's work. B will do H's, C will do I's, D will do K's. The pickets must be driven far enough in the first instance. If they have to be driven after the wire is on, the wire will be too low. Mauls should be muffled with sandbags nailed on.

strand of barbed wire is run along the top of each row of French wire, being fastened to the pickets with a round turn six inches above the French wire. These strands of barbed wire are pulled as taut as possible and are twisted on the French wire with a staple, peg or pair of wire cutters close to each picket and in several places between the pickets. This barbed wire supports the French wire. The two rows of French wire are about two feet apart and tied together by a diagonal strand of barbed wire running from the tops of the pickets of one row to the tops of the pickets of the other row. In addition a strand of barbed wire is run along the front of the front row of French wire and twisted to it. This is partly to hold up people trying to crawl through and partly to hold the French wire together, should it come loose from the fastenings. This wire is usually called the «apron wire.» After this, more apron wire can be added or loose wires



Double Fence Entanglements.

French Wire.— This consists of a continual spiral of plain wire three feet six inches in diameter, each turn of wire being clipped to the turns on both sides in five places. When closed up it looks very much like a coil of plain wire, but when pulled out it makes a cylinder of wire mesh. Each small coil pulls out to the length of 20 yards. A big coil consists of five small coils. The extended coil can be easily crushed down by throwing a weight on the top and must, therefore, be supported by pickets and barbed wire. It is easily carried and quickly put up. It is held in place by iron staples five inches long. The number of men required for a party is 26. Two men keep the direction with a string as for low wire and the remaining 24 are divided into parties of three as for low wire. Two or more rows of French wire make an obstacle. Each small coil is stapled down in five places; that is, at each end, one-fourth, one-half and three-fourths of the way along. Where two coils meet the same staple fastens down both coils. Pickets five feet long are driven into the centre of the coils in five places as for the staple. These pickets should be driven in at least a foot. A may be inserted between the two rows. Where opposing trench lines are very close together, stakes cannot be driven for the usual form of wire entanglement on account of the noise of driving which would draw fire. If not too close to the enemy, iron rods with a screw end may be used in lieu of stakes; these may be three-fourths inch in diameter with one or two loops in their length to which to fasten the wire. In ordinary ground such rods can be screwed into a firm hold without noise. When the enemy is too close for this, various forms of portable obstacles in the nature of *chevaux de frise* are employed. These are made up at the depots, brought forward through the trenches and tossed out in front by day or by night.

The «high wire entanglement» is similar in a general way to the low entanglement, but is four to six feet in height. It usually consists of three to five rows of stakes connected by barbed wire. In addition to the horizontal wires conecting the tops of the stakes, it has diagonal wires running from the top of each stake to the bottom of all adjacent stakes. The side toward the enemy should be completed as

an ordinary wire fence. Slight irregularities in height of stakes and arrangement of wires add to the value of the obstacle. Openings for the passage of troops through wire entanglements are generally about 10 yards wide and are placed so that two belts of wire overlap the openings. The continuity of the obstacle may be observed by using gates or barriers that can be quickly opened and closed.

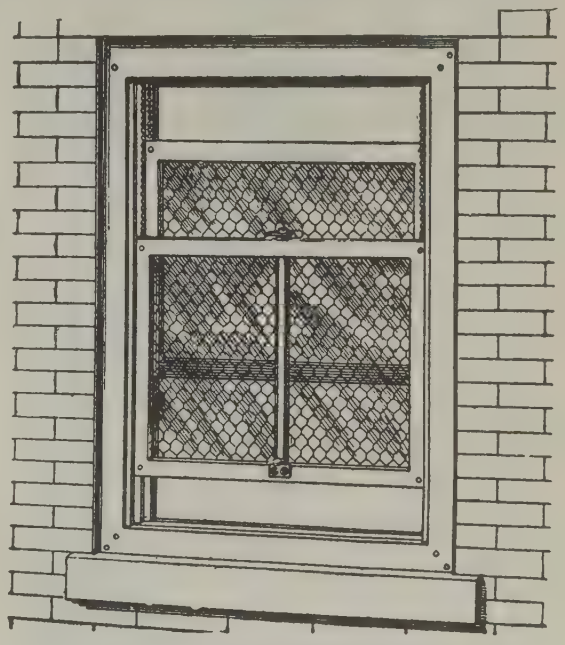
The best place for the openings is at the flanks of the supporting points, points between the wire entanglements around the supporting points and those in the intervals. If these openings must be placed in the intervals on account of the terrain, they must be covered by the close fire of sections of trench placed immediately in rear. The maintenance of a wire obstacle requires constant care. It should be inspected every night, and a few men should be detailed in each company as a permanent wiring party for the repair and improvement of the obstacle. In addition to barbed wire, a charged electric wire is at some places maintained. The wire is charged in section so that in a case of a ground only the section affected will be out of service instead of the entire wire.

EDWARD S. FARROW,
Consulting Military and Civil Engineer.

WIRE GAUGE, an instrument or mechanism for measuring the thickness of wire and sheet metals. It is usually a plate of steel having a series of apertures around its edge, each corresponding in width to the diameter of wire of a certain number. Commercially the standard sizes of wire conform to certain recognized gauges of which the Birmingham wire gauge is used in Great Britain and the American wire gauge in the United States. In 1893 a law was passed authorizing a standard gauge for the United States, for plate iron and steel. This gauge is somewhat used for wire and varies from No. 000,000 = .46 inch to No. 38 = .00625 inch. A special gauge has been developed for measuring electrical wires in units which are called circular mils. Consult 'Mechanical Engineer's Pocket Book' (latest issue) and 'Circular No. 31' of the United States Bureau of Standards.'

WIRE GLASS, a modern invention used in building construction, being a combination of wire and glass. Wire glass is either ribbed, rough rolled, polished plate or "maze," having wire netting imbedded in its centre during the process of manufacture. The temperature at which the wire is imbedded in the molten glass insures cohesion between the metallic netting and the glass, and the two materials become as one, so that if the glass is broken by shock, by intense heat or from other cause it remains practically intact. It combines the strength of the wire netting and the glass plate, and the wire is so thoroughly covered as to obviate the possibility of rust or corrosion. Wire glass will break, but it will not scatter. It can be fractured, but it will retain its place, and the perils incident to falling glass and the ingress or egress of draft and flame are avoided.

The first attempts to introduce a metallic mesh into the body of the glass were for the purpose of increasing its strength and to prevent its falling apart when broken. In this respect the product has been thoroughly developed, but in addition it has proved to be one of the most remarkable fire retardants available for building purposes, and in view of the exceptional hazard attaching to window and skylight openings in all buildings, its use as a fire retardant is outranking in importance as well as quantity its other values. Many experiments have been made to develop different processes of manufacturing wire glass, but, owing to the



Wire Glass Fire-Proof Window

inherent difficulties of maintaining the homogeneous quality of the glass, preventing damage from excessive heat to the wire and securing a practical central location of the wire in the body of the glass only two methods have proved effective. One of these, known as the Shuman process, from the name of its inventor, Frank Shuman, of Philadelphia, consists of rolling a sheet of glass, laying the wire mesh upon the body of the glass, pressing the same into it instantly and while still plastic, and by a coincident process, smoothing over the slight abrasions made in the surface of the glass so as to secure a true and smooth surface on both sides. The other process known as the Appert process, from its inventor, Leon Appert, of France, involves the rolling of one sheet of glass, laying the wire mesh upon this sheet and immediately and by a simultaneous and continuous process pouring and rolling a second sheet upon the top of the wire so as to completely imbed it and secure at the same time an absolutely solid single sheet of finished glass. Wire glass is now made in all the varieties known to the rolled glass process, including rough or hammered, ribbed and figured glass. Wire glass is also polished like plate glass, giving an entirely clear and transparent glass, and is largely used in fireproof office buildings where there is any external exposure to fire.

The mechanical strength of plate glass is effectively increased by the introduction of the wire mesh, so that it will submit to much

greater strains, and in fact one of its first purposes and effects was to eliminate the necessity for using in skylights one-half inch glass. See GLASS MANUFACTURING IN AMERICA.

WIRE ROPE. A helical arrangement of strands of wire around a core, or center. Wires are helically laid into strands, then the strands into rope. Most often the core is made of fiber, but in certain cases, it may consist of a separate strand, or of an independent wire rope. Wire rope is used to operate many different kinds of material-handling machinery; to raise or lower apparatus in mines and wells; to rig ships; and to control assemblies in airplanes. Wire ropes are also used as industrial conveyers; as slings; for passenger elevators in buildings; for suspension bridges; and for bracing or guying tall structures, such as radio transmission towers and gin poles. Although relatively modern in many of its applications, wire rope dates to unrecorded antiquity, a 4-strand wire rope some 15 feet in length having been unearthed in the ruins of Pompeii. This rope was made of bronze. Present day wire ropes are made of iron, traction steel, mild plow steel, plow steel, and improved plow steel. From iron wire rope, which possesses a tensile strength of about 100,000 pounds per square inch, the strength increases, in the preceding order of listing, to the improved plow steel, which has a tensile strength of approximately 240,000 pounds per square inch. Wire rope is also made, for special purposes, of bronze, monel, stainless steel, and other alloys having such characteristics as resistance to corrosion, resistance to heat, and magnetic properties. Steel wire ropes are made of either uncoated or galvanized (zinc coated) wires.

Wire rope may very properly be called a machine, since it has many interrelated working parts. While it exists in many different constructions (to include all the ropes in general or occasional use would require the listing of more than 100 types of construction) about 12 types are adequate for most industrial purposes. The remainder, which are required for a few specific and unusual uses, represent varying ways of combining wires whose cross sections vary in diameter or shape. Wire rope must be constructed in many different ways, since, as a machine, it must work under all sorts of conditions, and endure different factors of wear. For some wire ropes, the chief destructive factor might be abrasion; for others, resistance to bending fatigue; for still others, tensile strength, strain, or corrosion.

The overall, average type of construction—the one most readily adaptable to the greatest number of applications—is called 6 x 19. This means 6 strands of 19 wires each, or a total of 114 wires, plus a fiber core. Even in this 6 x 19 basic construction, there are several variations, such as 6 x 19 Filler Wire, 6 x 19 Seale, 6 x 19 Warrington, 6 x 19 Hemp Clad, and 6 x 16 Filler Wire. Accompanying cross-section illustrations of these constructions show wherein each type differs. Note also the cross-section drawing of a 6 x 7 construction (6 strands of 7 wires each). Obviously a rope of this construction, with its individual wires of larger diameter could withstand far more abrasion than wires of relatively small diameter in the 6 x 19 construction. Obviously, however, the 6 x 19 wire rope would be much more flexible than the 6 x 7, and therefore could withstand bending fatigue longer.

Types of Wire Rope and Their Uses.—The purpose to which a wire rope is to be put largely determines the type of construction selected. A brief explanation of the uses to which the more popular constructions are put can be made as follows:

6 x 19 Filler Wire.—This popular rope has greater flexibility and resistance to bending fatigue than either 6 x 19 Warrington or 6 x 19 Seale. It is used with good results on many machines equipped with rather small sheaves, or drums, especially where abrasion has not too severe an effect upon it. Its principal uses are in: shovel hoists, boom falls, car retarders, car dumpers, coal bridges, coal pockets, coal hoisting towers, derricks, elevators, grab buckets, shaft hoists, inclines, skip hoists, tackle blocks, winches, slings, draglines, trench hoes, locomotive cranes, mining machines, oil well drilling rigs, pile drivers, and as choker ropes, in logging operations.

6 x 19 Seale.—This rope is specified for operations in which greater resistance to abrasion and a more rugged rope body are desired. The outer wires are larger in size, and are thus equipped to wear down more deeply before breaking than are wires of Filler Wire and Warrington constructions. This type, 6 x 19 Seale, withstands crushing on the drum, meets severe service conditions successfully, but is not as flexible; nor does it have as great reserve strength as the Filler Wire and Warrington constructions.

Seale ropes find their principal uses in draglines, car spotters, crab winches, track line on cableways, inclines, logging ropes generally, rotary drilling, scrapers, winches, and as arch lines in tractor logging.

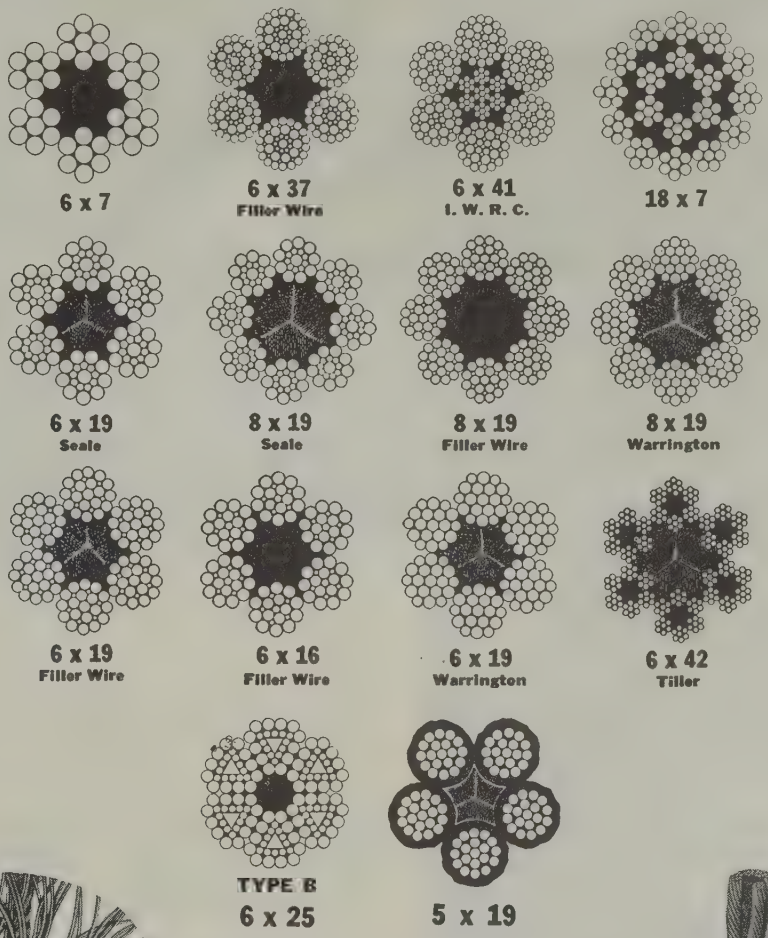
6 x 19 Warrington.—In a Warrington rope, wires of 4 sizes are used. The Warrington construction finds its application largely confined to cable tool drilling lines, though this type of rope is also used successfully on tackle blocks and boom falls, as casing and tubing lines in oil fields, and as slings.

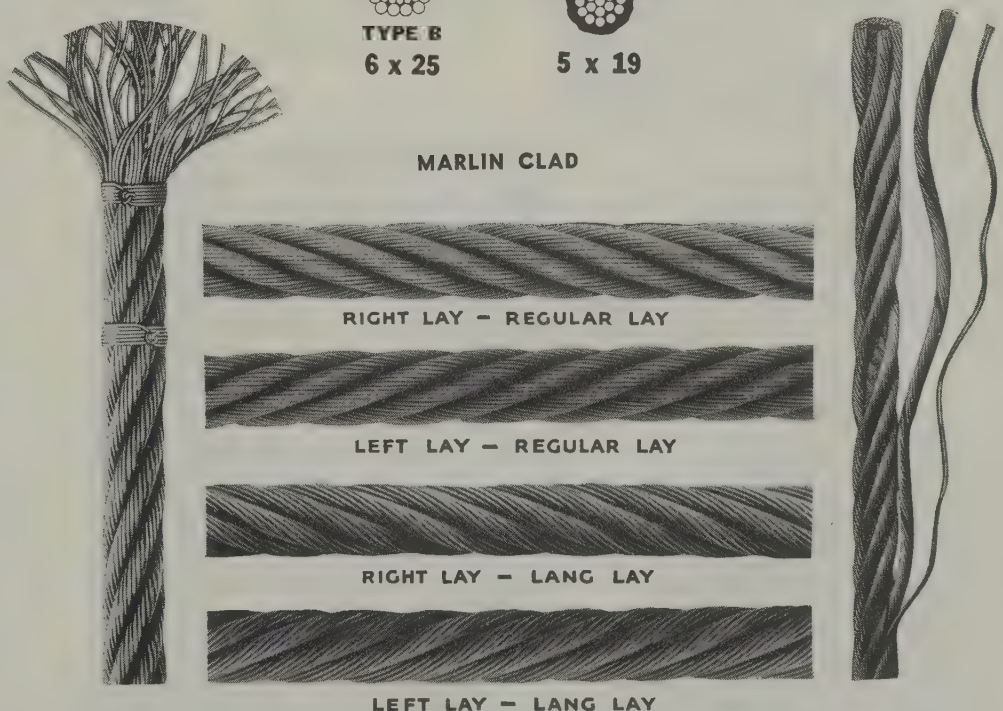
5 x 19 Hemp Clad.—The 5 x 19 hemp-clad (or marlin-covered) rope is selected for operations in which men must handle the ropes continually, or where steel to steel contact over sheaves and drums must be avoided. Hemp-clad ropes are principally used on grain shovels, as topping lifts in marine service, as mooring lines, and for rope drives. This type of rope is also available in the 6 x 19 construction.

Flattened Strand.—The contour of the strands, the arrangement of wires, and the size of wires combine to provide Flattened Strand wire ropes with certain qualities and characteristics: additional strength; greatly increased wearing surfaces that result in greater resistance to abrasion; and larger bearing surfaces, strand on strand, that provide greater resistance to distortion. The smoother contour of the complete rope lessens interlocking of layers under over-winding conditions. This type of rope is used on carrier scrapers, skip hoists, slope haulages; as drag cables, holding and closing lines on coal bridges and towers; as ladder lines on dredges, closing lines on clamshell dredges; as holding and closing lines on grab buckets; and on pile drivers.

6 x 16 Filler Wire.—This rope is adaptable to applications in which it is desired to provide greater resistance to abrasion than is afforded by 6 x 19 Filler Wire, and greater flexibility than can be secured with 6 x 19 Seale. This construc-

WIRE ROPE



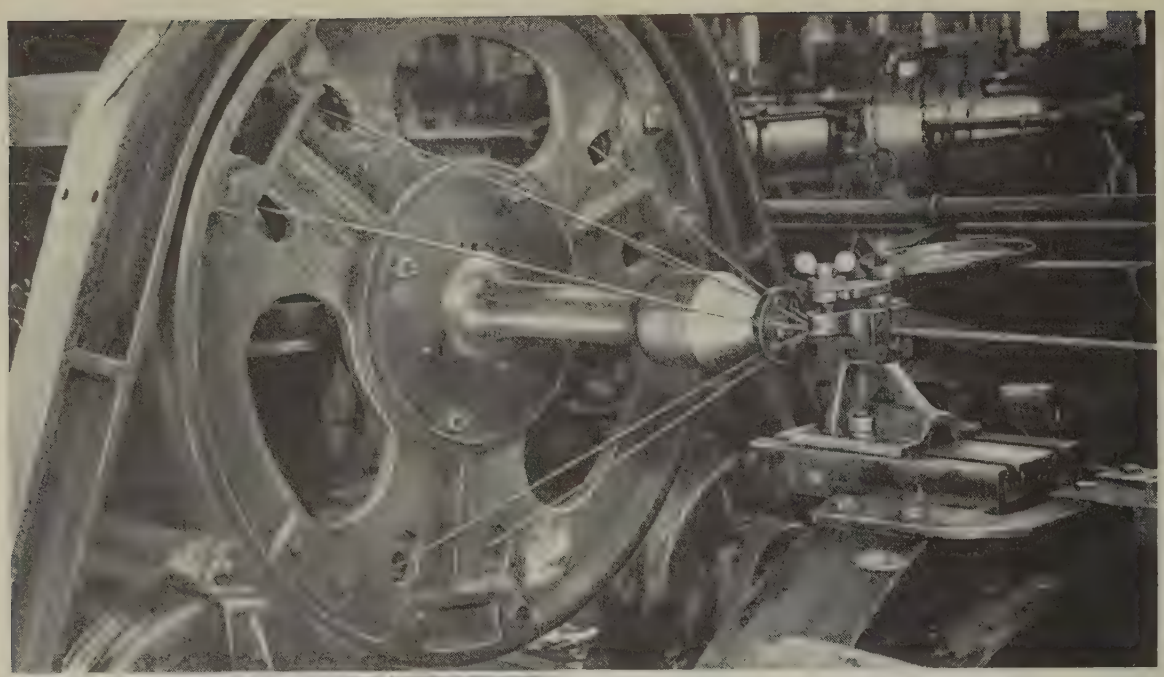


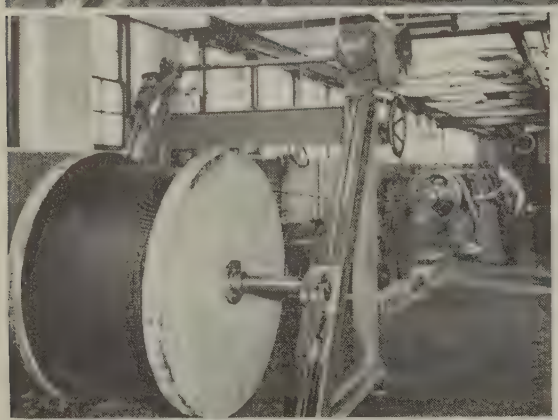
Preformed Wire Rope Information Bureau

Nonpreformed wire rope requires seizing wires to hold strands and wires in place.

Preformed wire rope partially unstranded to illustrate freedom from internal stresses.

WIRE ROPE



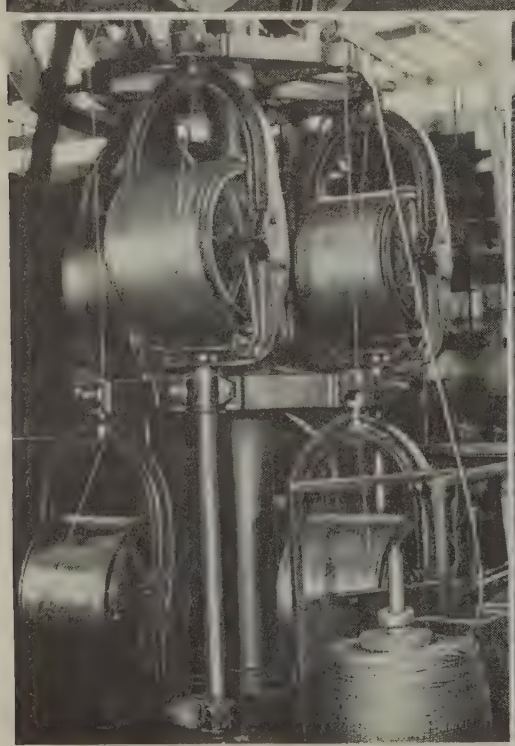


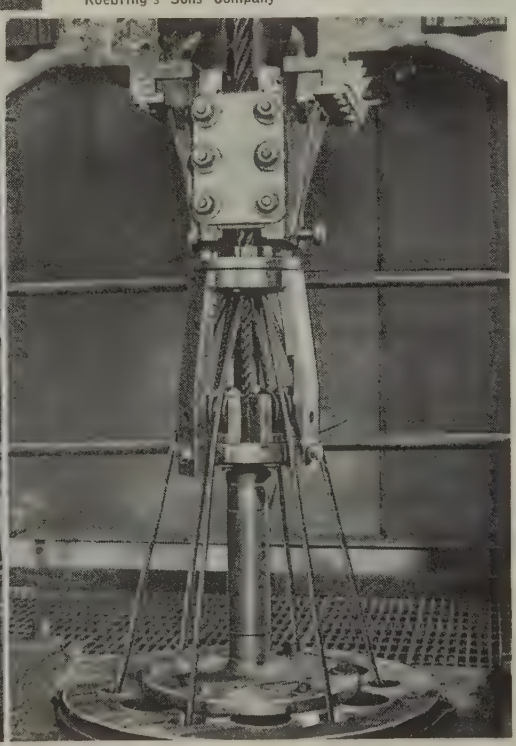
Above: Close-up of a forming head on a 7-bobbin horizontal stranding machine.

Left: A modern design tube-closing machine performing the final step in the manufacture of wire rope.

Below left: Lower half of a vertical wire rope closing machine, showing the bobbins containing the strands, with the fiber core in foreground. *Right:* Upper half of the same machine, showing the strands being laid around the core. The completed wire rope can be seen at top.

(Center) American Chain & Cable Company, Inc.; (others) John A. Roebling's Sons Company





tion is used largely for cargo falls, car haulages, draglines, inclines, and slope haulages.

6 x 7.—Large wires give longer resistance to abrasion. At the same time, they detract from the flexibility of the rope. Their principal advantage and principal limitation define their field of use as one in which rope is likely to be greatly abraded, and in which it encounters few sheaves and drums, except of large diameter. They are principally used in cable tool drilling, in Eastern oil fields; in car haulage, inclines, and transmission; and for sand lines, bailing lines, guys, standing rigging, and torpedo lines.

6 x 37.—These ropes are usually known as extraflexible ropes. The larger number of smaller wires makes them the most flexible among ropes of standard construction. They are intended for use in those services where abrasion is a minor factor, and flexibility and/or bending life is most important. A great advantage possessed by these wire ropes is that more than 50 per cent of their strength is contained in the inner wires, which are protected from abrasion. This type of construction is also used generally for ropes of very large diameter (over 2 inches), in which a lesser number of wires per strand would make the rope too stiff to handle and install. These wire ropes are used chiefly as slings, indoor crane ropes, mining machines, towing hawsers, and shovel hoist lines.

6 x 41 Independent Wire Rope Center (IWRC).—Wire rope of this type of construction is used principally for shovel hoist lines, in sizes ranging from ⅞ inch to 2¼ inches diameter. In these sizes, and for this purpose, 6 x 41 construction with Independent Wire Rope Center is almost always specified as Lang lay—not regular lay. As such, it supplies a suitable combination of flexibility, structural stability or compactness in the strands, longer life of the outer wires of Lang lay ropes under abrasive conditions, and ability to absorb impact or shock stresses.

6 x 42 Tiller Rope.—This type of construction is intended for applications in which the greatest degree of flexibility and comparatively little strength are required. This rope is actually six hemp-core ropes, each 6 x 7, stranded together around another hemp core. The 6 x 42 is used largely as a marine tiller rope on small craft, and as an elevator hand rope.

Application of 8-Strand Ropes.—In addition to the 6-strand constructions, there are a few ropes of 8-strand construction that are occasionally used. These are mostly variations of 6 x 19 designs.

8 x 19 Filler Wire—Filler Wire construction affords greater flexibility than does the 8 x 19 Warrington rope. Filler Wire is used principally for coal pockets and swinging cables, and occasionally for overhead traveling cranes.

8 x 19 Seale.—Where a greater degree of abrasion is encountered, the 8 x 19 Seale construction is employed. This rope is used mostly on passenger elevators, and occasionally for cargo falls.

8 x 19 Warrington.—This rope is used for steering gear cable, for pavers, and for mixers. Like all 8-strand ropes, it has good flexibility, but is more likely to crush on the drum than is a 6-strand rope.

Ropes Other Than 6-Strand or 8-Strand.—Although most wire ropes in use are of either 6-strand or 8-strand construction, it is by no means necessary to limit the number of strands in a rope. Theoretically, a rope may be made of any number of strands, but, unless one has a special, definitely useful purpose in mind, there is no object in making or using any of the "freak" ropes that may be produced. There are, however, a number of very useful ropes that depart from the usual 6-strand and 8-strand constructions. Typical of these is the following:

18 x 7 Nonrotating Construction.—This type of construction offers advantages where the single part of a line lifts an unguided load. In such a case the average line shows a tendency to spin. Spinning has the effect of pulling down the rope lay and untwisting the rope, thus damaging it severely.

Essentially, the 18 x 7 is a rope within a rope. Six inner strands, of seven wires each, are layed around a hemp core to form a Lang lay rope.

The 12 outer strands are laid in opposite directions producing a regular lay rope effect. Under load, the inner strands tend to rotate in one direction, the outer strands tend to rotate in the opposite direction. Since these opposite directional tendencies tend to neutralize each other, the spinning tendency of the rope is greatly reduced.

Wire Rope Cores.—On account of the important position that the center supporting medium assumes in a wire rope, it is sometimes referred to as the heart of the rope. Two kinds of cores are in general use: fiber cores, and metallic cores. The fiber cores are usually of manilla or sisal, but mauritius, jute, or cotton is also used. Cotton and mauritius are used only in small ropes. Still other ropes are manufactured with synthetic, paper, or asbestos cores.

The function of a fiber center in a wire rope centers of 6 x 7 or 7 x 7 construction, or they may be 7-wire, 19-wire, or 37-wire strands.

The function of a fibre center in a wire rope is twofold: (1) to supply a resilient foundation for the strands, and to support the rope structure; (2) to serve as a source of lubrication for the rope, the center having been originally impregnated with lubricant; and to absorb additional lubricants.

Three Rope-making Operations. — The making of wire rope involves a number of operations that must be performed with precision. First, each wire must be drawn to a constant diameter, and care must be taken, during the drawing, that the valuable qualities of the metal are preserved. Then the wires must be closed uniformly into strands at a predetermined pitch. Finally, the strands must be closed into the rope, at the pitch specified for that particular rope.

What is the Length of Lay?—The strand pitch of a wire rope is generally called the length of lay. The length of lay of any wire rope is determined by measuring the distance parallel to the axis of the rope, between a point on a strand and an identically placed point on that same strand, after the strand has made one complete turn around the rope. Variations in the length of lay provide widely varying rope characteristics. For instance, the shorter the length of lay, the more elastic the rope.

Right Lay and Left Lay. — When the strands in a rope pass from left to right across the top of the rope, the rope is called a right lay rope. When the strands go from right to left, it

is called a left lay rope. Strands, themselves, as well as ropes, may be right lay or left lay.

It should be understood, then, that the term right lay, or left lay, when used in connection with the description of wire rope, refers only to the direction in which the completed strands are laid around the core.

Regular and Lang Lay Rope.—When the wires in a strand are laid in a direction opposite to the lay of the strands in the rope, the rope is called regular lay. When the strand wires are laid in the same direction as the strands are laid in the ropes, the rope is called Lang lay.

Wire Rope Processing.—For nearly 100 years, wire rope was made, as previously described, by forcibly laying a given number of wires into a strand; then, by still greater force, laying a number of strands into the completed rope. This forcible laying sets up, within the steel itself, considerable torsional stress. This internal stress caused wire rope to be "cranky," hard to handle, caused it to seek to kink back upon itself, and to wear out prematurely.

During 1924, however, there was developed a new and revolutionary process which eliminated practically all of this life-limiting, torsional stress. This was the first major improvement made in the manufacture of wire rope in nearly a century. The process, called "preforming," may be described as follows:

When preformed wire rope is being manufactured, there is an additional process through which the strands are passed before the laying operation assembles them into a rope. By this process, each individual wire and strand is helically formed into the shape it will assume in the finished rope.

The importance and the influence of this operation on the service of wire rope are great. As can be appreciated from the brief description of the process of making nonpreformed wire rope, the strands of all such ropes are held in their helical positions by force. Whether idle or working, these strands and their wires are constantly making an effort to straighten out. In other words, the parts of the ropes are always under stress. This internal stress accentuates metallic fatigue, causing individual wires of wire rope in service to break before they have reached the end of their useful lives. In addition, this condition of wires and strands of a nonpreformed wire rope—a condition overcome by preforming—is responsible for many other undesirable characteristics of nonpreformed wire rope.

Preforming, accordingly, is a process which gives to the strands the helical shape they will assume in the rope, thus providing a rope in which the strands are at rest. This reduces both metallic fatigue and friction between the parts of the rope. Preformed rope is free to serve to the limit of the ability of its combined parts, and may be cut without seizing. Preforming, moreover, permits the general application of Lang lay and wire center constructions, and gives the ropes maximum bending life.

Sheave and Drum Diameters.—The diameters of sheaves and drums have a definite bearing upon the performance of wire rope in service, and upon its length of life. Because these factors have long been recognized, it has been possible to determine, through considerable experimentation conducted in both laboratory and field, the diameters which are most practical and productive of economy, and to check performance on installations of almost every type, in work of widely different character.

Table for Calculating Minimum Sheave and Drum Diameters.—To appreciate the importance of observing correct diameters for different constructions used, note that a 1-inch rope of 6 x 7 construction requires a 42-inch sheave, while a 1-inch rope of 6 x 41 construction requires but an 18-inch sheave.

Construction:	Times diameter of rope:
6 x 7	42
6 x 19 Seale	34
6 x 16 Filler Wire	30
6 x 19 Warrington	30
Flattened Strand	30
8 x 19 Seale	26
6 x 19 Filler Wire	26
6 x 22 Filler Wire	23
8 x 19 Warrington	21
8 x 19 Filler Wire	21
6 x 37	18
6 x 41	18

Wire Rope Attachments.—Satisfactory wire rope service is also very often dependent upon properly designed and properly attached fittings, or terminals, to the ends of the ropes. Because of the almost innumerable applications for wire rope, there are many different kinds of fittings, such as sockets, thimbles, hooks, shackles, and the newer and improved type of swaged fitting.

The thimble splice is often used with hooks, rings, or shackles to make wire rope slings of various types.

Basket socket attachments are commonly of two types: open and closed. Basket sockets are of drop forged steel, weldless, and tapered to permit the wires of the end of the wire rope to be broomed out; then, after thorough cleansing, wedged in the tapered basket by molten zinc.

The efficiency of such fittings or attachments is largely dependent upon the manner in which they are applied. With highly skilled workmanship, such spliced or babbitted fittings can develop a fairly high degree of efficiency—70 per cent to 90 per cent of the rope's strength. With the advent of preformed wire rope, there has been developed a type of wire rope terminal that is, to all intents and purposes, "foolproof." It is known as the swaged terminal.

Since preformed wire rope may be cut and handled without the necessity for seizing wire, it is readily possible to slip over the end of preformed wire rope a cylinder of steel; then, by means of pressure, to shrink, or swage, that cylinder onto the rope to a point where the steel of the cylinder cold-flows into the interstices of the rope, and thus become an integral part of it. Such processed fittings, which may be properly applied by unskilled labor, not only develop 100 per cent of the rope's strength, but may be so designed as to meet the needs of innumerable applications.

One of the first agencies to discover and acknowledge the 100 per cent efficiency of preformed wire rope with processed swaged fitting was the air service of both the United States Navy and the United States Army. Practically all airplane controls and assemblies soon employed this type of wire rope terminal. Wire rope is also in evidence in literally thousands of diverse industrial applications. See also CABLE; MINING—*Mine Haulage* (Wire Rope Trams).

R. B. WILLIAMS,
Preformed Wire Rope Information Bureau, Chicago, Ill.

WIRELESS TELEPHONY. See TELEGRAPHY AND TELEPHONY, RADIO.

WIREWORM, the larva of any one of several species of snapping beetle or elater (q.v.), so called because of its shape and the hardness of its integument. These yellow colored larvae are among the most destructive garden pests. Voracious eaters of roots and underground stems, they continue in the larval state for from three to five years. Pupation takes place underground. Some millepedes, especially species of *Iulus,* and similarly injurious, are also called wireworms.

WIRT, wûrt, **William,** American jurist and statesman: b. Bladensburg, Md., Nov. 8, 1772; d. Washington, D.C., Feb. 18, 1834. He received a grammar school education, became a private tutor, studied law, was admitted to the bar in 1792 and began practice at Culpeper Court House, Va. In 1799 he removed to Richmond, was elected clerk of the house of delegates and in 1802 received from the legislature the appointment of chancellor of the eastern shore of Virginia. In 1803 he published in the Richmond *Argus* his *Letters of a British Spy,* purporting to be papers left at an inn by an English member of Parliament traveling in Virginia. They consist principally of sketches of prominent public orators, with remarks on eloquence and some pages of local description, and proved extremely popular. A second series appeared in 1808 in the Richmond *Enquirer* under the title of *The Rainbow.* Wirt was an assistant in the prosecution of Aaron Burr and in the course of the trial displayed a learning and eloquence which established his reputation as one of the foremost lawyers in the country. A series of papers somewhat in the style of the *Spectator,* begun by him and several of his friends in 1812 under the title of *The Old Bachelor,* appeared in 33 numbers of the Richmond *Enquirer* and afterward in book form. His *Sketches of the Life and Character of Patrick Henry* appeared in 1817 and became immediately popular. In 1816 Wirt was appointed by President Madison attorney of the United States for the district of Virginia and from 1817 to 1829 was attorney general of the United States. On his retirement he passed the rest of his life in the practice of his profession at Baltimore. In 1832 he was the candidate of the Anti-Masonic Party for president of the United States. Consult Kennedy, J. P., *Memoirs of the Life of William Wirt* (Philadelphia 1849); Trent, William P., *English Culture in Virginia* (Baltimore 1889).

WIRT, William Albert, American educator: b. Markle, Ind., Jan. 21, 1874; d. March 11, 1938. He was graduated from De Pauw University in 1898, later studied at the University of Chicago, and subsequently studied the educational systems of England, France, Belgium and Germany. He was superintendent of schools at Redkey, Ind., in 1895–1897; and in 1897 he became superintendent at Bluffton, Ind. There he put into practice his own theories of educational methods with marked success, attracting widespread attention among educators. He became superintendent of schools at Gary, Ind., in 1907; and in 1914 he was appointed expert adviser to the New York boards of education and of estimate in the reorganization of the New York City schools. His system tested satisfactorily in 2 large public schools in New York and was extended to 120 additional schools. His work at the time was branded as undemocratic and anti-American and the city administration which employed him was repudiated at the polls, largely on the Gary Plan issue. See also EDUCATION, ELEMENTARY.

WISCASSET, Me., town, and Lincoln County seat, altitude 50 feet; on the Sheepscot River, and the Maine Central Railroad, 40 miles northeast of Portland. It is in a region noted for picturesque scenery and is a popular summer resort. It has a good harbor and is a port for coasting vessels; some vessels are built here, and the town also contains a boat building yard and sawmills. Among the schools is the public academy (high school) founded in 1877. The town was incorporated as Pownalboro in 1760 and as Wiscasset in 1802. Pop. (1950) 1,584.

WISCONSIN, wĭs-kŏn's'n, one of the North Central states of the United States. It is bounded on the east by Lake Michigan, on the south by Illinois, on the west by Iowa and Minnesota, and on the north by Lake Superior and that part of Michigan known as the upper peninsula. The name *Wisconsin,* first spelled Miskonsing then Ouisconsin by the French, was derived from the Indian name for the principal river of the region and is usually interpreted to mean "gathering of the waters."

State flag.

Land area	54,705 square miles
Water area, inland lakes	1,449 square miles
Total area	56,154 square miles [1]
Latitude	42° 30′—47° 3′ N.
Longitude	86° 49′—92° 54′ W.
Altitude	581 to 1,940 feet
Population (1950)	3,434,575
Capital city—Madison; Pop. (1950)	96,056
Admitted as a state	May 29, 1848
Bird	Robin
Flower	Violet
Motto	Forward
Nickname	Badger State
Song	No official song
Tree	Sugar Maple

Physical Features.—*Topography.*—Wisconsin is essentially a shield-like plain sloping gently toward all sides from the height of land near its northern border. In Vilas and neighboring counties the average elevation is about 1,650 feet. From this it falls away to Lake Michigan which is 581 feet above sea level, Lake Superior which is 602 feet, and the Mississippi River which descends from 677 feet at Prescott to 592 feet at the southwestern corner of the state. However, the surface is not that of a simple plain. Glacial action, erosion, and other

[1] In addition the state has political jurisdiction over 9,878 square miles of water area in adjoining lakes Superior and Michigan.

geological factors have imparted to it a varied character that is always pleasing and often beautiful.

State seal.

There are five principal topographic and geologic regions. The Northern Highland, which covers the north-central section, has a gently rolling terrain with scattered glacial hills. From this surface stand out occasional quartzite upthrusts, the more prominent of which are the Penokee Range running west and south from Hayward, the Barron Hills in Rusk and Barron counties, the Flambeau Ridge in Chippewa county, and Rib Mountain near Wausau. The latter is the highest point within the state and rises some 600 feet above the surrounding countryside. Lying between the Northern Highland and Lake Superior is the narrow Superior Lowland, formerly a part of the lake bed and now deeply eroded by the swift streams which flow across it. On the south the Northern Highland is surrounded by a curving, sandy Central Plain which is some 65 miles in width at its broadest point above the city of Portage.

The eastern part of the state is a belted plain. First there is a narrow upland running from Marinette county to Dane county, then the broad Green Bay-Lake Winnebago-Rock River lowland extending the length of the state, and lastly a rolling upland along the Lake Michigan coast reaching from the Door Peninsula to the Illinois border. Variety is added to the landscape by bold limestone escarpments along the western edges of the uplands; by hilly glacial deposits known as drumlins, kettle moraines, and terminal moraines; and by the action of the streams in cutting down valleys and building up flood plains.

The southwestern quarter of the state, the Western Upland, is often referred to as the driftless region, for in the glacial age it remained uncovered, an island in the expanse of ice. In form it is an ancient plateau, but due to the ages of erosion no continuous level surface remains. The streams have cut down through the strata of limestone so that now it is a region of narrow ridges and deep, steep sided valleys—coulee country. Through this region the Mississippi River from north to south and the Wisconsin River from east to west have cut deep gorges or troughs. Their valleys are narrow, never more than a few miles wide, quite flat bottomed; rising on each side are steep, castellated bluffs often 300 to 600 feet in height. It is by all odds the most beautiful part of the state and is often compared to the valley of the Rhine.

Rivers and Drainage.—The major watershed in Wisconsin is a low arch running north and south, a little to the east of the center of the state. This separates the streams running into Green Bay and Lake Michigan from those that flow south and west into the Mississippi River. About 30 miles south of Lake Superior is a minor east-west divide from which several small streams flow down the slope of the Northern Highland, across the Superior Lowland, and into Lake Superior. Below the Wisconsin River east other divide, the Military Ridge, runs from east of Blue Mounds to the bluffs overlooking the intersection of the Wisconsin and Mississippi rivers. A very low divide in Columbia and Fond du Lac counties separates the drainage basins of the Fox and Rock rivers.

Chief among the westerly flowing streams are the St. Croix, Chippewa, Black, and Wisconsin, all of which rise in the Northern Highland. They, together with the Menominee, Oconto, and Wolf which flow into Green Bay, were counted as navigable in early days, at least during periods of high water, as far up their courses as the falls line where the streams emerge from the Northern Highland onto the Central Plain. Near Portage the northward flowing Fox is separated from the Wisconsin by only a mile and a half of low marshy plain, which in the fur trading era made these streams one of the great arteries for commerce between the waters of the Mississippi and the Great Lakes. They were connected in the late 19th century by a canal, which still exists but is not used. The Manitowoc, Sheboygan, Milwaukee, and other streams flowing directly into Lake Michigan are all limited to the narrow Niagara Highland bordering that body of water.

Coasts and Harbors.—The shoreline of Lake Superior within Wisconsin measures a little over 150 miles, that of Lake Michigan nearly 380 miles. The former is broken by Bayfield Peninsula, Chequamegon Bay, and the Apostle Islands; the latter by Door Peninsula, Green Bay, and Washington and adjacent small islands. Other than these the shoreline is very regular. There are no large natural harbors on Lake Michigan, the harbors of Milwaukee, Racine, Kenosha, Sheboygan, Manitowoc, Green Bay, and Marinette being the improved mouths of rivers. On Lake Superior the harbors of Superior-Duluth, Ashland, and Port Wing are larger and better, being protected by sandspits which guard the inlets from wind and waves.

Lakes and Swamps.—Every part of Wisconsin, except the driftless region, is beautified by many lakes of which more than 7,000 have been charted. Those in the southeastern belted plain are larger, having been formed by glacial damming of the watercourses. Of these, Lake Winnebago is the largest with an area of 215 square miles, though only 15 feet deep. The Four Lakes —Mendota, Monona, Waubesa, and Kegonsa— form the setting for the state capital. Others include lakes Geneva, Koshkonong, Muskego, Shawano, Beaver, Poygan, and the Oconomowoc and Waupaca groups. In the Northern Highland are two concentrations of many small lakes. That in Vilas, Oneida and Iron counties covers 15 per cent of the land surface; the group in Washburn, Burnett, and neighboring counties only slightly less. All of these are lakes of great beauty, set in the midst of forests of birch, poplar, maple and pine; the water is clear, soft, and deep. They are equally important as reservoirs for the waters of the streams they feed, serving to regulate the flow and to prevent disastrous floods.

The state has an even wider distribution of swamp lands than of lakes, these being most prevalent in the northern lake country, the Central

Plain, and the Rock River valley. There are almost 4,000 square miles of undrained swamps and an additional 7,000 of marshy and other poorly drained terrain.

Climate.—In common with other states of the region, Wisconsin has a continental climate, marked by extremes of heat and cold, with sharp changes caused by the movement of cyclonic storms across the region from west to east. Only the eastern edge of the state benefits appreciably from the moderating influence of the waters of Lake Michigan. The mean annual temperature ranges from 48° in the southwestern corner to 39° on the northern border. The recorded extremes within the state of 111° above and 54° below zero tend to give an unbalanced picture of the climate, for temperatures of more than 20° below zero are infrequent and the summers tend to be cool, except for short heat waves. The climate is favorable for agriculture, the growing season having a length of 170 days in the southeastern corner of the state and averaging 120 or more days for all but that third of the state contained in the extreme Northern Highland. There the season may be as short as 75 days. Rainfall is extremely favorable. The average for various sections ranges between 27 and 34 inches, 50 per cent of which falls in the growing months of May to August.

Political Divisions.—For purposes of local government the state is divided into 71 counties, which in turn are divided into approximately 1,300 towns, 364 villages, 163 cities, and the Menominee Indian Reservation.

Chief Cities.—Milwaukee, with a population in 1950 of 637,392, was the most populous city in the state, the next being Madison (96,056) and Racine (71,193). Two communities fell in the 50,000 class, four in the 40,000 class, five in the 30,000 class, seven in the 20,000 class, and 18 in the 10,000 class. (Population figures for Wisconsin communities are listed on the back of the accompanying state map.) As defined by the federal Bureau of the Census there were in Wisconsin in 1950, five standard metropolitan areas and part of a sixth, Superior-Duluth. The Milwaukee metropolitan area had about 863,937 persons in 1950; Madison, 168,630; Racine, 109,105; Green Bay, 97,922; and Kenosha, 75,157.

Counties.—Counties, with their county seats, are listed in the following table:

County	County Seat	County	County Seat
Adams	Friendship	Juneau	Mauston
Ashland	Ashland	Kenosha	Kenosha
Barron	Barron	Kewaunee	Kewaunee
Bayfield	Washburn	La Crosse	La Crosse
Brown	Green Bay	Lafayette	Darlington
Buffalo	Alma	Langlade	Antigo
Burnett	Grantsburg	Lincoln	Merrill
Calumet	Chilton	Manitowoc	Manitowoc
Chippewa	Chippewa Falls	Marathon	Wausau
Clark	Neillsville	Marinette	Marinette
Columbia	Portage	Marquette	Montello
Crawford	Prairie du Chien	Milwaukee	Milwaukee
Dane	Madison	Monroe	Sparta
Dodge	Juneau	Oconto	Oconto
Door	Sturgeon Bay	Oneida	Rhinelander
Douglas	Superior	Outagamie	Appleton
Dunn	Menomonie	Ozaukee	Port Washington
Eau Claire	Eau Claire	Pepin	Durand
Florence	Florence	Pierce	Ellsworth
Fond du Lac	Fond du Lac	Polk	Balsam Lake
Forest	Crandon	Portage	Stevens Point
Grant	Lancaster	Price	Phillips
Green	Monroe	Racine	Racine
Green Lake	Green Lake	Richland	Richland Center
Iowa	Dodgeville	Rock	Janesville
Iron	Hurley	Rusk	Ladysmith
Jackson	Black River Falls	St. Croix	Hudson
Jefferson	Jefferson	Sauk	Baraboo
Sawyer	Hayward	Washburn	Shell Lake
Shawano	Shawano	Washington	West Bend
Sheboygan	Sheboygan	Waukesha	Waukesha
Taylor	Medford	Waupaca	Waupaca
Trempealeau	Whitehall	Waushara	Wautoma
Vernon	Viroqua	Winnebago	Oshkosh
Vilas	Eagle River	Wood	Wisconsin Rapids
Walworth	Elkhorn		

The People.—*Origins and Racial Groups.*—Few traces remain, other than in place names, of the centuries during which Wisconsin was inhabited only by Indians and French fur traders. In 1940 the Indian remnants numbered only 12,265. In the same year the Negro population was 12,158, leaving 99.2 per cent of the population classified as white stock.

In the beginning of settlement some immigrants came up the Mississippi River from the South to settle in the lead mining region, but the great bulk of the settlers came from the northern states. According to the census of 1850, 96 per cent of that part of the population labeled as native-born American was of Yankee origin. But in the rush of immigration from Germany, Norway, Sweden, Ireland, and other countries, the Yankee was soon reduced to a minority. By 1870 the native-born of American-born parentage were only one third of the whole; and as late as 1910 the proportion was native-born American 32.9 per cent, American-born of foreign-born parentage 45 per cent, and foreign-born 22.1 per cent.

The bulk of this immigrant stock was of German origin, and Milwaukee was long the leading American center of German culture. In 1910 the German element constituted 51 per cent of the immigrant group in the state, the Norwegian 10.1 per cent, Canadian 5.1 per cent, Austrian 5.2 per cent, Irish 4.8 per cent, and Swedish 3.6 per cent. The 20th century brought an influx from eastern European countries, especially from Poland, which raised that group in 1930 to 10 per cent of the total. Every European immigrant element known to the nation is represented in the population of Wisconsin and all have made their individual contributions to its culture and history.

Growth and Trends.—In 1840 the population, including part of what later became Minnesota, was 30,945; by 1850, two years after Wisconsin had become a state with its present boundaries, the figure had risen to 305,391. The increase thereafter did not fall below 20 per cent until 1910. For the decade from 1930 to 1940 its population increased by 6.8 per cent as compared with an increase of 11.7 per cent for the decade ending in 1930. This declining rate followed closely the national trend for the same period. The population in 1940 was 3,137,587 and the 1950 population was 3,434,575.

Although Wisconsin is an important agricultural state, its population is largely urban. Of the 1940 population of 3,137,587, 46.5 per cent was classified as rural, but only 873,462 persons, or 28 per cent, were actually engaged in farming. The 1950 rural population declined to 42.1 per cent of the whole. The farm population has remained relatively static since 1900, actually declining slightly since 1920. The growth of population for the state is accounted for by urban and nonagricultural rural dwellers. In keeping with this trend, the population of the state is becoming increasingly concentrated in the eastern and southeastern section where in-

dustry prevails. This third of the state contained two thirds of the population in 1940.

Famous Men and Women.—Among the celebrated people born in Wisconsin are Harry Houdini (1874–1926), world-famous magician; Thorstein Veblen (1857–1929), social theorist and economist; Ella Wheeler Wilcox (1850–1919), poet; Frank Lloyd Wright (b. 1869), architect; and Robert M. La Follette (1855–1925) and Thomas J. Walsh (1859–1933), progressive senators and chief investigators of the scandals of the Harding administration; Frederick J. Turner (1861–1932) historian.

Natural Resources.—*Game and Wild Life.*—Of the species of big game originally in the Wisconsin region, only black bear and white-tailed deer are found today. Small fur-bearing animals such as the beaver, muskrat, mink, raccoon, skunk, weasel, badger, red and gray fox, woodchuck, and opossum are plentiful. Wolves and wildcats persist, though bounties are paid for their destruction. The ring-necked pheasant and Hungarian partridge, both imported, and the native ruffed grouse are the principal upland game birds. Quail and sharp-tailed grouse are present in small numbers. Various species of wild ducks and geese cross the state in migration seasons. The inland lakes and streams are stocked with species of trout, bass, walleyed pike, northern pike, and muskellunge, as well as many kinds of smaller pan fish. Lake trout, whitefish, herring, and perch are the chief commercial species taken in the waters of Green Bay, Lake Michigan, and Lake Superior.

Minerals.—The principal minerals of commercial importance, in order of value, are: building stone, crushed stone, gravel, clay products, iron ore, zinc ore, sand, lead, and lime. Building stones quarried include dolomite, granite, marble, and sandstone. The lead and zinc deposits of the southwestern part of the state are almost exhausted. The only iron mines are in the Penokee-Gogebic Range, though there are notable deposits in Dodge, Jackson, Florence, and Sauk counties. These latter have not been exploited because of their low quality ore.

Waterpower.—In 1941 the total installed waterwheel water power in Wisconsin was 624,978 horsepower, and it was estimated that there was present, but undeveloped, water power of 294,000 horsepower 90 per cent of the time, and 507,000 horsepower 50 per cent of the time. The river systems developed, in order of importance, were the Wisconsin, Chippewa, Menominee, St. Croix, Fox, and Peshtigo.

Soils.—The soil cover in Wisconsin varies widely, both in nature and fertility. The southeastern section, especially in the valleys and more level plains areas, has a rich, glaciated, limestone silt loam soil that is equal to the best in neighboring states. The driftless region of the southwest has a residual limestone soil which is fertile but because of the hilly character of the region is easily eroded under cultivation. The Superior Lowland and the lowland area about the head of Green Bay have a heavy, stiff, red clay soil with a tight, poorly drained subsoil. That of the Central Plain is a sandy loam of moderate fertility, but the soil of the Northern Highland is generally a light sandy loam or sand of such low fertility as to be unsuited to intensive agriculture. By reason of the areas of poor soil and the abundance of rough, hilly land and swamps or marshes, only 65.32 per cent of the land area of the state was included in farms in 1939 and only 37.23 per cent was actually devoted to growing crops.

Forests.—Originally, five sixths of Wisconsin was covered with marketable timber—oak, hickory, walnut, and maple in the south; maple, birch, basswood, and hemlock in the northeast; and conifers, principally white and Norway pine, in the Northern Highland. By 1920 all but isolated spots of this virgin forest had been harvested. Farms replaced the forest in the hardwood areas, but farms could not maintain a foothold in the cut-over pine lands of the north. They were allowed to grow up again to trees, birch and aspen, followed more slowly by the conifers. Consequently, though the acreage of good saw timber is gone, there remain forest lands amounting to over 16,000,000 acres. As a resource these forests are more potential than real. To aid in their growth the state has organized forest protection districts covering more than three fourths of the area. Through public forests, a broad reforestation program, and assistance to private owners it seeks to promote the development of the potentialities of the region.

Parks, Reservations, and Preserves.—In 1947 the state owned and cared for 21 scenic, historical and wayside parks, having a total acreage of 15,219 acres. These included many of the most scenic and interesting areas within the state, and were provided with camping facilities, trails, and other conveniences for the use of visitors. Eight state forests embracing 259,128 acres, and with frontage on many beautiful lakes, were open to the public for recreational purposes. In addition there were in the Northern Highland two national forests, Chequamegon and Nicolet, covering more than two million acres and county forests totaling approximately two million acres. The five Indian reservations in Wisconsin include much of scenic value and historical interest. The four Chippewa reservations are Red Cliff, Bad River, Lac du Flambeau, and Lac Court Oreilles. The Menominee reservation in Shawano and Oconto counties is the largest and most scenic because of its fine stand of virgin hemlock and hardwood, and the Wolf River with its roaring waterfalls and whirling rapids.

Production.—*Agriculture.*—There were 177,745 farms in Wisconsin, according to the agricultural census of 1945, containing a total of 23,615,031 acres, 10,544,975 acres of which were devoted to the production of crops. The average farm size was 132.9 acres. After 1920 the total farm population and the number of farms decreased slowly, while the average farm size and the number of acres under cultivation increased. In 1945 there were automobiles on 86 per cent of the Wisconsin farms, 32 per cent had trucks, and 61 per cent had tractors. 70 per cent of the farm homes were lighted with electricity, 88 per cent had radios, and 48 per cent had telephones. The gross farm income in 1947 was $1,104,299,000.

Wisconsin has long been the leading dairy state in the United States. In 1947 the Wisconsin Crop and Livestock Reporting service estimated that there were 3,962,000 head of cattle in the state, 2,585,000 of which were milk cows producing approximately 14 per cent of all the nation's milk. In addition there were on the farms 1,605,000 swine, some sheep, and the usual complement of farm fowl. In 1946 milk and milk products accounted for 53 per cent of the farm income.

In keeping with the dairy-livestock farming system, over nine tenths of the land devoted to crops in 1946 was planted to tame hay, oats, and corn. Less than one tenth was used for cash crop production. Barley, wheat and rye were grown in small amounts. Potatoes were an important supplementary crop on the sandy Central Plain. Tobacco was produced in favored areas, particularly near Madison and Viroqua. The state led all others in the production of vegetables for canning, over 100,000 acres having been devoted to peas alone. It also produced notable quantities of such fruits as apples, cranberries, cherries, and strawberries.

Processed Farm Products.—In 1939 Wisconsin ranked first in the United States in the production of cheese, making 50 per cent of the nation's supply. The state also ranked first in condensed and evaporated milk products and in special dairy products, but third for creamery butter. Other farm-connected industries of importance and the relative ranking of the state were: meat packing, 12th; malt liquors, 3rd; leather tanning, 3rd; canning of fruits and vegetables, 6th. Farm-connected industries accounted for approximately one fifth of the state's industry by value of product, and one eighth by the value added by manufacturing.

Forest Products.—For many years Wisconsin was a great lumber producer, cutting over three million board feet annually in the 1890's when production was at its peak. From 1900 to 1905 it outranked all other states, but declined rapidly thereafter as its virgin timber was exhausted. Production after 1930 averaged around 300 million board feet annually. Pulp wood is comparatively more important, the cut during the ten years preceding 1946 averaging between 400,000 and 500,000 cords yearly, but amounting to only about half the supply needed by the state's pulp and paper mills. In 1939 Wisconsin ranked second in the production of its paper, planing, pulp, and plywood mills, which accounted for almost 10 per cent of the state's industry. It has a well developed furniture industry, and ranked first in the making of specialized laboratory, hospital, and other professional furniture. The abundance of hemlock in the forests of the eastern part of the state was instrumental in the growth of a large tanning industry in the 19th century, but supplies are no longer adequate to care for the needs of the local tanneries.

Mineral Extraction.—Wisconsin ranked 33rd in the United States in mineral production in 1939, the bulk of its output consisting of nonmetallic minerals. The value of all minerals in 1945 was $22,213,000. Building stone accounted for more than one third of the total, with sand and gravel next in importance. Iron and zinc ores were mined to the value of $3,500,000 each. The once thriving lead industry had shrunk to less than 2,000 tons of metal annually. Although the state once ranked sixth in the production of iron and steel, there has not been a blast furnace operating within its bounds since 1929.

Manufacturing.—The State Industrial Commission reported that in 1946 there was an average of 308,400 industrial employees who received an average weekly payroll of 14,087,000. The industry of the state was remarkably varied, no one classification of industry in the census report having produced as much as 10 per cent of the total value added by manufacturing. Concentration was strongest in motor vehicles and parts, heavy metals products, and machinery. From the factories came nationally known makes of bedsprings, automobiles, flashlights, scales, malted milk, beer, floor waxes, plows, batteries, fountain pens, paper tissue, hosiery, and bathtubs. Less than one fourth of the materials used in manufacture were drawn from the farms, forests, and mines of the state. The success of its factories is due primarily to transportation advantages and especially to the skill and efficiency of the personnel.

Over half the industry of the state was concentrated in Milwaukee, Racine, and Kenosha counties which were strongest in heavy industry and also important for footwear, beer, meat packing, and millwork. Paper and pulp products factories were concentrated in the Fox River valley and the upper Wisconsin River valley. The cities of upper Lake Michigan led in aluminum ware, sanitary ware, furniture, and shipbuilding. The Rock River valley cities produced heavy metals products, farm machinery, shoes, fountain pens, and batteries. Eau Claire and Chippewa Falls were noted for rubber goods and aluminum ware; La Crosse for air-conditioning equipment, automotive parts, and rubber products.

In comparison with other states and the nation, Wisconsin has not maintained its relative position in the years since 1930. During the depression decade its industry declined more than the national average, and during World War II it did not share in plant expansion and output of war materials in proportion to its prewar importance.

Transportation and Communication.—Wisconsin lies on the western edge of the great industrial region centering upon the Great Lakes. Some 90 per cent of its industrial and agricultural products are sold outside the state, more than half of this going to consumer areas east of the Chicago district and the bulk of the remainder to the states of the middle west. It is a heavy importer of materials for manufacture, three fourths of its industry being dependent on outside sources for over half of the materials used in the industrial process.

Proximity to Chicago, which is the focal point for the state's railroad network, facilitates the movement of produce and goods to the market areas, while the ports of Lakes Michigan and Superior give easy access by water to the eastern centers of iron, steel, and coal production as well as to the markets of that region. The railroads serving the state had 6,384 miles of main line track in 1947. Rural roads and highways, which carried an increasing load of truck and bus traffic, totaled 84,781 miles, including the state trunk system of nearly 10,000 miles and the county trunk system of over 17,000 miles. Air traffic developed rapidly, with 124 registered airports in 1947, and airlines in operation, or projected for early operation, to serve all the principal cities of the state.

Economic and Financial Factors.—*Banking System.*—On Dec. 31, 1948 there were 95 national banks with total assets of $1,488,791,000 and total deposits of $1,396,538,000, and 460 state banks with total assets of $1,661,326,000 and total deposits of $1,561,391,000.

Public Finance.—For the fiscal year ending June 30, 1947, state revenue from all sources amounted to $138,459,327 and expenditures were $126,166,587, exclusive of taxes and other revenue collected by the state and returned to units of local government. The state had no debt except

to its own trust funds, which in 1945 amounted to $3,943,000. In 1942 the total revenue of all local and municipal governmental units was $221,073,000 and expenditures were $209,621,000. The outstanding debt of all local units was $122,705,000.

Wealth, Income, and Taxation.—In 1946 the assessed valuation of all real and personal property in the state was $5,827,999,457, and total income payments to individuals in the state were estimated at $3,803,000,000. State and local taxes collected in the year ending June 30, 1946 amounted to $269,774,538, or approximately $82.25 per capita. General property taxes were 46.9 per cent of the total, motor vehicle taxes 13.7 per cent, utility taxes 5.7 per cent, income taxes 18.1 per cent, and all other taxes 15.6 per cent.

Government. — *Executive.* — The executive power is vested in a governor who, with the lieutenant governor, secretary of state, treasurer, and attorney general, is elected every two years. A state superintendent of public instruction is elected every four years. There is no limit on the number of terms an officer may serve. The governor may veto bills passed by the legislature, and may veto part or all of any appropriation bill, though such vetoes may be overridden by a two-thirds vote of the members present in each chamber of the legislature. With the expansion of state activities in the 20th century, an increasing number of administrative boards and commissions have been created by legislative enactment, members of which are appointed by the governor subject to confirmation by the senate.

A list of Wisconsin's governors follows:

GOVERNORS OF WISCONSIN

TERRITORIAL

Henry Dodge		1836–1841
James Duane Doty		1841–1844
Nathaniel P. Tallmadge		1844–1845
Henry Dodge		1845–1848

STATE

Nelson Dewey	Democrat	1848–1852
Leonard J. Farwell	Whig	1852–1854
William A. Barstow	Democrat	1854–1856
Arthur McArthur (acting)		1856
Coles Bashford	Republican	1856–1858
Alexander W. Randall	"	1858–1862
Louis P. Harvey	"	1862
Edward Salomon	"	1862–1864
James T. Lewis	"	1864–1866
Lucius Fairchild	"	1866–1872
Cadwallader C. Washburn	"	1872–1874
William R. Taylor	Democrat-Greenback	1874–1876
Harrison Ludington	Republican	1876–1878
William E. Smith	"	1878–1882
Jeremiah M. Rusk	"	1882–1889
William D. Hoard	"	1889–1891
George W. Peck	Democrat	1891–1895
William H. Upham	Republican	1895–1897
Edward Scofield	"	1897–1901
Robert M. La Follette, Sr.	"	1901–1906
James O. Davidson	"	1907–1911
Francis E. McGovern	"	1911–1915
Emanuel L. Philipp	"	1915–1921
John J. Blaine	"	1921–1927
Fred R. Zimmerman	"	1927–1929
Walter J. Kohler	"	1929–1931
Philip F. LaFollette	"	1931–1933
Albert G. Schmedeman	Democrat	1933–1935
Philip F. La Follette	Progressive	1935–1939
Julius P. Heil	Republican	1939–1943
Walter S. Goodland	"	1943–1947
Oscar Rennebohm	"	1947–1951
Walter J. Kohler	"	1951–1957
Vernon W. Thomson	"	1957–

Legislative.—Legislative power rests in a bicameral legislature. The senate is composed of 33 members elected for four-year terms, those from odd-numbered districts being elected in one biennium, those from even-numbered districts in the next. The assembly of 100 members are all elected simultaneously for two-year terms. The legislature meets regularly the second Wednesday in January of each odd-numbered year and is normally in session from six to eight months. It may be called in special session by the governor. The assembly has the power of impeaching all civil officers of the state, and the senate acts as the court for the trial of impeachments. Supreme and circuit court judges may be removed from office by address of both houses. The people of the state may legislate directly through the initiative and referendum, and all elected officials including judges are subject to recall by the electors of the district from which they were elected.

Courts.—The judicial system consists of a state supreme court of seven justices elected for terms of 10 years each; 20 circuit courts, the judges of which are elected for six-year terms; courts of probate (county courts), one for each county, elected for six-year terms; justices of the peace elected for two-year terms; and such municipal and special courts as the legislature may establish.

Public Welfare.—In 1947 Wisconsin maintained 13 state and 39 county institutions, administered under the State Department of Public Welfare, for the care of its insane, mentally deficient, penal, correctional, and parole cases. There were two state and 19 county institutions, supervised by the State Board of Health, for the care of tuberculosis patients.

Wisconsin has been one of the leaders in the development of social welfare programs. It has made provision for assistance to the blind since 1907, for mandatory aid to dependent children since 1915, and for old age assistance since 1925. For the fiscal year ending June 30, 1947, expenditures for these types of assistance were: aid to blind, $573,648; aid to dependent children, $6,371,247; old age assistance, $21,281,391. The state pioneered in the fields of workmen's compensation and unemployment compensation. In 1946 the latter law covered some 16,500 employers of six or more persons each and over 655,000 workers. In the fiscal year ending June 30, 1946, the peak period of postwar readjustment, unemployment compensation benefits paid out amounted to $9,906,449 and the state's unemployment benefits fund had a net balance of $185,000,000. Workmen's compensation benefits for 1946 amounted to $6,604,871.

Suffrage and Elections.—Every citizen of the United States of the age of twenty-one or over may vote in any election provided he has resided in the state for one year and in the election district 10 days. Judicial officers, state and county superintendents of public instruction, members of county boards, and city and village officers are elected in nonpartisan elections held in April. Other state and county officers are elected in the regular elections held in November of the even-numbered years. The open primary election prevails for the nomination of all party candidates to political office. There are strict laws to safeguard the purity of all elections.

Educational System.—*Public Education.*—Public elementary and secondary education is free. Full-time attendance is compulsory for all children between the ages of 7 and 14, and for those between the ages of 14 and 16 unless regularly employed. In districts which conduct high schools or vocational schools attendance is com-

WISCONSIN

Right: The springhouse at Little Norway, a replica of a small Norwegian village commemorating Norwegian immigration in Dane County.

Photo by Louis Tager from Black Star

Below: The campanile, or bell tower, of the University of Wisconsin, at Madison. This is one of the landmarks of the campus.

Photo by Charles May

Below: A colorful threshing scene near Baldwin, Wisconsin. Agriculture is one of the state's basic industries.

Photo by John M. Russell from Shostal

WISCONSIN

Above: At a factory in Boscobel, workmen cut the cooked slabs of curd into little pieces during the making of cheddar cheese. Cheddar is one of the most popular of Wisconsin's many cheese products.

Left: Curious castellated rock formation, known as Castle Rock, rises suddenly out of the level terrain northwest of the Dells region. Left exposed during the Ice Age, stone shows the effects of centuries of wind and rain erosion.

Below: Aerial view of the beautiful campus of the University of Wisconsin at Madison, with Lake Mendota in the background.

(Top) Wide World; (others) Ewing Galloway

WISCONSIN

1950 Total Population 3,434,575

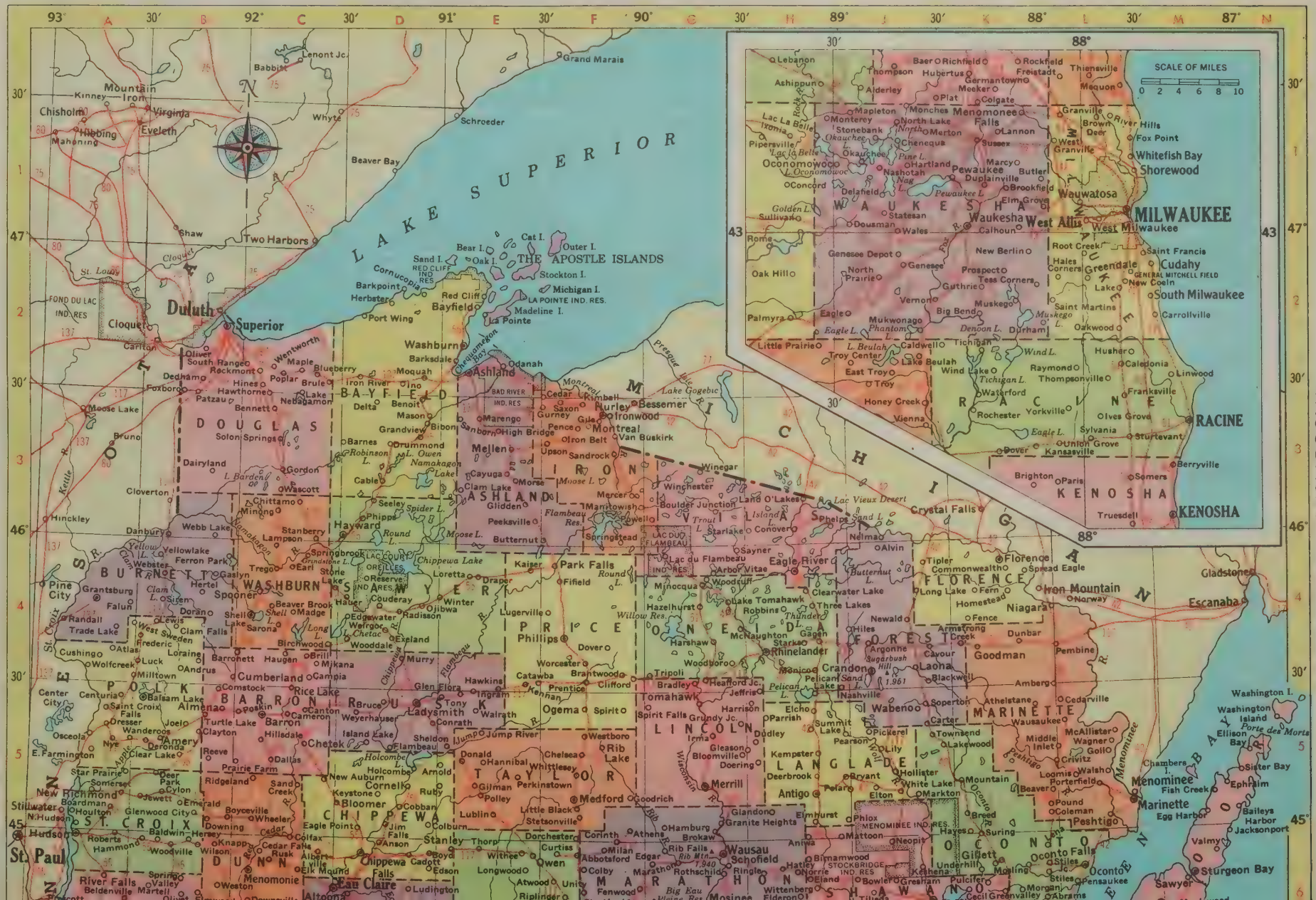
Abbotsford (F6).....1,013
Abrams (L6)..... 278
Adams (G8).....1,425
Adell (L8)..... 366
Afton (H10)..... 175
Albany (G10)..... 839
Albertville (C6)..... 75
Albion (H10)..... 200
Alderley (J1)..... 60
Algoma (M6).....3,384
Allen (C6)..... 92
Allen Grove (J10)... 250
Allenton (K9)..... 382
Allouez (K7).....4,094
Alma ◉(C7).....1,068
Alma Center (E7).... 441
Almena (B5)..... 406
Almond (G7)..... 435
Alto (J8)..... 200
Altoona (C6).....1,713
Alvin (J4)..... 108
Amberg (K5)..... 560
Amery (B5).....1,625
Amherst (H7)..... 608
Amherst Jct. (H7)... 185
Angelica (K6)..... 100
Angelo (E8)..... 123
Aniwa (H6)..... 257
Anson (D6)..... 120
Antigo ◉(H5).....9,902
Apostle (isls.) (F2).
Apple (riv.) (A5)....
Appleton ◉(J7).....34,010
Arbor Vitae (G4).... 175
Arcadia (D7).....1,949
Arena (G9)..... 296
Argonne (J4)..... 350
Argyle (G10)..... 702
Arkansaw (B6)..... 237
Arlington (H9)..... 255
Armstrong Creek (K4) 145
Arnold (D5)..... 100
Arnott (G7)..... 117
Arpin (G6)..... 325
Ashford (K8)..... 50
Ashippun (H1)..... 278
Ashland ◉(E2).....10,640
Athelstane (K5)..... 58
Athens (G5)..... 823
Attica (H10)..... 100
Auburndale (F6)..... 325
Augusta (D6).....1,458
Auroraville (H7)..... 95
Avoca (F9)..... 424
Avon (H10)..... 60
Babcock (F7)..... 250
Bad River Ind. Res. (E2) .....
Bagley (D10)..... 329
Baileys Harbor (M5) 250
Baldwin (B6).....1,100
Balsam Lake ◉(B5) 488
Bancroft (G7)..... 185
Bangor (E8)..... 941
Baraboo ◉(G8).....7,264
Barneveld (F10)..... 373
Barnum (E9)..... 75
Barron ◉(C5).....2,355
Barronett (B4)..... 116
Barton (K9).....1,039
Basco (H10)..... 60
Batavia (K8)..... 120
Bay City (B6)..... 326
Bayfield (E2).....1,153
Bear Creek (J6)..... 476
Beaver (K5)..... 500
Beaver Dam (J9)..11,867
Beetown (E10)..... 175
Beldenville (A6)..... 106
Belgium (L8)..... 460
Bell Center (E9)..... 195
Belle Plaine (J6)..... 50
Belleville (G10)..... 735
Belmont (F10)..... 474
Beloit (H11).....29,590
Bennett (C3)..... 100
Benoit (D3)..... 350
Benton (F10)..... 842
Berlin (H8).....4,693
Beulah (lake) (J2)...
Bevent (H6)..... 65
Big Bend (K2)..... 480
Big Eau Pleine (res.) (G6) .....
Big Falls (H6)..... 146
Birchwood (C4)..... 502
Birnamwood (H6)... 561
Biron (G7)..... 528
Black (riv.) (E7).....
Black Creek (K7).... 650
Black Earth (G9)..... 655
Black River Falls ◉ (E7) 2,824
Blackwell (J4)..... 100
Blair (D7)..... 873
Blanchardville(G10) 707
Blenker (F6)..... 85
Bloom City (E8)..... 92
◉ County Seat

Bloomer (D5).....2,556
Bloomingdale (E8). 90
Bloomington (E10).. 631
Blue Mounds (G9).. 207
Blue River (E9)..... 425
Boaz (E9)..... 188
Bonduel (K6)..... 742
Boscobel (E9).....2,347
Boulder Jct. (G3).... 150
Bowler (J6)..... 344
Boyceville (C5)..... 645
Boyd (E6)..... 619
Branch (L7)..... 119
Brandon (J8)..... 728
Briggsville (H8)..... 150
Brighton (K3)..... 50
Brill (C4)..... 105
Brillion (L7).....1,390
Brodhead (G10).....2,016
Brokaw (G5)..... 380
Brookfield (K1)..... 539
Brooklyn (H10)..... 479
Brooks (G8)..... 125
Brothertown (K7)... 48
Brown Deer (L1)..... 350
Brownsville (J8)..... 275
Browntown (G10).... 279
Bruce (D5)..... 867
Brule (C2)..... 120
Brussels (L6)..... 182
Bryant (J5)..... 75
Buffalo (C7)..... 319
Burlington (K10).....4,780
Burnett (J8)..... 300
Burr Oak (E7)..... 75
Butler (K1).....1,047
Butternut (E3)..... 522
Byron (K8)..... 85
Cable (D3)..... 250
Cadott (D6)..... 791
Calamine (F10)..... 100
Caldwell (J2)..... 90
Calhoun (K1)..... 800
Calumetville (K8)... 56
Cambria (H8)..... 633
Cambridge (H9)..... 552
Cameron (C5)..... 963
Camp Douglas (F8) 556
Camp McCoy (E8)..
Campbellsport (K8)1,254
Campia (C4)..... 50
Canton (C5)..... 125
Caroline (J6)..... 280
Carrollville (M2).....1,240
Carter (J5)..... 200
Cascade (K8)..... 403
Casco (L6)..... 389
Cashton (E8)..... 836
Cassville (E10)..... 984
Castle Rock (lake) (G8) .....
Cataract (E7)..... 200
Catawba (E4)..... 233
Cato (L7)..... 250
Cavour (J4)..... 200
Cayuga (E3)..... 55
Cazenovia (F8)..... 403
Cecil (K6)..... 395
Cedar (F2)..... 41
Cedar Falls (C6)..... 50
Cedar Grove (L8).....1,010
Cedarburg (L9).....2,810
Cedarville (L5)..... 50
Centerville (D7)..... 125
Centuria (A5)..... 521
Chambers(isl.)(M5)
Chaseburg (D8)..... 219
Chelsea (F5)..... 100
Chenequa (J1)..... 270
Chequamegon (bay) (E2) .....
Chetac (lake) (D4).
Chetek (C5).....1,585
Chili (F6)..... 250
Chilton ◉(K7).....2,367
Chippewa (lake) (D4) .....
Chippewa (riv.)(B7)
Chippewa Falls ◉ (D6) 11,088
Chittamo (C3)..... 64
Clam (riv.) (A4).....
Clam Falls (B4)..... 67
Clam Lake (E3)..... 100
Clarno (G10)..... 46
Clayton (B5)..... 350
Clear Lake (B5)..... 695
Clearwater Lake (H4) 152
Cleghorn (C6)..... 69
Cleveland (L8)..... 350
Clifton (F8)..... 50
Clinton (J10).....1,138
Clintonville (J6).....4,657
Clyman (J9)..... 250
Cobb (F10)..... 284
Cochrane (C7)..... 444
Colby (F6)..... 989
Coleman (L5) 668
Colfax (C6).....1,044

Colgate (K1)..... 65
Coloma (H7)..... 338
Columbus (H9).....3,250
Combined Locks (K7) 720
Commonwealth (K4) 125
Comstock (C5)..... 84
Conrath (E5)..... 114
Coon Valley (E8)... 466
Cooperstown (L7)... 75
Cornell (D5).....1,944
Cornucopia (D2)..... 175
Cottage Grove (H9) 372
Couderay (D4)..... 133
Crandon ◉(J4).....1,922
Cream (C7)..... 30
Crivitz (L5)..... 825
Cross Plains (G9).... 464
Cuba City (F10).....1,333
Cudahy (M2).....12,182
Cumberland (C4)....1,872
Curtiss (F6)..... 139
Cushing (A4)..... 138
Custer (H6)..... 104
Cylon (B5)..... 85
Dale (J7)..... 400
Dallas (C5)..... 370
Dalton (H8)..... 250
Danbury (B3)..... 383
Dancy (G6)..... 110
Dane (G9)..... 305
Danville (J9)..... 100
Darien (J10)..... 695
Darlington ◉(F10)..2,174
Dayton (H10)..... 127
De Forest (H9)..... 805
De Pere (K7).....8,146
De Soto (D9)..... 367
Deansville (H9)..... 54
Deer Park (B5)..... 226
Deerbrook (H5)..... 45
Deerfield (H9)..... 614
Delafield (J1).....2,000
Delavan (J10).....4,007
Dells, The (val.) (G8) .....
Dellwood (G7)..... 74
Delta (D3)..... 158
Denmark (L7).....1,012
Deronda (B5)..... 50
Dexterville (F7)..... 64
Diamond Bluff(A6) 220
Dickeyville (E10)..... 269
Disco (E7)..... 40
Dodge (D7)..... 211
Dodgeville ◉(F10)..2,532
Donald (E5)..... 65
Dorchester (F5)..... 457
Dousman (J1)..... 328
Dover (F4)..... 70
Downing (B5)..... 295
Downsville (C6)..... 300
Doylestown (H9)..... 261
Draper (E4)..... 60
Dresser (A5)..... 365
Drummond (D3)..... 150
Du Bay Flowage(G6)
Duck Creek (K6)..... 350
Durand ◉(C6).....1,961
Durham (K2)..... 76
Eagle (H2)..... 460
Eagle Point (C5)..... 250
Eagle River ◉(H4)..1,469
Earl (C4)..... 73
E. Ellsworth (B6).... 360
E. Farmington (A5) 54
E. Troy (J2).....1,052
Eastman (D9)..... 359
Eau Claire ◉(D6).36,058
Eau Claire (riv.) (D6) .....
Eau Galle (B6)..... 225
Eden (K8)..... 234
Edgar (G6)..... 705
Edgerton (H10).....3,507
Edmund (F9)..... 150
Edson (E6)..... 25
Egg Harbor (M5).... 210
El Dorado (J8)..... 200
Eland (H6)..... 232
Elcho (H5)..... 700
Elderon (H6)..... 212
Eleva (D6)..... 479
Elk Creek (C7)..... 40
Elk Mound (C6)..... 390
Elkhart Lake (L8)... 587
Elkhorn ◉(J10).....2,935
Ellenboro (E10)..... 90
Ellison Bay (M5)..... 147
Ellsworth ◉(A6).....1,475
Elm Grove (K1).....2,000
Elmhurst (H5)..... 35
Elmwood (B6)..... 772
Elroy (F8).....1,654
Elton (J5)..... 250
Embarrass (J6)..... 303
Emerald (B5)..... 130
Endeavor (G8)..... 314
Ephraim (M5)..... 244

Esdaile (A6)..... 75
Ettrick (D7)..... 415
Eureka (J7)..... 250
Euren (L6)..... 55
Evansville (H10).....2,531
Exeland (D4)..... 211
Fair Water (J8)..... 311
Fairchild (D6)..... 592
Fall Creek (D6)..... 584
Fall River (H9)..... 479
Falun (A4)..... 60
Fence (K4)..... 300
Fennimore (E9).....1,696
Fenwood (F6)..... 139
Ferryville (D9)..... 216
Fifield (F4)..... 450
Fillmore (K9)..... 50
Fish Creek (M5)..... 300
Fisk (J8)..... 125
Flambeau (D5)..... 50
Flambeau (res.)(F3)
Flambeau (riv.)(E4)
Florence ◉(K4).....1,400
Fond du Lac ◉ (K8) 29,936
Fontana (J10)..... 726
Footville (H10)..... 562
Forest Jct (K7)..... 150
Forestville (L6)..... 259
Fort Atkinson (J10)6,280
Fountain City (C7). 934
Fox (riv.) (K2).....
Fox (riv.) (K7).....
Fox Lake (J8).....1,153
Fox Point (M1).....2,585
Francis Creek (L7).. 225
Franklin (L8)..... 100
Franksville (M3)..... 260
Frederic (B4)..... 893
Fredonia (L8)..... 471
Fremont (J7)..... 504
Friendship ◉(G8)..... 566
Friesland (H8)..... 311
Galesville (D7).....1,193
Galloway (H6)..... 220
Gays Mills (E9)..... 662
Gen. Mitchell Field (M2) .....
Genesee (J2)..... 500
Genesee Depot (J2). 190
Geneva (lake)(K10)
Genoa (D8)..... 340
Genoa City (K11).... 866
Geo. Mead (res.) (F6) .....
Germania (H8)..... 75
Germantown (K1)... 357
Gibbsville (L8)..... 200
Gile (F3)..... 557
Gillett (K6).....1,410
Gilman (E5)..... 402
Gilmanton (C7)..... 230
Gleason (G5)..... 200
Glen Flora (E4)..... 91
Glen Haven (E10)... 175
Glenbeulah (L8)..... 384
Glenwood City (B5) 778
Glidden (E3).....1,221
Goodman (K4).....1,020
Gordon (C3)..... 250
Gotham (F9)..... 300
Grafton (L93).....1,489
Grand Marsh (G8). 170
Grandview (D3)..... 250
Granite Hts. (H5)... 60
Granton (E6)..... 299
Grantsburg ◉(A4)... 931
Granville (L1)..... 305
Gratiot (F10)..... 323
Green (bay) (L6)....
Green Bay ◉(K6)...52,735
Green Lake ◉(H8).. 728
Greendale (L2).....2,752
Greenleaf (L7)..... 250
Greenvalley (K6)..... 125
Greenville (J7)..... 250
Greenwood (E6)..... 956
Gresham (J6)..... 427
Gurney (F3)..... 159
Hager City (A6)..... 100
Hales Corners (L2).1,200
Hamburg (G5)..... 50
Hammond (A6)..... 554
Hancock (G7)..... 449
Hannibal (E5)..... 120
Hanover (H10)..... 160
Hartford (K9).....4,549
Hartland (J1).....1,190
Hatfield (E7)..... 50
Hatley (H6)..... 299
Haugen (C4)..... 246
Hawkins (E4)..... 414
Hawthorne (C3)..... 120
Hayward ◉(D3).....1,577
Hazel Green (F11).. 635
Hebron (J10)..... 115
Helenville (J10)..... 185
Herbster (D2)..... 75
Hewitt (F6)..... 200
Highland (F9)..... 785

Hika (L8)..... 200
Hilbert (K7)..... 648
Hiles (J4)..... 132
Hillsboro (F8).....1,341
Hillsdale (C5)..... 200
Hingham (K8)..... 200
Hixton (E7)..... 315
Holcombe (D5)..... 350
Holcombe (lake) (D5) .....
Hollandale (G10).... 281
Holmen (D8)..... 584
Holy Cross (L9)..... 65
Honey Creek (J3)... 200
Horicon (J9).....2,664
Horicon (res.) (J8).
Hortonville (J7).....1,081
Houlton (A5)..... 250
Hubertus (K1)..... 78
Hudson ◉(A6).....3,435
Humbird (E6)..... 380
Hurley ◉(F3).....3,034
Hustisford (J9)..... 622
Hustler (F8)..... 194
Independence (D7)..1,088
Ingram (E5)..... 146
Iola (H6)..... 867
Irma (G5)..... 65
Iron Belt (F3)..... 650
Iron Ridge (K9)..... 341
Iron River (D2)..... 895
Ironton (F8)..... 176
Island (lake) (H3)...
Ithaca (F9)..... 55
Ives Grove (L3)..... 75
Ixonia (H1)..... 200
Jackson (K9)..... 361
Jacksonport (M6)... 152
Janesville ◉(J10)...24,899
Jefferson ◉(J10).....3,625
Jim Falls (D5)..... 237
Johnson Creek (J9). 575
Johnstown (J10)..... 80
Juda (H10)..... 320
Jump River (E5)..... 100
Junction City (G6). 330
Juneau ◉(J9).....1,444
Kansasville (L3)..... 135
Kaukauna (K7).....8,337
Kegonsa (lake) (H10) .....
Kellnersville (L7)..... 135
Kendall (F8)..... 558
Kennan (F5)..... 194
Kenosha ◉(M3).....54,368
Keshena (J6)..... 97
Kewaskum (K8).....1,183
Kewaunee ◉(M7)....2,583
Kickapoo (riv.)(E9)
Kiel (L8).....2,129
Kieler (E10)..... 177
Kimberly (K7).....3,179
King (H7)..... 665
Kingston (H8)..... 334
Knapp (B6)..... 424
Kohler (L8).....1,716
Kohlsville (K9)..... 135
Koshkonong (lake) (H10) .....
Krakow (K6)..... 150
La Belle (lake)(H1)
La Crosse ◉(D8)...47,535
La Farge (E8)..... 905
La Pointe (E2)..... 236
La Pointe Ind. Res. (F2) .....
La Valle (F8)..... 448
Lac Court Oreilles Ind. Res. (D4).....
Lac du Flambeau Ind. Res. (G3).....
Lac La Belle (H1)... 174
Ladysmith ◉(D5)....3,924
Lake Beulah (J2)..... 107
Lake Church (L9).... 72
Lake Delton (G8).... 350
Lake Geneva (K10).4,300
Lake Nebagamon (C3) 340
Lake Tomahawk (H4) 200
Lakemills (H9).....2,516
Lakewood (K5)..... 109
Lampson (C3)..... 86
Lancaster ◉(E10)....3,266
Lannon (K1)..... 438
Laona (J4).....1,113
Leadmine (F10)..... 150
Lebanon (H1)..... 160
Lena (K6)..... 526
Leon (E8)..... 103
Leopolis (J6)..... 105
Lewis (B4)..... 155
Lily (J5)..... 150
Lima Center (J10).. 150
Limeridge (F9)..... 183
Linden (F10)..... 463
Lindsey (F6)..... 51
Little Chute (K7)....4,152
Little Prairie (H2)... 50


LAKE SUPERIOR
THE APOSTLE ISLANDS
LAKE MICHIGAN
WISCONSIN
SCALE OF MILES
0 2 4 6 8 10
Duluth
Superior
Ashland
Washburn
Bayfield
Cloquet
Two Harbors
Grand Marais
Hibbing
Virginia
Eveleth
Chisholm
Mountain Iron
Kinney
Babbitt
Cenont Jc.
Whyte
Schroeder
Beaver Bay
Shaw
Carlton
Oliver
Wentworth
Maple
Blueberry
Dedham
Foxboro
Patzau
Hawthorne
Hines
Poplar
Brule
Lake Nebagamon
Moose Lake
Bennett
Solon Springs
Bruno
Dairyland
Gordon
Wascott
Cloverton
Hinckley
Danbury
Webb Lake
Stanberry
Lampson
Spooner
Ferron Park
Webster
Gaslyn
Trego
Earl
Stone Lake
Pine City
Grantsburg
Hertel
Siren
Falun
Dorano
Shell Lake
Randall
Trade Lake
Frederic
West Sweden
Cushing
Atlas
Luck
Wolfcreek
Loraine
Barronett
Haugen
Brill
Mikana
Milltown
Andrus
Centuria
Center City
Balsam Lake
Saint Croix Falls
Dresser
Joel
Wanderoos
Osceola
Amery
Deronda
Clear Lake
E. Farmington
Almena
Poskin
Turtle Lake
Clayton
Barron
Cameron
Canton
Weyerhauser
Hillsdale
Island Lake
Chetek
Sheldon
Jump River
Westboro
Rib Lake
Donald
Hannibal
Whittlesey
Taylor
Gilman
Perkinstown
Merrill
Goodrich
Medford
Polley
Lublino
Little Black
Stetsonville
Glandon
Granite Heights
Elmhurst
Phlox
Menominee Ind. Res.
Hayes
Suring
Breed
Coleman
Pound
Peshtigo
Marinette
Egg Harbor
Fish Creek
Menominee
Chambers I.
Sister Bay
Ephraim
Baileys Harbor
Jacksonport
Sturgeon Bay
Sawyer
Washington I.
Porte des Morts
Ellison Bay
Escanaba
Gladstone
Iron Mountain
Norway
Florence
Commonwealth
Spread Eagle
Tipler
Long Lake
Fern
Homestead
Niagara
Fence
Dunbar
Pembine
Goodman
Laona
Blackwell
Crandon
Mole Lake
Wabeno
Soperton
Athelstane
Cedarville
Amberg
Nashville
Pelican Lake
Sugarbush Hill
1,961
Argonne
Creek
Armstrong
Rhinelander
Monico
Woodboro
Tripoli
Bradley
Heafford Jc.
Jeffris
Tomahawk
Spirit Falls
Grundy Jc.
Harrison
Parrish
Elcho
Summit Lake
Pickerel
Pearson
Lily
Lakewood
Townsend
Wausaukee
Carter
McAllister
Wagner
Middle Inlet
Crivitz
Golo
Loomis
Porterfield
Walsh
Athens
Hamburg
Brokaw
Rib Falls
Rib Mtn.
1,940
Wausau
Schofield
Rothschild
Ringle
Hatley
Norrie
Eland
Bowler
Gresham
Pulcifer
Bimamwood
Stockbridge Ind. Res.
Keshena
Underhill
Maple
Oconto Falls
Oconto
Stiles
Gensaukee
Morgan
Abrams
Cecil
Greenvalley
Mosinee
Wittenberg
Elderon
Big Eau Pleine Res.
Fenwood
Unity
Atwood
Riplinger
Longwood
Owen
Curtiss
Withee
Edgar
Abbotsford
Colby
Milan
Corinth
Dorchester
Chippewa Falls
Cadott
Edson
Boyd
Anson
Colfax
Jim Falls
Colburn
Cobban
Bloomer
Cornell
Holcombe
Arnold
New Auburn
Keystone
Ruby
Cumberland
Rice Lake
Bruce
Tony
Ladysmith
Conrath
Walrath
Ogema
Spirit
Prentice
Glen Flora
Ingram
Hawkins
Catawba
Brantwood
Clifford
Worcester
Phillips
Price
Lugerville
Willow Res.
Thunder
Three Lakes
Lake Tomahawk
Robbins
Hazelhurst
Minocqua
Woodruff
Arbor Vitae
Lac du Flambeau
Ind. Res.
Eagle River
Alvin
Nelma
Crystal Falls
Lac Vieux Desert
Island Lake
Trout L.
Starlake
Conover
Boulder Junction
Manitowish
Winchester
Land O'Lakes
Phelps
Sand L.
Mercer
Moose L.
Morse
Cayuga
Clam Lake
Glidden
Peeksville
Springstead
Butternut
Hayward
Spider L.
Round L.
Moose L.
Seeley
Chittamo
Mineng
Cable
Namakagon Lake
L. Owen
Robinson L.
Barnes
Drummond
Grandview
Bibon
Sanborn
High Bridge
Marengo
Mason
Benoit
Delta
Iron River
Ino
Moquah
Barksdale
Odanah
Ashland
Bad River Ind. Res.
Saxon
Gurney
Gile
Pence
Iron Belt
Upson
Sandrock
Van Buskirk
Montreal
Ironwood
Kimball
Hurley
Bessemer
Cedar
Lake Gogebic
Montreal R.
Presque Isle R.
Chequamegon Bay
Cornucopia
Red Cliff Ind. Res.
Red Cliff
Barkpoint
Herbster
Port Wing
La Pointe
Madeline I.
Michigan I.
La Pointe Ind. Res.
Stockton I.
Outer I.
Cat I.
Bear I.
Oak I.
Sand I.
Fond du Lac Ind. Res.
St. Louis R.
Cloquet R.
Nemadji R.
Bois Brule R.
Kettle R.
Yellow R.
Clam R.
Namekagon R.
Chippewa R.
Flambeau R.
Chippewa Lake
Lac Courte Oreilles Ind. Res.
Round L.
Kaiser
Park Falls
Fifield
Draper
Loretta
Couderay
Winter
Ojibwa
Radisson
Edgewater
Weirgor
Chetac
Exeland
Wooddale
Birchwood
Murry
Mikana
Campia
Hawkins
Ingram
Glen Flora
Tony
Walrath
Sheldon
Jump River
Island Lake
Flambeau
Holcombe
Donald
Chelsea
Whittlesey
Perkinstown
Gilman
Rib Lake
Westboro
Jump R.
Wisconsin R.
Rib R.
Menominee R.
Peshtigo R.
Oconto R.
Pike R.
Wolf R.
Fox R.
Milwaukee R.
Root R.
Pike R.
Waukesha
West Allis
West Milwaukee
Wauwatosa
Milwaukee
Whitefish Bay
Shorewood
Fox Point
River Hills
Brown Deer
Granville
Menomonee Falls
Lannon
Sussex
Lisbon
Merton
North Lake
Monches
Mapleton
Monterey
Stonebank
Lac La Belle
Ixonia
Pipersville
Okauchee
Lac La Belle
Oconomowoc
L. Oconomowoc
Concord
Delafield
Nashotah
Nagawaukee L.
Pewaukee L.
Pewaukee
Duplainville
Hartland
Pine L.
Chenequa
Colgate
Menomonee
Germantown
Meeker
Freistadt
Thiensville
Mequon
Ashippun
Alderley
Plat
Baer
Richfield
Rockfield
Thompson
Hubertus
Lebanon
Golden L.
Sullivan
Dousman
Wales
Statesan
Calhoun
Rome
Genesee Depot
New Berlin
Genesee
Prospect
Tess Corners
Guthrie
Vernon
Muskego
Muskego L.
Saint Martins
Oakwood
Root Creek
Saint Francis
Cudahy
General Mitchell Field
New Coeln
Greendale
Hales Corners
Lake
South Milwaukee
Carrollville
Oak Hill
North Prairie
Eagle
Mukwonago
Big Bend
Phantom L.
Eagle L.
Denoon L.
Durham
Palmyra
Little Prairie
L. Beulah
Caldwell
Tichigan
Tichigan L.
Wind L.
Wind Lake
Raymond
Thompsonville
Caledonia
Linwood
East Troy
Troy
Troy Center
Lake Beulah
Waterford
Franksville
Honey Creek
Vienna
Rochester
Yorkville
Olves Grove
Racine
Eagle L.
Sylvania
Sturtevant
Dover
Kansasville
Union Grove
Berryville
Brighton
Paris
Somers
Kenosha
Truesdell
Douglas
Bayfield
Burnett
Washburn
Sawyer
Price
Oneida
Forest
Florence
Marinette
Oconto
Shawano
Langlade
Lincoln
Taylor
Chippewa
Barron
Polk
St. Croix
Dunn
Pepin
Pierce
Pacific
St. Paul
New Richmond
Stillwater
N. Hudson
Hudson
Roberts
Hammond
Woodville
Wilson
Knapp
Cedar Falls
Rusk
Albertville
Elk Mound
Menomonie
Weston
Eau Claire
Ludington
Altoon
River Falls
Beldenville
Martell
Spring Valley
Glenwood City
Boyceville
Wheeler
Downing
Cedar
Baldwin
Hersey
Emerald
Boardman
Houlton
Jewett
Somerset
Deer Park
Dyon
Ridgeland
Sand Creek
Prairie Farm
Dallas
Star Prairie
Clear Lake
Reeve
Amery
Deronda
Osceola
Nye
Apple R.
Holcombe
Flambeau
Island Lake
Hillsdale
Chetek
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Lily
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Wausaukee
Carter
McAllister
Wagner
Middle Inlet
Crivitz
Golo
Loomis
Porterfield
Walsh
Athens
Hamburg
Brokaw
Rib Falls
Rib Mtn.
1,940
Wausau
Schofield
Rothschild
Ringle
Hatley
Norrie
Eland
Bowler
Gresham
Pulcifer
Bimamwood
Stockbridge Ind. Res.
Keshena
Underhill
Maple
Oconto Falls
Oconto
Stiles
Gensaukee
Morgan
Abrams
Cecil
Greenvalley
Mosinee
Wittenberg
Elderon
Big Eau Pleine Res.
Fenwood
Unity
Atwood
Riplinger
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Curtiss
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Boyd
Anson
Colfax
Jim Falls
Colburn
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Ladysmith
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Hazelhurst
Minocqua
Woodruff
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Lac du Flambeau
Ind. Res.
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Lac Vieux Desert
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Starlake
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Boulder Junction
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Cable
Namakagon Lake
L. Owen
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Menominee R.
Peshtigo R.
Oconto R.
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Wolf R.
Fox R.
Milwaukee R.
Root R.
Pike R.
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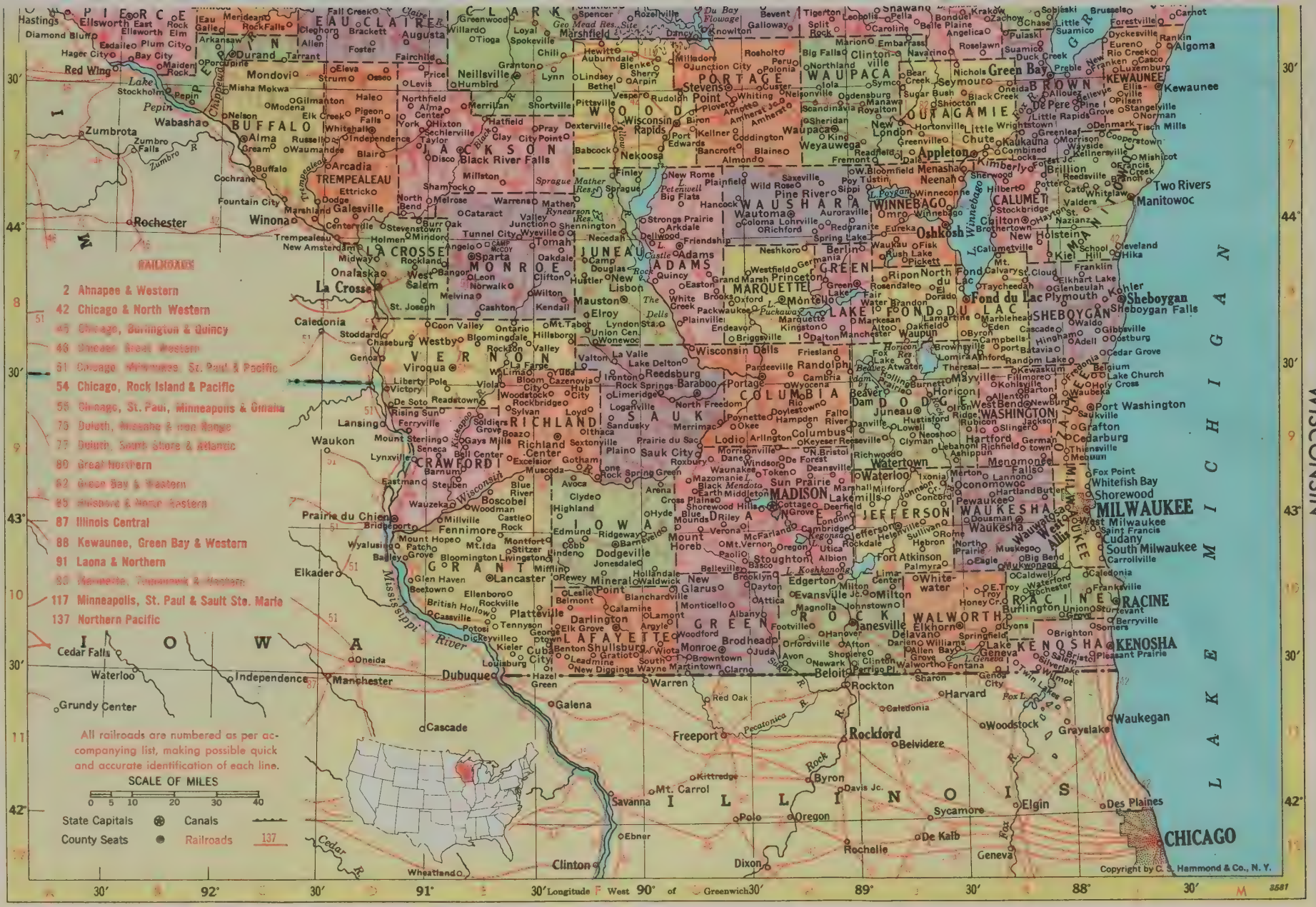
West Allis
West Milwaukee
Wauwatosa
Milwaukee
Whitefish Bay
Shorewood
Fox Point
River Hills
Brown Deer
Granville
Menomonee Falls
Lannon
Sussex
Lisbon
Merton
North Lake
Monches
Mapleton
Monterey
Stonebank
Lac La Belle
Ixonia
Pipersville
Okauchee
Lac La Belle
Oconomowoc
L. Oconomowoc
Concord
Delafield
Nashotah
Nagawaukee L.
Pewaukee L.
Pewaukee
Duplainville
Hartland
Pine L.
Chenequa
Colgate
Menomonee
Germantown
Meeker
Freistadt
Thiensville
Mequon
Ashippun
Alderley
Plat
Baer
Richfield
Rockfield
Thompson
Hubertus
Lebanon
Golden L.
Sullivan
Dousman
Wales
Statesan
Calhoun
Rome
Genesee Depot
New Berlin
Genesee
Prospect
Tess Corners
Guthrie
Vernon
Muskego
Muskego L.
Saint Martins
Oakwood
Root Creek
Saint Francis
Cudahy
General Mitchell Field
New Coeln
Greendale
Hales Corners
Lake
South Milwaukee
Carrollville
Oak Hill
North Prairie
Eagle
Mukwonago
Big Bend
Phantom L.
Eagle L.
Denoon L.
Durham
Palmyra
Little Prairie
L. Beulah
Caldwell
Tichigan
Tichigan L.
Wind L.
Wind Lake
Raymond
Thompsonville
Caledonia
Linwood
East Troy
Troy
Troy Center
Lake Beulah
Waterford
Franksville
Honey Creek
Vienna
Rochester
Yorkville
Olves Grove
Racine
Eagle L.
Sylvania
Sturtevant
Dover
Kansasville
Union Grove
Berryville
Brighton
Paris
Somers
Kenosha
Truesdell


RAILROADS
2 Ahnapee & Western
42 Chicago & North Western
45 Chicago, Burlington & Quincy
46 Chicago Great Western
51 Chicago Minneapolis, St. Paul & Pacific
54 Chicago, Rock Island & Pacific
55 Chicago, St. Paul, Minneapolis & Omaha
75 Duluth, Missabe & Iron Range
77 Duluth, South Shore & Atlantic
80 Great Northern
82 Green Bay & Western
85 Milwaukee & Road Western
87 Illinois Central
88 Kewaunee, Green Bay & Western
91 Laona & Northern
93 Marinette, Tomahawk & Western
117 Minneapolis, St. Paul & Sault Ste. Marie
137 Northern Pacific
All railroads are numbered as per accompanying list, making possible quick and accurate identification of each line.
SCALE OF MILES
0 5 10 20 30 40
State Capitals
County Seats
Canals
Railroads 137
WISCONSIN
MICHIGAN
LAKE
ILLINOIS
IOWA
MINNESOTA
CHICAGO
Copyright by C. S. Hammond & Co., N. Y.
Longitude West of Greenwich
92° 91° 90° 89° 88°
30° 44° 43° 42°

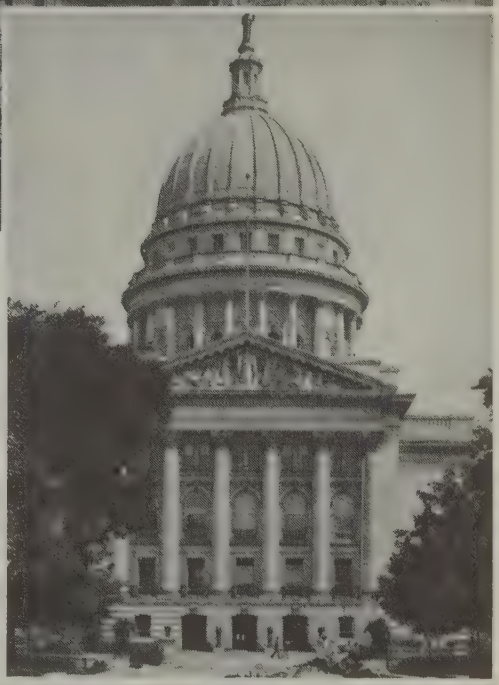
Little Suamico (L6) 150
Livingston (E10) 452
Lodi (G9) 1,416
Loganville (F9) 250
Lohrville (H7) 206
Lomira (J8) 746
London (H9) 140
Lone Rock (F9) 570
Long (lake) (C4)
Long Lake (J4) 229
Loraine (B4) 100
Loretta (E4) 115
Lowell (J9) 319
Loyal (E6) 1,104
Loyd (F9) 56
Lublin (E5) 161
Luck (B4) 803
Luxemburg (L6) 519
Lyndon Station (F8) 377
Lynxville (D9) 217
Lyons (K10) 400
Madeline (isl.) (E2)
MADISON (H9) 96,056
Maiden Rock (B6) 269
Manawa (J7) 990
Manchester (J8) 150
Manitowish (F3) 75
Manitowoc ◉(L7) 27,598
Maple (C2) 75
Mapleton (J1) 75
Maplewood (M6) 150
Marathon (G6) 853
Marblehead (K8) 125
Marcy (K1) 100
Marengo (E3) 110
Marinette ◉(L5) 14,178
Marion (J6) 1,118
Markesan (J8) 1,010
Marquette (H8) 350
Marshall (H9) 541
Marshfield (F6) 12,394
Marshland (C7) 70
Martell (B6) 125
Mason (D3) 140
Mather (F7) 75
Mattoon (J5) 510
Mauston ◉(F8) 3,171
Mayville (K9) 3,010
Mazomanie (G9) 962
Mc Farland (H10) 593
Medford ◉(F5) 2,799
Meeker (K1) 55
Mellen (E3) 1,306
Melrose (E7) 497
Melvina (E8) 121
Menasha (J7) 12,385
Mendota (lake) (H9)
Menominee (riv.) (L5)
Menominee Ind. Res. (J5)
Menomonee Falls (K1) 2,469
Menomonie ◉(C6) 8,245
Mercer (F3) 800
Merrill ◉(G5) 8,951
Merrillan (E7) 579
Merrimac (G9) 317
Merton (K1) 343
Michigan (lake) (M9)
Middleton (G9) 2,110
Midway (D8) 113
Mifflin (F10) 90
Mikana (C4) 125
Milan (F6) 153
Milford (J9) 150
Milladore (G6) 247
Millston (E7) 175
Milltown (B4) 580
Millville (E9) 50
Milton (J10) 1,549
Milton Jct. (H10) 1,104
Milwaukee ◉ (M1) 637,392
Mineral Point (F10) 2,284
Minocqua (G4)
Minong (C3) 357
Misha Mokwa (C7) 32
Mishicot (L7) 583
Mississippi (riv.) (D10)
Modena (C7) 116
Monches (J1) 53
Mondovi (C6) 2,285
Monico (H4) 375
Monroe ◉(G10) 7,037
Montello ◉(H8) 1,069
Monterey (J1) 85
Montfort (E10) 576
Monticello (G10) 792
Montreal (F3) 1,439
Montreal (riv.) (F2)
Morrison (L7) 100
Morrisonville (G9) 236
Morse (E3) 135
Mosinee (G6) 1,453
Mount Hope (D10) 232
Mount Horeb (G10) 1,716
◉County Seat

Mount Sterling (D9) 205
Mount Vernon (G10) 105
Mountain (K5) 200
Mukwonago (J2) 1,207
Muscoda (F9) 1,046
Muskego (K2) 1,968
Muskego (lake) (L2)
Nag (lake) (J1)
Namakagon (riv.) (C3)
Nashotah (J1) 400
Navarino (J6) 100
Necedah (F7) 862
Neenah (J7) 12,437
Neillsville ◉(E6) 2,663
Nekoosa (G7) 2,352
Nelma (J3) 77
Nelson (C7) 325
Nelsonville (H7) 188
Neopit (J6) 1,257
Neosho (J9) 287
Neshkoro (H8) 361
New Amsterdam (C8) 55
New Auburn (D5) 371
New Berlin (K2) 100
New Diggings (F10) 300
New Franken (L6) 115
New Glarus (G10) 1,224
New Holstein (K8) 1,831
New Lisbon (F8) 1,482
New London (J7) 4,922
New Richmond (A5) 2,886
Newald (J4) 280
Newburg (K9) 288
Niagara (K4) 2,022
Nichols (K6) 150
N. Bend (D7) 125
N. Bristol (H9) 88
N. Fond du Lac (J8) 2,291
N. Freedom (G9) 611
N. Hudson (A5) 787
N. Lake (J1) 300
N. Prairie (J2) 424
Norwalk (E8) 519
Oakdale (F8) 190
Oakfield (J8) 697
Oakwood (L2) 125
Oconomowoc (H1) 5,345
Oconto ◉(L6) 5,055
Oconto (riv.) (K5)
Oconto Falls (K6) 2,050
Ogdensburg (J7) 221
Ogema (F5) 300
Okauchee (J1) 1,673
Oliver (B2) 210
Omro (J7) 1,470
Onalaska (D8) 2,561
Oneida (K7) 150
Ontario (E8) 527
Oostburg (L8) 895
Oregon (H10) 1,341
Orfordville (H10) 543
Osceola (A5) 700
Oshkosh ◉(J8) 41,084
Osseo (D6) 1,126
Outer (isl.) (F1)
Owen (F6) 1,034
Owen (lake) (D3)
Oxford (H8) 509
Packwaukee (G8) 275
Palmyra (H2) 862
Paoli (G10) 108
Pardeeville (H8) 1,112
Park Falls (F4) 2,924
Parrish (H5) 95
Patch Grove (D10) 203
Patzau (B3) 350
Pecatonica (riv.) (H11)
Pelican Lake (H4) 200
Pella (J6) 95
Pembine (L4) 665
Pence (F3) 375
Pensaukee (L6) 200
Pepin (B7) 840
Pepin (lake) (B7)
Perkinstown (E5) 160
Perrigo Place (H10) 3,315
Peru (H6) 60
Peshtigo (L5) 2,279
Peshtigo (riv.) (K5)
Petenwell (lake) (G7)
Pewaukee (K1) 1,792
Pewaukee (lake) (K1)
Phantom (lake) (J2)
Phelps (H3) 600
Phillips ◉(E4) 1,775
Phlox (J5) 200
Pickerel (J5) 300
Pigeon Falls (D7) 300
Pine River (H7) 102
Pittsville (F7) 636
Plain (F9) 512
Plainfield (G7) 680
Platteville (F10) 5,751
Pleasant Prairie (L10) 274

Plover (G7) 515
Plum City (B6) 355
Plymouth (L8) 4,543
Polar (H5) 200
Poplar (C2) 489
Porcupine (C6) 73
Port Edwards (G7) 1,336
Port Washington ◉ (L9) 4,755
Port Wing (D2) 250
Portage ◉(G8) 7,334
Porte des Morts (str.) (N5)
Poskin (C5) 87
Potosi (E10) 556
Potter (K7) 210
Pound (L5) 354
Poy Sippi (J7) 450
Poygan (lake) (J7)
Poynette (G9) 969
Prairie du Chien ◉ (D9) 5,392
Prairie du Sac (G9) 1,402
Prairie Farm (C5) 343
Preble (L6) 5,092
Prentice (F4) 477
Prescott (A6) 1,005
Princeton (H8) 1,371
Prospect (K2) 150
Puckaway (lake) (H8)
Pulaski (K6) 1,210
Pulcifer (K6) 140
Racine ◉(M3) 71,193
Radisson (D4) 200
Randall (A4) 54
Randolph (H8) 1,350
Random Lake (K8) 679
Rankin (M6) 200
Readfield (J7) 200
Readstown (E9) 541
Red Cedar (riv.) (C5)
Red Cliff (E2) 80
Red Cliff Ind. Res. (D2)
Redgranite (J7) 648
Reedsburg (G8) 4,072
Reedsville (L7) 691
Reeseville (J9) 470
Reserve (D4) 175
Rewey (F10) 252
Rhinelander ◉(H4) 8,774
Rib (mt.) (G6)
Rib Falls (G6) 125
Rib Lake (F5) 853
Rice Lake (C5) 6,898
Richfield (K1) 276
Richland Center ◉ (F9) 4,608
Richwood (J9) 60
Ridgeland (B5) 273
Ridgeway (F10) 410
Ringle (G6) 100
Rio (H9) 741
Rio Creek (L6) 100
Riplinger (E6) 92
Ripon (J8) 5,619
River Falls (A6) 3,877
River Hills (M1) 567
Roberts (A6) 290
Rochester (K3) 333
Rock (riv.) (H11)
Rock Elm (B6) 225
Rock Falls (C6) 100
Rock Springs (F8) 442
Rockbridge (F9) 96
Rockdale (J10) 161
Rockfield (L1) 150
Rockland (D8) 216
Rolling Prairie (J9) 100
Rome (H1) 285
Rosendale (J8) 388
Rosholt (H6) 508
Rothschild (G6) 1,425
Roxbury (G9) 150
Royalton (J7) 375
Rozellville (G6) 128
Rubicon (K9) 132
Rudolph (G7) 225
Rusk (C6) 80
Rynearson (res.) (F7)
St. Cloud (K8) 408
St. Croix (riv.) (A4)
St. Croix Falls (A5) 1,065
St. Louis (riv.) (A2)
St. Martins (L2) 150
St. Nazianz (L7) 450
Salem (K10) 450
Sanborn (E3) 102
Sand (lake) (J4)
Sand Creek (C5) 175
Sarona (C4) 95
Sauk City (G9) 1,755
Saukville (L9) 699
Sawyer (M6) 539
Saxon (F3) 450
Sayner (H4) 300
Scandinavia (H7) 286
Schofield (H6) 1,948

School Hill (L8) 75
Sechlerville (E7) 60
Seneca (E9) 207
Sextonville (F9) 195
Seymour (K6) 1,760
Sharon (J11) 1,013
Shawano ◉(J6) 5,894
Sheboygan ◉(L8) 42,365
Sheboygan Falls (L8) 3,599
Sheldon (D5) 271
Shell Lake ◉(C4) 954
Sheridan (H7) 50
Sherry (G6) 82
Sherwood (K7) 350
Shiocton (K7) 673
Shopiere (H10) 300
Shorewood (M1) 16,199
Shorewood Hills (G9) 1,594
Shullsburg (F10) 1,306
Silverlake (K10) 603
Siren (B4) 613
Sister Bay (M5) 429
Slinger (K9) 919
Sobieski (L6) 82
Soldiers Grove (E9) 781
Solon Springs (C3) 480
Somers (M3) 175
Somerset (A5) 531
Soperton (J5) 340
S. Milwaukee (M2) 12,855
S. Range (B2) 104
S. Wayne (G10) 328
Sparta ◉(E8) 5,893
Spencer (F6) 757
Spirit (F5) 85
Split Rock (H6) 55
Spokeville (E6) 50
Spooner (B4) 2,597
Sprague Mather (res.) (F7)
Spring Green (G9) 1,064
Spring Lake (H8) 150
Spring Valley (B6) 975
Springbrook (C4) 150
Springfield (K10) 175
Stanberry (C3) 50
Stangelville (L7) 60
Stanley (E6) 2,014
Star Prairie (A5) 288
Starks (H4) 150
Starlake (G3) 100
Statesan (J1) 275
Stetsonville (F5) 334
Steuben (E9) 264
Stevens Point ◉ (G7) 16,564
Stiles (L6) 200
Stitzer (E10) 200
Stockbridge (K7) 409
Stockbridge Ind. Res. (J6)
Stockholm (B7) 124
Stockton (isl.) (F2)
Stoddard (D8) 459
Stone Lake (C4) 250
Stonebank (J1) 100
Stoughton (H10) 4,833
Stratford (F6) 982
Strongs Prairie (G7) 103
Strum (D6) 542
Sturgeon Bay ◉ (M6) 7,054
Sturtevant (M3) 1,176
Suamico (K6) 400
Sugar (riv.) (H10)
Sugar Bush (J7) 150
Surgarbush Hill (mt.) (J4)
Sullivan (H1) 349
Summit Lake (H5) 180
Sun Prairie (H9) 2,263
Superior (City) ◉ (C2) 35,325
Superior (lake) (F1)
Suring (K5) 546
Sussex (K1) 679
Sylvania (L3) 75
Symco (J6) 175
Taycheedah (K8) 150
Taylor (E7) 350
Tennyson (E10) 211
Theresa (K8) 461
Thiensville (L1) 897
Thorp (E6) 1,383
Three Lakes (H4) 850
Tigerton (H6) 827
Tilleda (J6) 120
Tisch Mills (L7) 250
Token (H9) 64
Tomah (F8) 4,760
Tomahawk (G5) 3,534
Tony (E5) 182
Trade Lake (A4) 100
Trego (C4) 250
Trempealeau (C8) 645
Trempealeau (riv.) (C7)
Tripoli (G4) 190

Troy (J2) 77
Troy Center (J2) 161
Truesdell (L3) 85
Tunnel City (E7) 190
Turtle Lake (B5) 696
Tustin (J7) 100
Twin Lakes (K11) 637
Two Rivers (M7) 10,243
Underhill (K6) 110
Union Center (F8) 261
Union Grove (L3) 1,358
Unity (F6) 355
Valders (L7) 560
Valley (F8) 120
Valley Jct. (E7) 60
Valmy (M6) 100
Valton (F8) 71
Verona (G9) 748
Vesper (F7) 342
Victory (D9) 118
Vieux Desert (lake) (J3)
Viola (E8) 785
Viroqua ◉(D8) 3,795
Wabeno (J5) 660
Waldo (L8) 367
Waldwick (G10) 86
Wales (J1) 237
Walworth (J10) 1,137
Wanderoos (B5) 100
Warrens (E7) 275
Washburn ◉(D2) 2,070
Washington (isl.) (M5)
Washington Island (M5) 800
Waterford (K3) 1,100
Waterloo (J9) 1,667
Watertown (J9) 12,417
Waubeka (L9) 200
Waukau (J8) 150
Waukesha ◉(K1) 21,233
Waumandee (C7) 110
Waunakee (G9) 1,042
Waupaca ◉(H7) 3,921
Waupun (J8) 6,725
Wausau ◉(G6) 30,414
Wausaukee (K5) 612
Wautoma ◉(H7) 1,376
Wauwatosa (L1) 33,324
Wauzeka (E9) 564
Wayside (L7) 177
Webster (B4) 552
Weirgor (D4) 87
W. Allis (L1) 42,959
W. Bend ◉(K9) 6,849
W. Bloomfield (J7) 65
W. Lima (E8) 110
W. Milwaukee (L1) 5,429
W. Salem (D8) 1,376
W. Sweden (B4) 150
Westboro (F5) 500
Westby (E8) 1,491
Westfield (H8) 935
Weston (C6) 56
Weyauwega (H7) 1,207
Weyerhauser (D5) 331
Wheeler (C5) 235
White Lake (J5) 408
Whitefish Bay (M1) 14,665
Whitehall ◉(D7) 1,379
Whitelaw (L7) 386
Whitewater (J10) 5,101
Whiting (H7) 854
Wild Rose (H7) 582
Willard (E6) 110
Williams Bay (J10) 1,118
Willow (res.) (F4)
Wilmot (K11) 381
Wilson (B6) 174
Wilton (F8) 533
Winchester (G3) 250
Wind Lake (K2) 1,067
Winegar (G3) 250
Winnebago (lake) (K7)
Winneconne (J7) 1,078
Winter (E4) 440
Wiota (G10) 112
Wisconsin (riv.) (E9)
Wisconsin Dells (G8) 1,957
Wisconsin Rapids ◉ (G7) 13,496
Withee (E6) 421
Wittenberg (H6) 874
Wolf (riv.) (J5)
Wonewoc (F8) 961
Woodford (G10) 115
Woodman (E9) 149
Woodruff (G4) 600
Woodstock (E9) 75
Woodville (B6) 410
Wrightstown (K7) 761
Wyalusing (D10) 100
Wyeville (F7) 195
Wyocena (H9) 714
Yellow (riv.) (F7)
Yuba (F8) 119
Zachow (K6) 130



WISCONSIN

Above: Milwaukee: a view looking north on the Milwaukee River as it passes through the business section of the city.

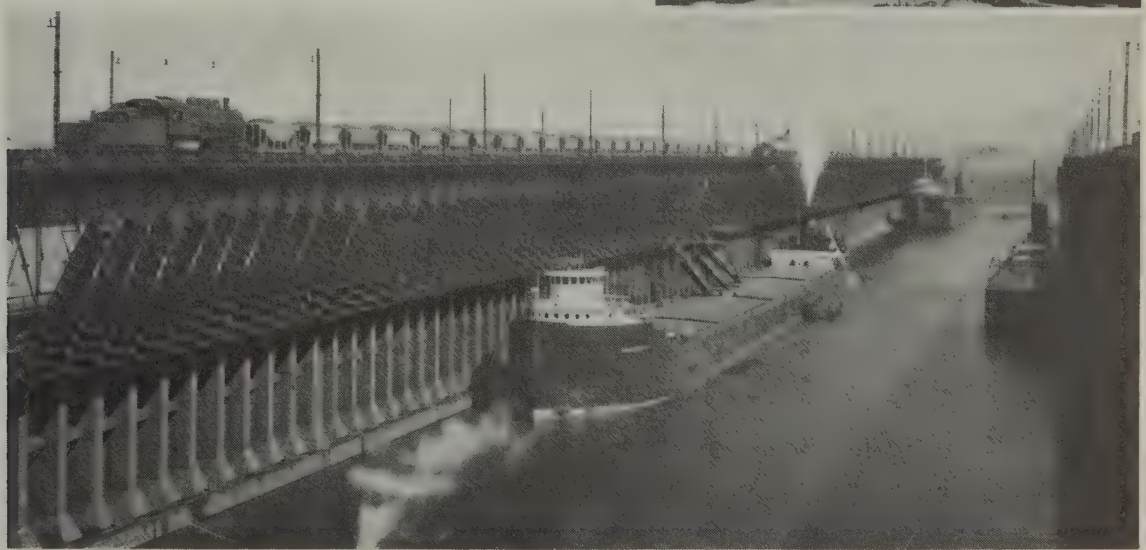
Ewing Galloway, N.Y.

Right: The State Capitol at Madison.

Ewing Galloway, N.Y.

Below: Iron ore from the great Minnesota deposits is brought by train to Superior where it is reloaded on Great Lakes vessels for shipment eastward.

Great Northern Railway



WISCONSIN

Above: Scenes like this, on a dairy farm near Madison, are a common sight in the nation's leading dairy state.

Left: In a Wisconsin farmhouse the hungry threshing crew sit down to a huge midday meal.

Below: The *Winnebago*, one of the old stern wheelers that ply up and down the Wisconsin River, pulls in to shore at Wisconsin Dells.

(Above) Ewing Galloway; (left) Triangle Photo Service; (below) Black Star

pulsory through 18 if unemployed, and on a part time basis if employed. All public schools are under the supervision of the State Department of Public Instruction, and parochial and private schools are required to meet standards prescribed by that department.

In the school year of 1945–1946, the total expenditure for public elementary and secondary education was $66,812,932, including state aid of $9,534,361. There were 6,037 elementary schools, employing 13,889 teachers, and enrolling 342,437 pupils. 457 secondary schools employed 6,328 teachers, and enrolled 141,919 pupils. Out of a total of approximately 6,350 school districts, about 4,500 operated single teacher schools. In that year, under the supervision of the State Board of Vocational and Adult Education, 42 day and 55 night schools were operated, giving training to 104,732 persons.

There were 24 county normal schools in 1947 under the supervision of the State Department of Public Instruction, for the training of rural teachers. The state operated nine state teachers colleges and Stout Institute, which trains teachers for vocational education. For higher education, the state conducts the University of Wisconsin (q.v.) and the Wisconsin Institute of Technology (school of mining) at Platteville.

Private Institutions.—During the school year of 1945–1946, parochial and private elementary and secondary schools enrolled 116,556 pupils. The more important private and church controlled institutions of higher education were: Beloit College, Beloit; Carroll College, Waukesha; Lawrence College, Appleton; Marquette University, Milwaukee; Milton College, Milton; Milwaukee-Downer College (for women), Milwaukee; Northland College, Ashland; Northwestern College, Watertown; Ripon College, Ripon; and St. Norbert College, West De Pere.

Libraries.—There were 290 public libraries in the state in 1947. In addition the State Free Library Commission through its Traveling Library department sent traveling libraries to all parts of the state as well as making individual loans to persons who were not able to use public libraries. The resources of the libraries of the State Historical Society and the University of Wisconsin, both at Madison, are made available to all parts of the state through interlibrary loan privileges. There is an outstanding collection of material on pulp and paper making at the library of the Institute of Paper Chemistry at Appleton.

History.—*Fur Trading Era (1634–1836).*—The first white man of record to set foot on Wisconsin soil was the Frenchman, Jean Nicolet, (1598–1642), who in 1634 visited the Green Bay region to cement trading relations with the Indians of the interior. During the next 130 years the region was explored by Louis Jolliet, Jacques Marquette, Pierre Radisson, Médart Chonart de Groseilliers, Nicolas Perrot, Daniel Greysolon Duluth, and others. Jesuit missionaries labored valiantly, but with little success, to Christianize the Winnebago, Chippewa, Menominee, Fox, Sauk, and Potawatomi natives. *Coureurs de bois* ranged the forests, while trading posts at Le Baye, La Pointe, and on the Mississippi conducted the legitimate barter by which the country was progressively denuded of its fur-bearing animals. Eventually, in 1763, control passed to the English, but the fur trade continued in the hands of the few French residents, of whom Charles de Langlade (1729–1801), sometimes called the "Father of Wisconsin," was chief. Nominally, the region passed to the United States of America in 1783, but it was not until 1816 that the British actually withdrew and occupation by the United States became a fact with the building in that year of Ft. Howard at Green Bay and Ft. Crawford at Prairie du Chien.

After 1783 the Wisconsin region was successively a part of the Northwest Territory (1787–1800), and the territories of Indiana (1800–1809), Illinois (1809–1818), and Michigan (1818–1836). Although the lead deposits of the area had been worked superficially by the Indians and French, it was not until 1822 that exploitation by the white man really began, and not until 1827 was Indian title to the region of the lead deposits extinguished and the area fully opened to mining. This brought a rush of wealth-seekers. Though at first many returned south each fall because of the inclemency of the winters (these were called "suckers"), others like badgers hastily dug caves in the hillsides in which to weather winter's blasts. These latter were jestingly called "Badgers," and thus originated the popular nickname for the state and its inhabitants.

Treaties with the Indians between the years 1829 and 1833 completed the cession to the white man of all that part of present Wisconsin south of the Wisconsin River and east of the Fox. Survey of lands began in 1833, and a land office was opened at Mineral Point in 1834. Nevertheless, when the Territory of Wisconsin was formed on July 3, 1836 there were only about 12,000 inhabitants within the bounds of the present state, most of whom were in the lead mining region of the southwest.

Period of Development (1836–1900).—With the formation of the territory, James Duane Doty, formerly judge of the first territorial court west of Lake Michigan, secured the location of the capital of the new territory at a site on the Four Lakes, where he held most of the land, and the building of Madison began in the winter of that year. Settlement of the region progressed rapidly, and in 1846 an enabling act was passed by the federal Congress permitting statehood. The first attempt at constitution making in 1846 proved abortive, due to certain provisions in it prohibiting banking and permitting married women to hold property separate from their husbands. Not until May 29, 1848 was the state constitution approved and statehood finally achieved.

The principal problem of the settlers of the new commonwealth, aside from clearing the forests from the land, was that of transportation. Steamboats and sailing vessels on the Mississippi and Great Lakes were adequate for the fringes of the state, but did not help the richer agricultural regions in the interior. Many canals were projected, and plank roads reaching inland from Lake Michigan ports proved temporary but inadequate expedients for transporting to market the growing flood of wheat. Railroads, the first of which began service between Milwaukee and Waukesha in 1851, proved to be the solution, and by the end of 1860 there were 891 miles of railway in operation within the state.

The Democratic Party had dominated the early territory and state, but in response to the slavery issue Wisconsin early joined in organizing the new Republican Party, which was officially formed in the state in July, 1854. It secured control of the state government in 1856,

since which date it has usually been the dominant party. Wisconsin contributed 91,379 soldiers to the Union armies during the Civil War, in addition to producing over 20,000,000 bushels of wheat annually for the feeding of the Northern forces.

During the three decades following the close of the Civil War, settlement of the state was completed, the building of the railroad network was finished, and exploitation of its lumber resources was carried past its zenith of activity. Wheat production declined sharply after 1870, and dairy farming was introduced and firmly established. Industry thrived, lumbering overshadowing all other activities, with the processing of farm products being next in line. Iron mining on the Gogebic Range produced a brief flurry of activity giving birth to a short lived iron and steel industry.

The Industrial State (1900–1949).—Economically, the years after 1900 marked the emergence of the modern industrial and dairying state. It took the leadership of the nation in dairying and maintained it unchallenged. Its industry, with the end of the virgin forests, advanced from the stage of exploitation of natural resources to the stage of specialized fabrication of goods for a world-wide market. In politics, the years immediately following 1900 were distinguished by the triumph of the Progressive Movement led by Robert M. La Follette, Sr. (1855–1925). A comprehensive series of progressive measures were adopted looking to the liberalizing of the agencies of government and society, until Wisconsin became a synonym for political experiment and progress. With two short intervals of conservative control, the progressive wing of the Republican Party dominated the state for 30 years, but fell victim to the Democratic landslide in the depression year election of 1932. In 1934 this progressive wing, which in general had supported the domestic measures of the Franklin D. Roosevelt administration, seceded from the Republicans and formed the Progressive Party. This organization was successful in the state elections of 1934 and 1936, but lost control of the state to the old line Republicans in 1938. After that the party rapidly disintegrated and in 1946 was disbanded, the majority of its members returning, unwelcomed, to the Republican fold.

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WISCONSIN, University of, the state university located at Madison, Wis. As early as 1836 the legislature of the Territory then known as Wisconsin passed an act for the establishment of "Wisconsin University" at Belmont, now in the State of Iowa, but the institution was never organized; again in 1838 a law was passed for the establishment of the "University of the Territory of Wisconsin," a board of visitors was appointed and the national endowment of two townships of land received. Nothing further was done, however, until 1848, when the state constitution provided for the establishment of a state university, and the university was incorporated by act of the legislature. A preparatory department was opened in 1849 and the collegiate department in 1850. In 1854 a second grant of two townships of land was made by Congress; but this land as well as that of the first grant was sold at very low prices to attract settlers, and the income derived from the fund was meager; no state appropriation was made until 1870. In 1858 the university was reorganized, the work of the preparatory department restricted and a collegiate department organized in six schools. During the War of Secession a large number of students entered the army, and though the work of the university was not suspended, no commencement was held in 1864. Since the war the progress of the university has been continuous. In 1866 a reorganization was effected. The federal grant under the Morrill Act for the establishment of colleges of agriculture and industrial arts was given to the university. Colleges of agriculture and engineering were then established as integral parts of the university. Women, who had been admitted since 1863 to a "normal" department, were given the opportunity to follow a regular collegiate course. In 1873 the legislature appropriated $10,000 a year to the university; in 1876 an annual 10th of a mill tax was appropriated; in 1883 and 1891 other mill taxes were added; in 1899 all mill taxes were consolidated with a grant of 1 per cent of the railroad licenses into a specific annual grant, which was increased in 1901 and again in 1903. The total endowment was $5,920,858 in 1952. At the time of the first annual grant of $10,000 a system of free tuition to graduates of high schools in the state was adopted, which led to the elimination of the preparatory department a few years later. This also resulted in making the university the actual head of the public school system of the state.

Since 1892 the university has extended its work in all directions; a number of special courses has been added, particular emphasis has been laid on graduate work and the number of graduate students increased. The university now includes the following colleges and schools: (1) the College of Letters and Science; (2) the College of Mechanics and Engineering; (3) the College of Law; (4) the College of Agriculture; (5) the Graduate School; (6) the Medical School; and (7) the School of Education. It also conducts a summer school and a university extension department. The College of Letters and Science includes, besides the general departments of instruction in arts and sciences, the several special departments as follows: The courses in chemistry and pharmacy, the School of Music, the Library School, the School of Commerce, the School of Journalism, the normal graduates' course and the Washburn Observatory. The degrees of A.B. and Ph.B. (general course) are conferred upon the graduates of the College of Letters and Science, except in the chemistry, medical and pharmacy courses which lead to the B.S. degree, and the normal graduates' course, leading to the degree of Ph.B (course for normal-school graduates).

For the degree of Ph.B. (general course), special emphasis is placed on mathematics, philosophy and science; for the A.B. degree, the work is largely elective. By proper arrangement of electives it is possible for students in the College of Letters and Science to obtain the A.B. degree at the end of four years and the B.S. degree in engineering in two additional years. The College of Agriculture offers a "long course" and a home economics course of four years, leading to the degree of B.S., a short course of two years, winter and summer dairy courses and a farmers' winter course; this college also includes the agricultural experiment station and the organization of farmers' institutes. The College of Law was established in 1868; it offers a three-years' course, leading to the degree of LL.B. The Graduate School received its present organization in 1895. It includes work in the College of Letters and Science, the College of Engineering and the College of Agriculture, courses especially for graduate work being offered in each department of these colleges; the school as a whole is under the control of a faculty committee. The degrees conferred are A.M., M.S., M.Ph., Ph.D., C.E., E.E., M.E., Ch.E., and Min.E. The Summer School offers courses in the subjects of the general college curriculum, in education, in gymnastics and a special normal course; it also includes a summer school in shop and laboratory work for mechanics. Tuition in the university is free to Wisconsin students. There are 115 scholarships for undergraduates and 15 student loan funds; there are also 43 fellowships, 24 honorary fellowships and 36 graduate scholarships, most of which are in special departments in the various colleges of the university. In addition, legislative scholarships are granted to the extent of 8 per cent of the non-resident enrollment of the previous year.

The university also conducts considerable scientific research for the state and carries on almost a score of public services for the people of Wisconsin.

Gymnasium work or military drills are required of men students during part of the course, and gymnasium work of women students. There is also ample provision for athletic sports, which are under the general control of an athletic council, on which faculty, alumni and students are represented. The University of Wisconsin is the only institution of the kind in the middle west which has a boat crew. The women students have organized an athletic association. The students maintain four men's literary societies and two women's societies. The men's societies have organized a forensic board which selects debaters for intercollegiate contests. There are also a science club, Signa Xi, composed of faculty members and graduate students, four dramatic societies and innumerable other student associations, a Woman's Self-Government Association and chapters of Phi Beta Kappa and Tau Beta Pi (engineering). There are several other honorary and professional fraternities in agriculture, commerce and economics, chemistry, engineering, medicine, debating, law, journalism and home economics. The university campus contains about 450 acres, bordering on the south shore of Lake Mendota; in the eastern part of the grounds the land rises abruptly in two hills, of which the eastern and higher is known as University Hill. On this hill are most of the college buildings; the Washburn Observatory stands on the western hill, which is known as Observatory Hill; farther west is the farm with its barns and buildings; to the east of University Hill is the lower campus used largely for athletic sports; the State Historical Society Library building, containing the libraries of the society and the university, also stands at the western end of this campus. Among the prominent buildings on and near the University Hill are north hall, south hall, biology building, chemistry building, law building, physics-economics building and university hall, Chadbourne hall, Barnard hall, Lathrop hall, music hall, science hall and the engineering building; on and near Observatory Hill are the Hiram Smith hall (dairy), horticultural building, agricultural hall, home economics-extension building, the infirmary, stock pavilion, soils building, agricultural engineering building, agricultural chemistry building and agronomy building. The university library in 1952 contained 183,000 bound volumes, in addition to which there are departmental libraries, the state historical library and legislative reference library open to students. The collection is particularly strong in American and English history, Greek, political and social science, Shakespeare and the publications of American learned societies. Campus enrollment in 1951–1952 was 18,909. The faculty in 1952 numbered 1,695. Among the later additions to the university are: buildings of the medical school, begun in 1921, for which $10,000,000 was appropriated; a stadium; Memorial Union Building; and nine new dormitories, law library, Biochemistry and Cancer Research buildings, and Chemistry addition, all completed in 1939. The University of Wisconsin ranks high among the state universities, both in members and in standard of scholarship.

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WISCONSIN DELLS, city, Wisconsin, in Columbia County, on the Wisconsin River, 43 miles north-northwest of Madison. The community is mainly agricultural; hardware, pickles, and butter are produced. The city is a summer resort. Nearby is the state park, Dells of the Wisconsin.

The city was settled c.1850; incorporated 1925. Until 1931 it was called Kilbourn. Pop. (1950) 1,957.

WISCONSIN RAPIDS, city, Wisconsin, Wood County seat; altitude 1,005 feet; on the Wisconsin River; 22 miles southwest of Stevens Point, and 120 miles nortlhwest of Madison; on the Green Bay and Western; the Chicago, Milwaukee, St. Paul and Pacific; the Minneapolis, St. Paul and Sault Sainte Marie; and the Chicago and Northwestern railways. The city is a manufacturing and agricultural center; the most important manufactured products being paper and pulp, paper products, butter, cheese and other dairy products, camp stoves and other camp equipment, paint, varnish, clothing, meat products, flour, plastics, and fiber cartons. Wood County is in the heart of the great dairy district of Wisconsin and claims a leading place in the United States in the shipment of cheese; it is also located in the center of the second largest cranberry producing region in the United States.

Wisconsin Rapids has excellent schools, well-paved streets, and a good water supply. Electricity is supplied by hydroelectric plants on the Wisconsin River and from other plants north of the city. Originally Wisconsin Rapids consisted of Centralia, on the west bank, and Grand Rapids, on the east bank of the river. In 1900 the towns were consolidated as Grand Rapids, but because of the confusion with Grand Rapids, Mich., the name was changed in 1920. Pop. (1950) 13,496.

WISCONSIN RIVER, river, in the State of Wisconsin. It has its rise in Vieux Desert Lake, on the Northern boundary of the state, flows south to Portage City, then southwest and enters the Mississippi River four miles below Prairie du Chien. Its total length is about 625 miles. It is navigable for 200 miles to Portage City, from which point it is connected with Fox River by a canal. Shifting sandbars in this river are a hindrance to navigation. There are several waterfalls along its course, the most famous of which are known as The Dells of Wisconsin and Grandfather Bull Falls. Some of the bluffs which line the picturesque gorges are fully 400 feet high.

WISDOM, Book of, the name of one of the so-called apocryphal books of the Protestant Bible. See WISDOM OF SOLOMON.

WISDOM OF SOLOMON, a book regarded by Protestants as apocryphal, but accepted by Roman Catholics, as part of the canon of the Old Testament. It purports to be the work of Solomon, but the Protestant view is that it was the composition of a Jew of Alexandria about a century before Christ. The author states that he is a king and the son of a king, that he prayed to God for wisdom, and received both wisdom and riches. God directed him to build a temple on the holy mount. Righteousness and wisdom are commended, unbelievers and idolatry are denounced, and examples are given from the Mosaic writings to show how the judgments of God overtake the worshippers of false gods and the wicked generally. Nor is the author content with indicating earthly penalties for wrongdoers. He points plainly to rewards in a future life for the good, and punishments for the wicked, and without referring to the resurrection of the body, he teaches the immortality of the soul. The book was highly esteemed among the Jews and was evidently well known to St. Paul, as the epistles to the Romans, the Corinthians and Ephesians indicate. Under the name of *Wisdom* in the Roman Catholic canon of the Old Testament, the book is in the list recognized by the Council of Trent as inspired Scripture. The Roman Catholic position is that it was truly the work of Solomon, and that the Alexandrian Greek version was a translation from the original Hebrew. See also APOCRYPHA; BIBLE.

WISE, wīz, **Bernhard Ringrose,** Australian statesman and author: b. Sidney, Australia, Feb. 10, 1858; d. London, Eng., Sept. 19, 1916. He was educated at Rugby and Oxford, where he was several times prizeman, founder of the Amateur Athletic Association of Great Britain, and first president of the Oxford Union and Athletic Club. From 1879 to 1881 he was amateur mile champion. After graduating in law he went to New South Wales, where he was attorney general (1887–1904) and minister of justice (1901–1904). In 1915 he was appointed agent general for New South Wales. He was a member of the national committee which framed the constitution of the Commonwealth, and he was very active in promoting industrial law reform and prison reform.

WISE, Daniel, American Methodist clergyman and author: b. Portsmouth, England, Jan. 10, 1813; d. Englewood, N. J., Dec. 19, 1898. He came to the United States in 1832, entered the Methodist ministry, edited the *Sunday School Messenger,* 1838–1844, and *Zion's Herald,* 1852–1856, as well as many Sunday School publications. He published more than 50 books for young people, mostly under the pen-names of "Francis Forrester" and "Lawrence Lancewood." Among these are *Personal Effort* (1841); *Life of Ulric Zwingli* (1850); *My Uncle Toby's Library,* 12 vols. (1853); *Vanquished Victors* (1876); *Heroic Methodists of the Olden Times* (1882); *Boy Travelers in Arabia* (1885); *Men of Renown* (1886); and *Some Remarkable Women* (1887).

WISE, Henry Alexander, American lawyer and political leader: b. Drummondtown, Accomac County, Va., Dec. 3, 1806; d. Richmond, Va., Sept. 12, 1876. He was graduated from Washington College, Pa., in 1825, was admitted to the bar in 1828 and began the practice of law at Nashville, Tenn. In 1830, however, he returned to Accomac County, where he built up a large practice as a lawyer. He was early active in the Democratic party; was a delegate to the National Convention of 1832, and in the same year was elected to Congress. After the election he fought a duel with his opponent, on the latter's challenge. On the removal of the government deposits from the United States bank, Wise, with other Democrats in the House, joined the Whigs in opposition against President Jackson. He was, however, re-elected to Congress in 1834 and in 1836; and also opposed Van Buren's banking and subtreasury plan. In 1837 he acted as the second of Graves, of Kentucky, in a duel with Cilley, of Maine, both members of Congress, in which the latter was killed. This occurrence led to much denunciation of Wise, who was, however, ascertained not to be responsible for the affair. In 1840 he was instrumental in securing the nomination of Tyler for the vice presidency, and after Tyler became president exerted an important influence on the administration policy. In 1844 he was appointed minister to Brazil; and on his return to the United States in 1847 again gave his support to the Democratic party. In 1855 he was Democratic candidate for governor of Virginia, conducted an active campaign, particularly against the Know Nothing party, and was elected by a majority of 10,000. Toward the end of his term as governor occurred the seizure of Harper's Ferry by John Brown and his followers, and the execution of John Brown at Charlestown, Dec. 2, 1859, was one of the last acts of his administration. He was a member of the state convention which met at Richmond in 1861 to consider the relations of Virginia to the Federal government, and one of

the committee on Federal relations to whom the principal business of the convention was referred. He favored a compromise between North and South, and the avoidance of hostilities if possible; but after Virginia declared for secession he loyally supported the Confederate cause in the American Civil War. He was appointed a brigadier general in the Confederate Army and occupied the Kanawha Valley, but was rapidly driven out by Gen. Jacob Dolson Cox in a series of skirmishes. He continued to serve in western Virginia until he was sent to Roanoke Island, N. C., with instructions to defend it. At the time of the attack upon the island by Gen. Ambrose Everett Burnside, in February 1862, he was ill on the mainland, but the greater part of his brigade, known as the "Wise legion," took part in the action. He was promoted major general in 1865, and served until the surrender at Appomattox. Thereafter he resumed the practice of law in Richmond. In 1872 he published *Seven Decades of the Union.* He was the father of John Sergeant Wise (q.v.) and cousin of Henry Augustus Wise (q.v.).

WISE, Henry Augustus, United States naval officer: b. Brooklyn, N. Y., May 24, 1819; d. Naples, Italy, April 2, 1869. He was the cousin of Henry Alexander Wise (q.v.). Entering the navy as midshipman in 1834, he served on the Florida coast during the Seminole War and on the Pacific coast during the Mexican War. He became assistant chief of the Bureau of Ordnance and Hydrography in 1862, remaining in that capacity during the balance of the American Civil War. He was promoted captain in 1866. Under the pseudonym of "Harry Gringo" he wrote *Los Gringos; or, An Interior View of Mexico and California, with Wanderings in Peru, Chile, and Polynesia* (1849); *Tales for the Marines* (1855); *Scampavias, from Gibel-Tarek to Stamboul* (1857); *The Story of the Gray African Parrot* (1859); a book for children, and *Captain Brand of the Centipede* (1860).

WISE, Isaac Mayer, American rabbi and educator: b. Steingrub, Bohemia, March 29, 1819; d. Cincinnati, Ohio, March 26, 1900. He studied at Prague and Vienna, and in 1843 became rabbi at Radnitz. In 1846 he moved to the United States, and for eight years he was rabbi of a congregation at Albany, N. Y. He was elected rabbi in 1854 of the Congregation B'nai Yeshurun, at Cincinnati, Ohio, and this office he continued to hold until the close of his life. In his later years he was regarded as the most prominent Jew of his time in the United States. Above all, he was a great organizer. He was one of the principal founders of the Union of American Hebrew Congregations in 1873 and of Hebrew Union College in 1875; he was president of the latter, established for the education of rabbis, until his death. From its founding in 1889, he was also president of the Central Conference of American Rabbis, of which he had been a leading organizer. While he opposed political Zionism, he was a prominent figure in progressive Judiasm. In 1854 he established and came editor of *The Israelite* (later known as *American Israelite*), and followed this the next year with *Die Deborah,* a supplement in German. Besides novels in German and two plays, he wrote *A History of the Israelitish Nation* (1854); *Essence of Judaism* (1860); *Origin of Christianity* (1870); *The Martyrdom of Jesus of Nazareth* (1874); *The Cosmic God* (1876); *A History of the Hebrews' Second Commonwealth* (1880); *Judaism and Christianity* (1883); *Pronaos to Holy Writ* (1891). David Philipson edited his *Selected Writings* (1900) and *Reminiscences* (1901).

WISE, John, American Congregational clergyman: b. Roxbury, Mass., August 1652; d. Ipswich, Mass., April 8, 1725. He was graduated from Harvard in 1673, and 10 years later he became pastor of the Second (Chebacco) Church of Ipswich, Mass. Continuing in this capacity until the end of his life, he became widely known as an exponent of democratic principles. In 1687 he was fined for remonstrating against the violation of charter rights in levying a province tax without authority from the Assembly, and Governor Sir Edmund Andros deprived him of his ministerial office for a brief period. He brought suit against Chief Justice Joseph Dudley in 1689 for denying him the privileges of the habeas corpus act, and the same year he represented the townsmen of Ipswich at a convention in Boston for reorganizing the colonial government. In 1690 he served as chaplain in an unsuccessful expedition against Quebec. He was one of the signers of a petition to the Assembly in 1703 seeking reversal of the sentence imposed upon one of the victims of a trial for witchcraft. The attempts of Increase and Cotton Mather to place the Massachusetts churches under the authority of ecclesiastical councils met with his determined and successful opposition; he expressed his views on the subject in two pamphlets entitled *The Churches' Quarrel Espoused* (1710) and *A Vindication of the Government of New England Churches* (1717). A large edition of both essays was published in 1772; and a fourth edition, with an historical memoir by Joseph Sylvester Clark, was issued in 1860. In the memoir it is stated that several striking passages in the Declaration of Independence are nearly literal transcripts from the *Vindication.* Consult Tyler, M. C., *A History of American Literature During Colonial Times,* vol. 2 (1878).

WISE, John Sergeant, American lawyer and politician: b. Rio de Janeiro, Brazil, Dec. 27, 1846; d. New York City, May 12, 1913. The son of Henry Alexander Wise (q.v.), he left the Virginia Military Institute, Lexington, in 1864 to join the Confederate forces in the American Civil War. In 1867 he graduated in law at the University of Virginia and began practice of his profession in Richmond. In 1881 he was elected to Congress from Virginia. He was a candidate for the governorship of Virginia in 1885. In 1888 he removed to New York City, and there he continued in law practice for some 20 years. His published writings included *Diomed: The Life, Travels, and Observations of a Dog* (1898); *The End of an Era* (1899); *The Lion's Skin* (1905); *A Treatise on American Citizenship* (1906).

WISE, Stephen Samuel, American Reform rabbi and Jewish leader: b. Budapest, Hungary, March 17, 1874; d. New York City, April 19, 1949. Before he was a year old his family migrated to the United States, his father, Aaron Wise (1844–1896), becoming a rabbi in New York City and in 1886 being a founder of the Jewish Theological Seminary. He graduated at

Columbia University in 1892, and the following year he became pastor of the congregation of Madison Avenue Synagogue, New York City. In 1900 he was made head rabbi of the Temple Beth Israel, Portland, Ore., and there he became an outspoken proponent of social and political reform. He resigned this post in 1906 to return to New York City, and the next year he founded the Free Synagogue, which he was to serve as rabbi until the end of his life. Providing religious services containing the ancient Jewish spirituality in modern forms, he dispensed with such venerable traditions as the exclusive use of Hebrew, the separation of the sexes, and the covering of the head. Nevertheless, he was a strong opponent of the assimilationists, who sought to lose their identity as Jews, pointing out that the Americanism of Jews was in no way marred by adherence to their ancient heritage. He utilized his rich, intense oratory against corruption in government, represented labor unions in arbitration proceedings, led civic and welfare groups at legislative hearings, and supported the Democratic Party in national politics. His positive, independent utterances on religious and lay issues frequently aroused controversy.

The Federation of American Zionists, which he helped to found in 1897 and of which he was the first secretary, became the Zionist Organization of America in 1919, and this body he served as president from 1936 to 1938. He ardently pleaded the cause of a Jewish national homeland before President Wilson and other leading statesmen, and in 1917 he helped found the American Jewish Congress; he represented the congress at the Versailles Peace Conference of 1919, and at the biennial convention of the American Jewish Congress in 1948 he was elected president for his seventh consecutive term. In 1922 he founded the Jewish Institute of Religion, which offered rabbinical training in liberal Judaism, and in 1936 he was instrumental in the founding of the World Jewish Congress; he was elected president of the latter body, and in 1948, at its second plenary assembly (in Montreux, Switzerland), he was again chosen to head it. After the rise of Nazism he was active in organizations providing relief for European refugees.

Among his writings were *The Ethics of Solomon Ibn Gabirol* (1901); *How to Face Life* (1917); *Child Versus Parent* (1922); *The Great Betrayal* (with Jacob de Haas, 1930); *As I See It* (1944).

WISE MEN OF THE EAST, The, the three Magi, who, according to the Gospel of Matthew (2:1, 2), followed the guiding star to Bethlehem in order to render homage to the new born King of the Jews. A legend, which can be traced back to the 2d century, calls them kings, and later times distinguished them as Melchior, Gaspar, and Balthasar. They are honored at the feast of the Epiphany; in art, the youngest is portrayed as a Moor. In astral theology they were represented by Orion's three stars. Their bones are said to have been placed in the cathedral of Cologne, and hence they are often referred to as the Three Kings of Cologne.

WISEMAN, wīz'măn, **Nicholas Patrick Stephen,** English Roman Catholic prelate: b. Seville, Spain, Aug. 3, 1802; d. London, Feb. 15, 1865. He was of Anglo-Irish parentage, and after his father's death in 1805 he was taken to Waterford, Ireland. Following attendance at Ushaw College, Durham, England, he went to the English College, in Rome, where he took orders in 1825. He became professor of Oriental languages in the Roman University in 1827, and from 1828 until 1840 he was rector of the English College. During 1835–1836 he preached in England, and in the latter year he founded the *Dublin Review*. Consecrated titular bishop of Melipotamos in 1840, he was assigned to the central district of England; in 1849 he became vicar apostolic of the London district. In 1850 he was created cardinal and appointed archbishop of Westminster. He allayed public indignation at the papal establishment in England of a hierarchy with territorial titles by putting forth an address entitled *An Appeal to the Reason and Good Feeling of the People on the Subject of the Catholic Hierarchy* (1850); this explained the constitutional rights of Roman Catholics and was instrumental in bringing about a better state of feeling. His writings included *Lectures on the Connection Between Science and Revealed Religion* (1836); *Letters on Catholic Unity* (1842); *Papal Supremacy* (1850); *Fabiola* (1854).

WISHART, wĭsh'ärt, **George,** Scottish reformer and martyr: b. Pitarrow, Forfarshire, about 1513; d. Saint Andrews, March 1, 1546. He left Scotland for England in 1538 to avoid persecution for heresy, only to incur a like charge at Bristol the next year. In 1539 he visited Germany and Switzerland, and on his return to England became a tutor at Corpus Christi College, Cambridge. He went back to Scotland in 1543, and shortly embarked upon a preaching tour which took him to Perth, Edinburgh, Montrose, Dundee, and other places. In 1545, at the instigation of the Earl of Bothwell, he was arrested at Ormiston. Removed to Edinburgh in January the following year, he was delivered to Cardinal David Beaton, who sentenced him to be burned for heresy at Saint Andrews.

WISHART, or **WISEHEART, George,** Scottish bishop: b. Yester, East Lothian, 1609; d. Edinburgh, 1671. He is said to have been educated at the University of Edinburgh and, having entered the Episcopal Church, received a charge at Saint Andrews. In 1639, having refused to take the covenant, he was deposed from the ministry, and during the supremacy of the Presbyterian party he was several times imprisoned. He subsequently became chaplain to James Graham, 1st Marquis of Montrose, and after that leader's death in 1650 to Elizabeth, electress palatine and titular queen of Bohemia. He accompanied her to England, and on the Restoration was made rector of Newcastle, in 1662 he was consecrated bishop of Edinburgh. He is chiefly known by his *History of the Wars of Montrose* (1647), written in elegant Latin. When Montrose (q.v.) was executed a copy of this work was hung in derision about his neck.

WISHOSKAN, a linguistic stock of North American Indians, comprising the Patawat, Weeyot or Wiyot and Wishosk tribes, occupying the coast of California from a little below the mouth of Eel River to a short distance north of Mad River, including particularly the country about Humboldt Bay. They also extended up the streams named into the mountain passes. Of these tribes little is known, as they

are classed with the «Diggers» on account of their habit of living largely on roots. Their number is small, being at present less than 200.

WISHRAM. See WUSHKUM.

WISMAR, vĭs'mär, Mecklenburg-Schwerin, the capital of the Free State, situated on the Baltic, at the head of a bay of the same name, 20 miles north of Schwerin. It has an excellent harbor, carries on an active over-sea trade and has varied manufactures. Of the mediæval walls only four gates remain; but the numerous quaint old houses are a feature of the place, and several of the brick churches as well as the Fürstenhof, once a ducal residence, date from the 14th and 15th centuries. It was a Hanse town in the 13th century, passed to Sweden in 1649, was taken by the Danes in 1675, and by the Danes, Prussians and Hanoverians in 1712, when its strong fortifications were destroyed, and in 1803 was pawned to Mecklenburg-Schwerin, which secured it finally in 1828. Pop. 26,016.

WISSLER, Clark, American anthropologist: b. Wayne County, Ind., 18 Sept. 1870. He was graduated at Indiana University in 1897 and received the degree of Ph.D. at Columbia University in 1901. He was assistant and later lecturer in anthropology at Columbia in 1903–09; he was also assistant in anthropology at the American Museum of Natural History, New York, in 1903–06 and curator since. Since 1924 he has been professor of anthropology at Yale. Author of 'The Correlation of Mental and Physical Tests' (1901); 'North American Indians of the Plains' (1912); 'North American Indian' (1917); 'Social Anthropology' (1929).

WISSMANN, vĭs'män, **Hermann von,** German African explorer: b. Frankfort-on-the-Oder, 4 Sept. 1853; d. 15 July 1905. He entered the German army, reaching the rank of lieutenant in 1874, and crossed the African continent in the employ of the German African Society (1880–82). He commanded an expedition sent out by Leopold II in 1884–85, and as imperial German commissioner in 1889–90 he suppressed the Arab revolt under Bushiri, but failed in attempting to take two steamers to Lake Victoria via Nyassa and Tanganyika lakes in 1892. He was governor of German East Africa in 1895–96, and president of the Berlin Geographical Society in 1897. He published 'In the Interior of Africa' (3d ed., 1891); 'Under the German Flag across Africa' (1880–83); 'My Second Crossing of Equatorial Africa' (1891); 'Africa: Descriptions and Advice' (1895), etc. Consult Ruhle, 'Hermann von Wissmann' (Münster 1892).

WISTAR, Caspar, American physician: b. Philadelphia, Pa., 13 Sept. 1761; d. there, 22 Jan. 1818. He attended the medical department of the University of Pennsylvania in 1782, subsequently graduated in medicine at the University of Edinburgh (1786), returning to the United States in 1787. He was professor of chemistry and the institutes of medicine at the College of Philadelphia 1789–92. In the latter year that institution was united with the medical department of the University of Pennsylvania, and he was there adjunct professor of anatomy, midwifery and surgery 1792–1808; then becoming professor of anatomy and holding that chair until his death. He was the first to show that the posterior portion of the ethmoid bone was attached to the triangular bones. He opened his house once a week for meetings of students, travelers, scientists and citizens, and these symposiums continued long after his death, and were known as the Wistar parties. Wistar became a member of the American Philosophical Society in 1787, and succeeded Thomas Jefferson as its president in 1815. The Wistar Institute of Anatomy and Biology at the University of Pennsylvania was named in Wistar's honor, as was also the climbing shrub, popularly known as the «wistaria vine.» He wrote 'A System of Anatomy for the Use of Students of Medicine' (1811–14).

WISTAR, Isaac Jones, American penologist: b. Philadelphia, Pa., 14 Nov. 1827; d. Claymont, Del., 18 Sept. 1905. He was educated at Haverford College, Pa., and served in the Civil War as brigadier-general of volunteers, United States army, 1862–65. He was president of the Academy of Natural Sciences of Philadelphia 1892–96, has been inspector of the Eastern Penitentiary of Pennsylvania, was president of the State Board of Charities of Pennsylvania and founded the Wistar Institute of Anatomy and Biology, named in honor of Caspar Wistar (q.v.).

WISTARIA, a genus of leguminous climbers, named in honor of Caspar Wistar, an American anatomist (1761–1818), which contains several species, natives of China, Japan and North America. They are high-climbing, hardy shrubs, and have odd pinnate leaves, with entire leaflets and large, terminal, pendulous racemes of papilionaceous flowers. These have large standards and wings freed from the keel, which is incurved and obtuse, and are usually purple or white. The fruits are coriaceous legumes, opening readily. Nearly all of the wistarias are cultivated for covering walls, verandas, trellises, etc. The Chinese wistaria (*W. chinensis*), which was introduced into England about 1816, is perhaps the best. It has profuse dense clusters of pea-shaped flowers, which are about a foot long and bloom in May before the leaves appear and occasionally again in autumn. When grown over a trellis, the blossoms depend in great masses of blue. This vine is a rampant grower, and the flowering wood may be known by its short, jointed, antler-like growth and absence of climbing spines.

Wistaria is a favorite plant of the Japanese, who have a variety (*W. chinensis multijuga*) with racemes a yard long, loosely flowered, and with small blossoms, which are fragrant, however. This plant they train about their houses and over trellises in the greatest profusion. The American wistaria (*W. frutescens*) or kidney-bean tree, is not so vigorous as the Chinese species and has slightly pubescent racemes, only about six inches long. It is found, when wild, climbing over trees at the edges of swamps from Virginia to Florida, and improves with cultivation.

WISTER, Annis Lee Furness, American translator: b. Philadelphia, Pa., 9 Oct. 1830; d. Philadelphia, Pa., 15 Nov. 1908. She was married to Dr. Caspar Wister (d. 1888) in 1854. She made many translations of note, among them E. Marlitt's 'The Old Mamselle's Secret' (1868); 'Gold Else' (1868); 'The Countess

Gisela' (1869); 'The Little Moorland Princess' (1873); and 'The Second Wife' (1874); Wilhelmine von Hillern's 'Only a Girl' (1870); Hackländer's 'Enchanting and Enchanted' (1871); Volkhausen's 'Why Did He Not Die' (1871); Von Auer's 'It Is the Fashion' (1872); and Fanny Lewald's 'Hulda; or, The Deliverer' (1874). Her translations were issued in a uniform edition of 30 volumes in 1888. With F. H. Hedge (q.v.) she published 'Metrical Translations and Poems' (1888).

WISTER, Owen, American novelist: b. Philadelphia, 14 July 1860; d. N. Kingstown, R. I., 21 July 1938. He was graduated from Harvard in 1882, studied law and was admitted to the Philadelphia bar in 1889, but from 1891 devoted his attention to literature. He was especially successful in his delineation of Western life and character and published 'The Dragon of Wantley: His Tail' (1892); 'Red Men and White' (1896); 'Lin McLean' (1898); 'The Jimmy John Boss and Other Stories' (1900); 'U. S. Grant, a Biography' (1900); 'The Virginian,' which has been widely popular and has been successfully dramatized (1902); 'Oliver Wendell Holmes' (in 'American Men of Letters' series, 1902); 'Members of the Family' (1911); 'The Pentecost of Calamity' (1915); 'The Ancient Grudge' (1920); 'Neighbors Henceforth' (1922); 'Watch Your Thirst'; 'When West Was West' (1928).

WITCH, or **WYCH, ELM,** the common broad-leaved elm (*Ulmus glabra*) of England and Scotland, which does not grow to so large dimensions as the field elm; nevertheless at Selborne, Gilbert White measured a witch elm which, seven feet from the ground, was eight feet in diameter. It is a tree of picturesque habit, and, unless grown in crowded masses, rarely produces a straight trunk. It has a wide, spreading head, often slanted to one side, and the branches begin near the base. These drooping branches lash neighboring trees unmercifully, and if they chance to rest on the ground readily strike root. The tree is easily increased by layers or by the abundant seeds. The timber of the witch elm is more durable than that of other English elms, but has their fine-grained, tough and elastic qualities. It is very flexible when steamed, and is utilized for bent-wood work, frames in boat-building and bows; in olden times, if the branches were forked, they served as divining-rods, perhaps because of the likeness of the broad, ovate leaves to those of the hazel, which is one of the so-called lightning plants. These plants are sacred to Thor, are considered to be an actual embodiment of lightning, and their forked branches (having, according to mythology, a resemblance to a lightning flash) are used as talismans to point out the hidden stores of gold or subterranean water.

WITCH-HAZEL, a tall, sometimes arborescent shrub (*Hamamelis virginiana*) of eastern American woodlands. It has a characteristic horizontal, straggling growth; as Thoreau says: «Its spray, so jointed and angular, is not to be mistaken for any other.» Witch-hazel is one of the most difficult shrubs to eradicate from a clearing, as it has many diverging stems, so crooked and springy as to render axe-work unsuccessful. The bark is pale-gray; the leaves, somewhat resembling the ovate foliage of the hazel-nut, are more or less oblique and undulate-edged, not at all handsome, but turning to a beautiful clear yellow in autumn. No sooner have they fallen off, with the rest of the forest foliage, in October or November, than the witch-hazels reclothe themselves with a luminous vesture of filmy, featherly yellow, which turns out to be the long-delayed blossoms — whether the earliest or the latest flowers of the year botanists cannot decide. Individually, they are not conspicuous, having only four narrow, strap-shaped, golden petals, but are so tufted on the twigs as to gild the bushes. Meanwhile the fruits, little blunt, horned woody capsules that have been slowly ripening since the previous fall, begin to gape, and by elastic fissuring and incurving their walls, shoot their stony-hard, bullet-shaped, polished seeds far and wide. Twigs of this witch-hazel, so unorthodox in its season of blooming, and remotely resembling the hazel-nut in foliage, were chosen as material for the forked divining-rods, which, twisting in the hand of the treasure-seeker, or well-digger, pointed downward and disclosed the site of subterranean water or gold. A much more practical use for witch-hazel has been found nowadays. An infusion of the leaves of witch-hazel in alcohol furnishes the familiar slightly astringent and tonic lotion for external inflammations known as «witch-hazel» or «hamamelis.» Branches of witch-hazel thrown into the fire exhale the characteristic, peculiar odor of the lotion. Both the foliage and bark, moreover, contain much tannin. The witch-elm (q.v.) of England is also called witch-hazel.

WITCH HILL, the name of a hill in Salem, Mass., so called because of the executions of witches which took place there in 1692. It is also known as Gallows Hill.

WITCHCRAFT, supernatural power which persons were formerly supposed to obtain by entering into a compact with the devil. The compact was sometimes express, whether oral or written, when the witch abjured God and Christ, and dedicated herself wholly to the evil one; or only implied, when she actually engaged in his service, practised infernal arts, and renounced the Sacrāments of the Church. The express compact was supposed to be solemnly confirmed at a general meeting, at which the devil presided, and sometimes privately made by the witch signing the articles of agreement with her own blood, or by the devil writing her name in his «black book.» The contract was sometimes of indefinite duration, at other times for a certain number of years. The witch was bound to be obedient to the devil in everything, while the other party to the pact delivered to the witch an imp, or familiar spirit, to be ready at call and to do whatever was directed. He further engaged that they should want for nothing, and be able to assume whatever shape they pleased to visit and torment their enemies and accomplish their infernal ends. The belief in witchcraft appears to have existed in various forms among ancient nations, including the Hebrews; it prevails to-day among savage and semi-savage races, and is not extinct in civilized countries. It was always condemned by the Church, and in the 14th century the popes believed that they recog-

nized in sorcery a prevalent and dangerous evil, and began to issue bulls against it. In the 15th century the Inquisition took charge of the work of exterminating witches, and the close of that century, and the beginning of the 16th, witnessed thousands of executions in Germany, Italy and other countries. France was slow to permit any general persecution of witches, and it was not until about the time of the break with Rome that the first formal enactment, of 1541, declared witchcraft to be a felony in England. From that time on, for more than a century, the burning of witches was kept up in England and Scotland, the statute of 1563 being the first regular enactment against the supposed crime in the latter country.

The Reformation was attended by, or rather coincident with, an increased intensity of the witchcraft superstition, and its resulting horrors. Theologians of all creeds were equally believers in the reality of compacts with the devil, and regarded the persons who entered into such compacts as unfit to live. It is probable that the religious fervor aroused by controversy over disputed dogmas may have served to bring more vividly to the minds of clergy and laity alike their assumed obligation to obey the Scriptural injunction against witchcraft, and that, in this way, the Reformation may have promoted this form of persecution. Besides, the tribunals actively engaged in crushing out disbelief in the accepted creeds of their respective states could readily devote any surplus energy and zeal to what seemed to them the related crime of witchcraft. From one end of Europe to the other executions of witches were of daily occurrence, and it is estimated that, from the time of the promulgation of the bull of Pope Innocent VIII against sorcery, in 1484, until 1782, when the last judicial victim, a servant girl at Glarus, in German Switzerland, was executed, 300,000 women perished on this often imaginary charge. Some of the victims were probably poisoners, but very many of them were undoubtedly innocent of any wrong-doing whatever. Children of tender years were sometimes among the condemned.

Spanish America witnessed many executions on the charge of witchcraft, and it is stated on credible authority that as late as 20 Aug. 1877 five alleged witches were burned alive at San Jacobo, Mexico. This appears to have been more in the nature of a lynching than of an execution of a sentence of a competent court.

In England and Scotland, as already stated, the 17th century witnessed hideous scenes of witch-torture and extermination. The last victims in England were Mrs. Hickes and her daughter, nine years of age, executed in 1716, and the last in Scotland suffered in 1722. Prosecution for witchcraft was abolished both in England and in Scotland by George II (1736), which made all persons pretending to use the name punishable by imprisonment. By a subsequent act passed in the reign of George IV, they were made punishable as rogues and vagabonds.

All the American colonies had laws against witchcraft similar to those in England at the time, and from the first there were occasional trials and executions on that charge. The great Salem witchcraft delusion, with its attendant tragedies, occurred near the close of the 17th century and was largely due to excitement caused by the teachings and writings of Cotton Mather, the noted Puritan divine, who was a strong believer in the superstition. The Salem witch frenzy broke out in the family of one Samuel Parris, a minister, but for whose instigation the delusion, with its accompanying sacrifice of innocent lives, could not have obtained the headway it did. A company of girls suddenly began to act mysteriously, bark like dogs, and scream at something unseen. An old Indian servant was accused of bewitching them. The excitement spread and impeachments multiplied. A special court was formed to try the accused, and as a result the jails rapidly filled, and many were condemned to death. It was unsafe to express a doubt of a prisoner's guilt. Fifty-five persons suffered torture, and 20 were executed before the delusion ended. Witches were supposed to be able, with the assistance of the devil, not only to foretell events, but to produce mice and vermin, to deprive men and animals, by touching them or merely breathing on them, of their natural powers, and to afflict them with diseases, to raise storms, etc., to change themselves into cats and other beasts, etc. General assemblies of witches, called "Witches' Sabbaths," were held yearly, or oftener, at which they appeared entirely naked, and besmeared with an ointment made from the bodies of unbaptized infants. To these meetings they were supposed to ride from great distances on broomsticks, pokers, goats, hogs, or dogs, the devil taking the chair under the form of a goat. Here they did homage to their master, and offered him sacrifices of young children, etc., and practised all sorts of license till cock-crowing. Neophytes were introduced to the devil at these meetings, and received his mark on their bodies, in token that they had sold their souls to him. As before remarked, the belief in witchcraft still prevails in many parts of the world, and in some countries where pretended sorcerers exert a powerful influence, lives are often sacrificed as a result of their practices and in order that they may continue their nefarious work.

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WITENAGEMOT, wĭt'ĕ-nä-gĕ-mŏt', or **WITENAGEMOTE,** originally an assemblage of all the freemen of a tribe or state, among the Teutonic conquerors of southern Britain, but which, in the course of events, and without any special law, resolved itself into an assembly of the princes, aldermen, thanes, large landowners and leading ecclesiastics. The witenagemot met once a year or oftener, and had great power, electing a king in the event of disputed succession, approving the regular succession, if there was no dispute, passing upon the trial and punishment of high offenders, enacting laws, and acting as a grand inquest into public affairs. It passed out of existence with the Norman Conquest, and the subsequent Parliament was a separate growth, and not a continuation of the Witenagemot. Consult Chadwick, H. M., 'Studies on Anglo-Saxon Institutions' (Cambridge 1905); Freeman, E. A., 'History of the Norman Conquest' (5 vols., Oxford 1872–79).

WITHER, wĭth'ĕr, or **WITHERS, George,** English poet and pamphleteer: b. Bentworth, near Alton, Hampshire, 11 June 1588; d. London, 2 May 1667. He studied at Magdalen College, Oxford (1604–06), but did not obtain a degree, and a few years later he went to London to study law. He devoted much attention to literature, and proved his skill in satiric verse by being thrown into the Marshalsea for his 'Abuses Stript and Whipt' (1613). While there imprisoned he wrote busily, and is said to have composed there several of his best poems, among them 'The Shepherd's Hunting' (1615), a continuation of 'The Shepherd's Pipe' (1614) of William Browne (q.v.). After his release he entered Lincoln's Inn, in 1615. About this same time he wrote the love elegy 'Fidelia.' In 1621 some official persons thought reflections against the state and leading politicians were to be detected in 'Wither's Motto, Nec Habeo, Nec Careo, Nec Curo' (1621), and again the author was ordered to the Marshalsea, though soon liberated. After 1622 he wrote nothing, save 'Hallelujah' (1641), a collection of religious verse, that in critical estimation attained the rank of earlier work. He became a Puritan, and wrote largely for the furtherance of the political and religious cause with which he was identified. At the revolution, he recruited (1642) a troop of horse for Parliament, and was made captain and the commander of Farnham Castle. When taken by Royalists and in danger of capital punishment, he was released through the interference of Sir John Denham (q.v.), who protested that «so long as Wither lived he (Denham) would not be accounted the worst poet in England.» He was promoted major, made a commissioner for the sale of the king's goods, and (1655) became a clerk in the statute-office of the court of chancery. For his 'Vox Vulgi,' a poem dissuading from the restoration which remained in manuscript until printed by Macray in 'Anecdota Bodleiana' (1880), he was committed to Newgate in 1660 and imprisoned there until released in 1663 under bond for good behavior. 'Fragmenta Poetica' (1656; reprinted as 'Fragmenta Prophetica,' 1669) was his last work. For some time subsequent to his death he was considered a rimer of no merit, was omitted from collections of English poetry, and included in the 'Dunciad' as «wretched Withers.» But Ellis praised him in 'Specimens of the Early English Poets' (1790), and others, including Sir S. E. Brydges by various reprints and Lamb by the essay 'The Poetical Works of George Wither' (Lamb's 'Works,' 1818, new ed., New York 1903) obtained for him suitable recognition. His reputation is based chiefly on his earlier work. The greater part of his writings was printed by the Spenser Society (20 vols., 1870–83). Consult besides the books already mentioned Ward's 'English Poets' (Vol. II, 1880); and Sidgwick, F. (ed.), 'The Poetry of George Wither' (London 1902).

WITHERITE, a mineral composed of barium carbonate mined extensively near Hexham, Northumberland, England. Usually found in massive condition though orthorhombic crystals do occur; hardness, 3 to 3.75; specific gravity, 4.29 to 4.35; lustre, vitreous; color, white, often yellowish or grayish; streak, white. Used in the manufacture of baryta for sugar refining, in plate-glass making, and in the adulteration of white lead and zinc white.

WITHERSPOON, Herbert, American singer and impresario: b. Buffalo, N. Y., 21 July 1873; d. New York City, 10 May 1935. He was graduated from Yale University, 1895; studied singing in New York, London, Paris and Berlin; acting in Munich; sang with H. W. Savage Opera Company, 1898–1900; toured with Thomas and Pittsburgh orchestras; first basso, Metropolitan Opera Company, New York, 1908–16; president, Chicago Musical College, 1925–29; director, Chicago Civic Opera Company, 1930–31; director, Cincinnati Conservatory of Music, 1932–33. A few weeks before his death, he was appointed general manager of the Metropolitan Opera Company, to succeed Giulio Gatti-Casazza, who retired at the end of the 1934–35 season.

WITHERSPOON, John, American Presbyterian clergyman and college president; b. Yester, Haddingtonshire, Scotland, 5 Feb. 1723; d. near Princeton, N. J., 15 Nov. 1794. He was graduated from the University of Edinburgh in 1742, was licensed to preach the next year and was parish minister of Beith, 1745–57. He led a body of militia to the aid of the Pretender at Glasgow in 1745, and was captured at the battle of Falkirk, but was soon released. He was pastor at Paisley, 1757–68, and then accepted the presidency of the College of New Jersey (now Princeton University) in 1768. He was a delegate for six years from New Jersey to the Continental Congress; and a signer of the Declaration of Independence. He greatly increased the efficiency of the college and was a noteworthy figure in the political as well as the educational affairs of his time. He wrote 'Ecclesiastical Characteristics' (1753); 'Nature and Effects of the Stage' (1757); 'Essays on Important Subjects' (1764); 'Considerations

on the Nature and Extent of the Legislative Authority of the British Parliament (1774). His collected works appeared in nine volumes in 1804.

WITNESS, *in law,* a competent person called to give testimony, as in a court of justice, regarding facts in issue. Formerly the jurors acted as witnesses, and it was not until about the 15th century that the custom was discontinued. A witness, either in a civil or a criminal case, may be compelled to attend court when required by law. A witness is commonly summoned by a subpoena, and if he does not attend when called without giving sufficient excuse, he is liable for damages to the party who subpoenaed him. In addition, he may be punished by fine or imprisonment. In some jurisdictions, a prisoner is not allowed to be a witness in his own behalf, but the rule is not general.

Formerly many objections against the competency of witnesses were allowed, but many of these have been removed by legislation. A prisoner cannot be called as a witness for the prosecution to give evidence against himself. Usually a wife is not a competent witness against her husband, or a husband against his wife. A witness is exempt from civil arrest while in attendance at court, but not from arrest on a criminal charge. A witness usually testifies orally in open court, but sometimes his testimony is taken in writing before a commissioner or other legal official.

WITTE, vĭt'ĕ, **Emanuel de,** Dutch painter: b. Alkmaar, 1617?; d. Amsterdam, 1692. A pupil of Van Alst, from 1642 to 1649 he lived at Delft. Thereafter he made his home at Amsterdam, where he became the chief Dutch exponent of the painting of church interiors. His earlier paintings were mostly historical, or portraits. His works are found at the museums of several cities of the Netherlands and Germany, and also in the National Gallery, London.

WITTE, vyĕt'tyĕ, Count **Sergei Yulievich,** Russian statesman: b. Tiflis, July 29, 1849; d. St. Petersburg (Leningrad), March 12, 1915. His family on the paternal side was of Dutch extraction. He graduated from the New Russian University, Odessa, and in 1877, after some years as a journalist, he entered the government railway service. He had charge of transporting troops on the Odessa Railway during the Russo-Turkish War of 1877–1878, and then joined the traffic division of the Southwestern Railway; in 1886 he became general manager of the latter system, and two years later he was made head of the railway department of the Ministry of Finance. Appointed minister of finance in 1893, he stimulated the development of manufacturing industries, made the sale of alcohol a government monopoly, established the gold standard, and greatly extended the railway system, in particular, securing construction of the Trans-Siberian Railway (q.v.). His policies made him numerous enemies in influential circles and in 1903 he was removed from office, then becoming appointed president of the council of ministers. He initiated the administrative reforms which became imperative after the revolution of 1905, and in August of that year he negotiated at Portsmouth, N.H., the treaty ending the war with Japan on favorable terms. Created a count, on Oct. 30, 1905, he became the first prime minister of Russia under the new constitutional regime. Faced with increasing opposition on the part of reactionaries, he resigned his office on May 2, 1906. Thereafter, though a member of the council, he remained in virtual retirement.

WITTEKIND, vĭt'tĕ-kĭnt, or **WIDUKIND,** Saxon leader in the struggle with Charlemagne: d. about 807. He came of a noble Westphalian house, and first appears at the head of the Saxon expedition against the Westphalian fortress of Eresburg in 774. Charlemagne's return from Lombardy drove him across the Weser, and instead of submitting to the emperor at the Diet of Paderborn in 777 like many other Saxon leaders, having renewed the revolt in 776, he fled to Jutland. He returned during Charlemagne's absence in Spain, laid waste the Rhineland, and surprised and annihilated the Frankish army on the Süntelgebirge (782). The emperor retaliated by executing 4,500 Saxon prisoners, an action that aroused the entire Saxon race to arms. The battle of Detmold was indecisive (783), but that of Osnabrück forced Wittekind to enter on negotiations; the issue was that in 785 he accepted baptism in the imperial camp at Attigny, in Champagne. The emperor, it is said, made him duke of the Saxons and lord of Engern, and from the castle of Babilonie, near Lübeck, he exercised a benignant sway till he fell in battle with Gerold, the Swabian duke. Various princely houses, as those of Brunswick and Sardinia, claim Wittekind for the founder of their line. The Emperor Charles IV, in 1377, placed a monument to him in the parish church at Enger, where he is supposed to have been buried, and in Menden, Westphalia, a monument was erected to him in 1812.

WITTENBERG, vĭt'ĕn-bĕrkh, Saxony, Prussia, town on the Elbe, 45 miles southeast of Magdeburg. It was the home of the Reformation, and here Martin Luther (q.v.), while a university professor, nailed his 95 theses to the door of the Schlosskirche. The university in which he was professor was united to Halle in 1817. The principal buildings are the Schlosskirche, in which both Luther and Philipp Melanchthon (q.v.) are buried; the Stadtkirche, where Luther and Melanchthon preached; the remains of the Augustinian monastery, with Luther's apartments; the houses of Melanchthon and Lucas Cranach (q.v.); the town hall and the gymnasium. There are public monuments to Luther and Melanchthon. Textiles, hosiery, leather, machinery, pottery, electrical apparatus, bricks, cement, and essential oils are among the manufactures. Pop. 37,180.

WITTENBERG COLLEGE, located at Springfield, Ohio. It was founded in 1845 under the auspices of the Lutheran Church in Ohio. Its organization included a Preparatory School, a Collegiate Department, a Theological Seminary, a School of Oratory, a Conservatory of Music, and a School of Art. There is also a Summer School, designed chiefly for teachers, giving courses in pedagogical methods. The Collegiate Department confers the single bachelor's degree of A.B. for a four years' course. Women are admitted to all departments. In 1944 the plant was valued at $2,368,653 and the endowments totaled $2,277,018. The library contains 71,102

volumes. In 1949 the students numbered 1,657 and the faculty 97.

WITWATERSRAND, wĭt-wô'tẽrz-rănd (Dutch, white water ridge), or **THE RAND,** a series of parallel ranges of hills in the Transvaal (q.v.) Province of the Union of South Africa, famous as the greatest gold producing area in the world. The hills rise to heights over 6,000 feet above sea level from a plateau 4,000 feet above sea level. The Witwatersrand forms the divide of the Southern Transvaal watershed. Rain on the southern slopes drains into the Vaal River, thence flows into the Atlantic Ocean via the Orange River. Waters from the northern slopes drain to the Indian Ocean through the Limpopo River. The area is about 25 miles wide by 80 miles long on an east-west line with Johannesburg (q.v.) near the center. It includes the magisterial districts (all with towns of the same names) of Springs, Brakpan, Benoni, Boksburg, Germiston, Johannesburg, Roodeport, Krugersdorp, and since 1943 Heidelberg, Nigel, Klerksdorp and Potchefstroom.

The Witwatersrand system comprises a number of beds of quartzites and shales, with reefs of gold bearing conglomerates. Some of the beds carry zones of intrusions of amygdaloidal lava or andesitic lava. In the Central Rand area the Upper Witwatersrand bed has three main series of reefs from which the gold is mined. These reefs are conglomerates of quartz pebbles set in a matrix of pyritic quartzite and have the mottled appearance of a sweet consisting of almonds and brown sugar known as banket. The name "banket" is used to describe these reefs. The origin of the gold was probably detrital, subsequently recrystallized.

Gold was first found by P. J. Marais in 1853 in the Jukskei River on the northern slope of the Witwatersrand near where Johannesburg was to be founded in 1886. In the early days prospecting was forbidden but in 1868 a reversal of policy was made and a bonus offered for the discovery of profitable mines. Gold was discovered and worked in other parts of the Transvaal before the Witwatersrand discoveries. In 1885 the brothers F. and H. Struben were granted a government concession for the discovery of gold on the Witwatersrand the previous year by F. Struben, and they commenced crushing in January, 1886. Later that year the Main Reef was found on the Langlaagte farm and in September, 1886, Johannesburg was proclaimed a public diggings.

In 1949, forty-three producing mines, members of the Transvaal Chamber of Mines, recovered 11,708,013 ounces of gold valued at £110,617,436, paid £37,876,000 in wages, spent in stores £38,614,307 (1948), and distributed dividends of £17,394,046 on a nominal capital of £67,257,879 after taxation allowance of £12 million. The total Witwatersrand production for 1949 was 12,445,357 ounces valued at £121,026,254 (Union of South Africa, 12,651,595 ounces, £123,028,991), about 43 per cent of the world production.

The deepest workings are in the central area about 9,000 feet below the surface. The rock temperature increases about 1°F. for each 180 feet of depth. The employees number about 34,000 Europeans and 290,000 non-Europeans. A compressed air pipe system 16 miles long with a 132,500 horsepower compressing plant feeds the central area mines. The electricity supply to the mines and industries is rated at 905,000 kilowatts. The ore is treated by the cyanide process to extract the gold (see GOLD, METALLURGY OF).

The secondary industries including engineering shops, foundries, cement plants, etc., have an annual output exceeding £100 million, employ more than 60,000 Europeans and 130,000 non-Europeans.

All the large gold and coal mining companies have representatives on the Transvaal Chamber of Mines formed in 1887; it deals with all collective matters affecting the mining industry.

The Rand Refinery at Germiston is the largest gold refinery in the world and is a private company, the shareholding being confined to gold mining companies. It was completed in December, 1921, and from its inception on Dec. 22, 1921, to September, 1945, it had refined bullion with 275,067,929 ounces of gold and 27,133,755 ounces of silver. The gold from the refinery is sent to the South African Reserve Bank for marketing.

According to the 1946 census the European population of the Witwatersrand was 544,241, while the non-European population was 877,688.

JOHN DOLAN.

WIXON, Emma. See NEVADA, EMMA.

WIYOT. See WISHOSKAN.

WLADISLAUS, kings of Poland. See LADISLAS.

WOAD, wōd, a cruciferous herb (*Isatis tinctoria*), which has been used for centuries in the countries of temperate Europe, as a dye plant, yielding an indigo-blue color. The woad has entire foliage, the stem leaves being sagittate, and has large coriaceous pods. Julius Caesar tells us that the ancient Britons stained their bodies with woad, so as to give themselves a more formidable appearance in battle; and from Pliny we learn that their women, before engaging in certain religious rites, also covered their nude bodies with the dye. The plant was formerly much cultivated in England for the sake of its dye, which was extracted from its crushed and fermented leaves, but the stronger and finer blue produced by the indigo (g.v.) plant finally superseded it, although at first the latter produced but a crude dye. Those who cultivated woad opposed the introduction of indigo, and the opposition to it became so pronounced that in England and other European countries royal edicts were issued forbidding its importation. They were repealed by the middle of the 18th century. Woad is now mixed in the vats with indigo juice, but is of use chiefly as a convenient material to induce fermentation, although it is said also to improve the color itself.

WOBURN, wō'bẽrn, Mass., city in Middlesex County; altitude 83 feet; 10 miles northwest of Boston; on the Boston and Maine Railroad. The immediately surrounding territory is agricultural, with truck farming; the city is residential and industrial. Tanning and the manufacture of patent leather are leading industries; other products are chemicals, glue, leather-working machinery, mops, and women's undergarments. The demand for unskilled and cheaper workmen led to a large influx of foreign population. The public school system includes both junior and senior high schools; there are parochial grammar and high

schools. Woburn has two libraries, one of which maintains a collection of minerals and historic souvenirs. Of a number of old houses, one is the Baldwin mansion, the extensively remodeled house (built in 1661) of Loammi Baldwin, originator of the Baldwin apple and builder (1803) of the Middlesex Canal, between Somerville and Lowell, the bed of which is still traceable. Before the public library is a statue of Benjamin Thompson (q.v.), born in Woburn in 1753, who became a count of the Holy Roman Empire (Count Rumford).

First settlement of the Woburn site was made in 1640, by several families migrating from Charlestown, and in 1642 the settlement was incorporated as a village. The city charter was granted in 1889. The city has mayor and board of aldermen. Pop. (1940) 19,751; (1950) 20,492.

WODEN or **WODAN**, a Teutonic god. See ODIN.

WOESTIJNE, vōōs-tī'nĕ, **Karel van de**, Belgian poet, novelist, and journalist: b. Ghent, Belgium, March 10, 1878; d. Zwijnaerde, near Ghent, Aug. 24, 1929. He wrote several books of essays and criticism, several novels, and much verse. He was professor of Flemish language at the University of Ghent. He was a member of the Royal Flemish Academy.

WOFFINGTON, wŏf'ĭng-tŭn, **Margaret** (known as PEG WOFFINGTON), Irish actress: b. Dublin, Ireland, Oct. 18, 1714?; d. Teddington, England, March 28, 1760. She first appeared on the stage at 12 as Polly Peacham, with several other children, in *The Beggar's Opera,* but her first appearance in a mature part was as Ophelia in Dublin in 1737. From 17 to 20 she played on the Dublin stage all manner of parts, from Ophelia to Sir Harry Wildair, and on Nov. 6, 1740 made her first appearance at Covent Garden as Silvia in *The Recruiting Officer.* She soon became a great success, the exquisite art of her male characters being especially remarkable. She kept the affection of the public until the tragic close of her career. On May 3, 1757 she broke down in playing Rosalind, and left the stage forever.

Her character appears to advantage in Charles Reade's novel *Peg Woffington* (1853); and in the play *Masks and Faces* (1852), by Reade and Tom Taylor.

WOFFORD COLLEGE, located at Spartanburg, South Carolina, was founded in 1854 under the control of the South Carolina Conference of the Methodist Episcopal Church, South, in accordance with the will of Benjamin Wofford, a minister of that church, who left a legacy of $100,000 to the conference for establishing a college. It was opened to students in 1854.

The college is largely supported by the Methodist Church. It is a college for men. The degrees of A.B., B.S., and M.A. are conferred. The college campus comprises 70 acres; the buildings include the main building, the John B. Cleveland Science Hall, Alumni Hall (a dormitory), residence cottages, the Wilbur E. Burnett gymnasium, Whiteford Smith Library Building, and the fitting school. The library contains over 51,000 volumes; students number (1952) 590.

WOHLER, vû'lĕr, **Friedrich**, German chemist: b. Eschersheim, Germany, July 31, 1800; d. Göttingen, Germany, Sept. 23, 1882. He was educated at the gymnasium at Frankfurt, and then studied at Marburg University. From 1825 to 1831 he taught at technical schools in Kassel and in Berlin. He then became a professor of chemistry on the medical faculty at the University of Göttingen, a position he retained until his death. He was an excellent teacher, and he instructed students from many countries of the world. He served as inspector general of pharmacas of the kingdom of Hannover for a short time.

Of his contributions to the field of chemistry, the most important was the synthesis, for the first time, of an organic compound (urea) in 1828. He was also the first to isolate aluminum and beryllium, and to observe cases of isomerism. A process for manufacturing nickel was devised by him.

He was author of *Grundriss der Unorganischen Chemie* (1831); and *Grundriss der Organischen Chemie* (1840).

WOHLGEMUTH, WOHLGEMUT, or **WOLGEMUT**, vōl'gĕ-mōōt, **Michel** or **Michael,** German painter: b. Nürnberg, 1434; d. there, 1519. He was an eminent member of the Franconia school of German painting whose most complete representative is Albrecht Dürer. The latter was indeed his pupil in the large studio or workshop where many branches of art were carried on by the master and a host of pupils and assistants. The occupations of this artistic association comprised altarpieces, consisting of paintings, or wood carvings in high relief ablaze with color and gilt, such as abound in Spanish churches under the name of *retablos;* wood engraving, the blocks being cut from Wohlgemuth's designs, which were of supreme vigor and well adapted to the exigencies of printing from wood and easel paintings of portraits and history.

Many paintings have been attributed to Wohlgemuth which were evidently executed by the less skillful hands of pupils or assistants, but those whose authenticity is unquestionable are characterized by powerful drawing, rich and harmonious coloring and supreme delicacy of finish. His retable (1465), now in the Munich Gallery, is a remarkable masterpiece, and that which he furnished for the high altar of St. Mary at Zwickau gained for the painter much applause and the then princely sum of about $3,558. Another work of the same kind is to be found in Nürnberg Museum, having been originally painted for the churches of the Austin Friars at Nürnberg; his last retable was executed for the church at Schwabach (1508). His fidelity and grace as a portrait painter are acknowledged by critics, who recognize in his realistic vigor and conscientious mastery of detail the best features of contemporaneous German painting.

Two of his paintings, *Pilate Washing His Hands Before the People* and a *Descent from the Cross,* are in the Royal Institution Gallery at Liverpool, but few works of this master are to be found elsewhere out of Germany.

WOIWODE, woi'wōd, **VOIVODE**, or **VOIVOD**, an old Slavonic name for a general, afterward used as a title of civil rank and authority. The princes of Walachia and Moldavia were called woiwode; the name was given in Poland to the

governors of the provinces, a title abolished in 1832. In Serbia and Bulgaria the title of wojwode still lingers with its original signification of "leader in war."

WOLCOT, wůl'kŏt, or **WOLCOTT, John** ("PETER PINDAR"), English poet: b. Dodbrooke, Devonshire, May 1738; d. London, 14 Jan. 1819. He studied medicine and in 1767 went to Jamaica as physician to the governor, Sir William Trelawney. He then took orders in the Church of England and was a curate in Jamaica, 1769–73. After spending the next 12 years as a physcian in Cornwall he went to London, where his daring poetical satires involved him in many quarrels and brought him extended fame. So effective were his attacks on King George III that the ministry silenced him with a pension of $1,500 per annum. His ablest opponent was William Gifford, who attacked him in his 'Epistle to Peter Pindar.' He was an art critic of taste and penetration far beyond his time; his yearly reviews in verse of the Academy exhibitions are much the best of his work, and still instructive. Among his satires are 'Lyric Odes to the Royal Academicians' (1782–86); 'Bozzy and Piozzi' (1786); 'An Epistle to the Reviewers'; 'Peeps at St. James'; 'Royal Visits,' and 'The Lousiad' (1785–95). Consult Reitter, 'Leben und Werke Peter Pindars' (Vienna 1900).

WOLCOTT, Edward Oliver, American lawyer and politician: b. Longmeadow, Hampden County, Mass., 26 March 1848; d. Monte Carlo, Italy, 28 Feb. 1905. In 1862 he went to Cleveland, Ohio, with his family, and during the Civil War was enlisted with the 105th Ohio regiment for a few months. He entered Yale in 1866, but did not complete his course; and was graduated from the Harvard Law School in 1871. He then went to Colorado, where he established a law office in Georgetown, Clear Creek County; in 1876 was elected district attorney for the first judicial district of the State, and before the expiration of his term cleared the docket of all criminal cases. In 1878 he was elected to the State senate, where he became the Republican leader. In 1879 he was made attorney for the Denver and Rio Grande Railroad; settled in Denver, where he built up a large private practice; and in 1884 was appointed general counsel of the same road. In 1888 he was elected to the United States Senate, and re-elected in 1894. There he was known as an earnest advocate of bimetallism; in 1896 however, he refused to support the free-silver platform of the Democratic party, continued his affiliation with the Republican party, and in 1900 was president of the National Convention. In 1897 he was chairman of a commission appointed by President McKinley to investigate the attitude of the leading European governments toward international bimetallism. In 1903 he was again a candidate for election to the United States Senate, but was defeated by H. M. Teller.

WOLCOTT, Oliver, American statesman and signer of the Declaration of Independence, son of Roger Wolcott (1679–1767) (q.v.): b. Windsor, Conn., 26 Nov. 1726; d. Litchfield, 1 Dec. 1797. He was graduated at Yale College in 1747 and in the same year received a captain's commission from the governor of New York, and raised a company for the defense of the northern frontier, where he remained until the peace of Aix la Chapelle. In 1751 he was appointed sheriff of Litchfield County, Conn., and in 1774 a member of the State council. He was also chief judge of the Court of Common Pleas, a judge of the Probate Court and a major-general of militia. In 1775 he was appointed one of the commissioners of Indian affairs for the Northern Department, whose duty was to secure the neutrality of the Indians. In 1776 he commanded the 14 Connecticut regiments raised to act with the army in New York, and in the same year took his seat in Congress. After the Declaration was signed he returned to the army, and was present at the battle of Saratoga, but continued to serve in Congress at intervals till 1783. He was lieutenant-governor of Connecticut, 1786–96, when he was elected governor, which office he held at the time of his death. Consult Sanderson, John, 'Biographies of the Signers' (Vol. III, rev. ed., Philadelphia 1865).

WOLCOTT, Oliver, American politician, son of the preceding: b. Litchfield, Conn., 11 Jan. 1760; d. New York, 1 June 1833. He was graduated from Yale in 1778, and for a short time served as volunteer aide to his father in the Revolutionary War. After his admission to the bar in 1781 he was for several years in the employ of the financial department of the government of Connecticut and assisted Oliver Ellsworth in 1784 in settling the accounts between his State and the United States. In 1788–89 he was comptroller of the United States public accounts, auditor of the United States treasury 1789–91, comptroller 1791–95, and Secretary of the National Treasury 1795–1800, in succession to Alexander Hamilton. He was a judge of the United States Circuit Court, 1801–02, and then removed to New York and was in mercantile business there till 1812. He aided his brother Frederick in building extensive factories at Wolcottville, Conn., and was governor of Connecticut 1818–27. His later years were spent in New York. He published several political pamphlets and in 1846 his papers were edited by Gibbs with the title 'Memoirs of the Administrations of Washington and John Adams' (New York 1846).

WOLCOTT, Roger, American colonial governor: b. Windsor, Conn., 4 Jan. 1679; d. East Windsor, Conn., 17 May 1767. At 12 he was apprenticed to a weaver, but by private study secured an education, and in 1711 was appointed commissary of the Connecticut colonial forces in the attack on Canada. In the subsequent French wars he was successively promoted till he attained the rank of major-general at the siege of Louisburg in 1745. He was governor of the colony of Connecticut 1751–54 and had previously been a member of the assembly and of the council, judge of the County Court and of the Superior Court and deputy governor. He published in 1725 'Poetical Meditations, Being the Improvement of Some Vacant Hours'; and wrote a poem of 1,500 lines entitled 'A Brief Account of the Agency of the Honorable John Winthrop, Esq., in the Court of King Charles II, A.D. 1662,' in which he gives a description of the Pequot War. The latter was first printed in the collections of the Massachusetts Histori-

cal Society, and the original is among the manuscripts of the Connecticut Historical Society.

WOLCOTT, Roger, American lawyer and governor: b. Boston, July 13, 1847; d. there, Dec. 21, 1901. Graduated from Harvard University in 1870 and from the law school of the university in 1874, he was admitted in the latter year to the bar, but subsequently practiced little. In 1877–1879 he was a member of the common council of Boston, and in 1882–1885 of the Massachusetts House of Representatives, where he gained a considerable reputation by his oratory and his activity in constructive politics and the furtherance of good government. He was sent as a delegate to the state Republican Convention in 1885, in 1887–1889 was again a member of the Boston common council, and in 1891 was chosen first president of the newly-organized Republican Club of Massachusetts, in which post he rendered valuable service to his party. This was recognized by his nomination as lieutenant governor. He was elected in 1892, served by re-election until 1896, and upon the death of Governor F. T. Greenhalge in the latter year became acting governor. In November 1896 he was elected governor by the largest plurality ever given in the state to a candidate for the office. In 1897 and 1898 he was re-elected.

WOLD, Peter Irving, American physicist: b. S. Dakota, Nov. 27, 1881; d. June 17, 1945. He was graduated from the University of Oregon in 1901. After 1920 he was professor of physics at Union College, Schenectady, N. Y., and consultant of the General Electric Company's Research Laboratory. He performed notable work in the field of electrical invention.

WOLF, vôlf, **Ferdinand,** Austrian romance scholar: b. Vienna, Dec. 8, 1796; d. there, Feb. 18, 1866. He studied philosophy and jurisprudence at Gratz; received a position in the Royal Library at Vienna in 1827 and took an active part in the foundation of the Academy of Sciences, of which he became secretary. Among his many publications, all characterized by research and critical acumen, are *Collection of modern Castilian Rhymes* (2 vols., 1837); *Historical Studies of Spanish and Portuguese National Literature* (1859); *History of Brazilian Literature* (1863), etc. With C. Hofmann he edited a collection of the oldest Spanish romances and contributed frequently to the Vienna *Jahrbücher der Litteratur.*

WOLF, Friedrich August, German classical scholar: b. Hainrode, near Nordhausen, Prussia, Feb. 15, 1759; d. Marseilles, France, Aug. 8, 1824. He was educated at the gymnasium of Nordhausen and the University of Göttingen, and in 1782 was appointed rector of the Bürgerschule at Osterode in the Harz. The next year he was called as professor of philosophy and paideutics to Halle, where he labored for many years with the highest enthusiasm for the cause of education. In 1795 appeared his *Prolegomena ad Homerum* (3d and 4th eds., 1872 and 1875). In this he contended that the *Iliad* and *Odyssey* were not the work of one man, but of several Homeric rhapsodists (wand-bearing minstrels). The work in which he tried to maintain this statement created a profound sensation and has had the effect of permanently modifying the opinions of Homeric scholars as to the manner of the composition of the *Iliad* and *Odyssey.* (See Homer). From a literary point of view his labor has been of immense service. The University of Halle was suppressed in 1807, in the storm of the French invasion, and Wolf then removed to Berlin, where he entered the Ministry of Public Instruction, but soon resigned that he might give himself to the work of academic teaching, which disappointment and ill-health compelled him to give up in 1824 when he went south on a voyage for the sake of his health, but did not long survive his arrival at Marseilles. Wolf's great work was the invention, or at least the bringing into prominence, of a new instrument of education, namely, philology, which he defined as no meager study of the forms of language but "a knowledge of human nature as exhibited in antiquity." Locke and Rousseau had founded a school of educational theory which they considered to be more in accordance with common sense and modern needs than the classical culture of the Renaissance. Wolf revived the mental discipline and scientific aim implied in the prosecution of classical studies. Consult Arnoldt, *Friedrich August Wolf in seinem Verhältnisse zum Schulwesen und zur Pädagogik* (Brunswick1861–62); Pattison, Mark, *Essays* (Oxford 1889); Hüller, *Homerische Vorschule* (1836); Lachmann, *Betrachtungen uber Homers Ilias* (1865); Sandys, J. E., *A History of Classical Scholarship* (Vol. III, Cambridge 1908); Volkmann, *Geschichte und Kritik der Wolf'schen Prolegomena* (1874); also the Homeric writings of Gladstone, Blackie, Paley, Heyman, and Geddes.

WOLF, wo͝olf, **Henry,** American engraver: b. Eckwersheim, Alsace, Aug. 3, 1852; d. March 18, 1916. His artistic training was completed at Strasbourg, and when he came to New York, in 1871, his ability soon made itself known. He exhibited at the Paris Salon in 1888 and 1895, winning a gold medal in the latter year; at the World's Columbian Exposition of 1893; the Paris expositions of 1889 and 1900; Saint Louis in 1904 and at the Panama-Pacific Exposition, San Francisco in 1915, winning a grand prize. His chief works are *Engravings Illustrating American Artist Series* and "Gilbert Stuart Series of Women and Men" in the *Century Magazine.* His engravings may be seen in the Metropolitan Museum, Library of Congress, and Carnegie Institute.

WOLF, Hieronymus, German classical scholar: b. Göttingen, Aug. 13, 1516; d. Oct. 8, 1580. From 1557 until his death he was director of a school at Augsburg. He was one of the foremost Greek scholars of his century and is held in remembrance for his carefully annotated editions, with Latin translations, of Isocrates (1570) and Demosthenes, as well as for editions of Byzantine historians and many other classical labors.

WOLF, Hugo, Austrian composer: b. Windischgraz, Styria, March 13, 1860; d. Vienna, Feb. 22 ,1903. He received his early instruction on the piano and violin from his father, who was in the leather trade but was deeply interested in music. He studied at the Vienna Conservatory in 1875–1877, but was then dismissed for his supposed implication in a practical joke, and from this time had only self-instruction.

For some years he gave piano lessons and with some slight assistance from his father gained a bare subsistence. In 1884–87 he was musical critic on the *Salonblatt*. He ardently championed the music of Wagner and as bitterly attacked that of Brahms, with the result that he made many enemies, and in 1887 after the publication of 12 of his songs he abandoned his work on the *Salonblatt* to devote himself entirely to composition. His production was irregular, his highly emotional temperament, already foreshadowing the insanity that was to overtake him, spurring him at times to incessant work and again he lapsed into utter inactivity, at which periods he was subject to profound depression. His work, despite his dark moods and mad haste in production, maintained a steady high level that kept a devoted circle of friends, mainly critics and singers, about him; but his irritability hindered his material success despite their efforts. His work was never financially successful and he lived in cheap lodgings until 1896 when his friends bought a house for him and installed him in it. He enjoyed it only a year before insanity overtook him and he was placed in an asylum. A temporary improvement caused his release some months later, but after attempting suicide by drowning he asked to be returned to the asylum, where he died four years later. His fame rests securely upon his songs, of which he wrote 266, and which give him rank as one of the greatest of song-writers. His success was due not alone to his mastery of the art of composition but to a broad knowledge and love of literature. Superbly original, gifted with rare poetic insight and a high dramatic sense, his music invariably expresses the meaning of the poem set to it, as fully as if words and music were evolved simultaneously from his own brain. He scorned the art which made the words of a song a mere vehicle to carry the music, but while faithfully interpreting the sense of the verse he developed a breadth of style and intense dramatic power that leave him unrivaled among song-writers. His work as a composer was practically at an end in 1891. His works include 'Mörike Lieder' (43 songs); 'Eichendorff Lieder' (20 songs); 'Goethe Lieder' (51 songs); 'Spanisches Liederspiel' (44 songs); 'Italienisches Liederbuch' (1st part 22 songs; 2d part 24 songs); he wrote also settings for 13 lyrics by different authors, several choral works and orchestral pieces, and the opera 'Der Corregidor,' which was successfully produced in 1895. Consult Decsey, E., 'Hugo Wolf' (4 vols., 1903–06); Von Hellmer, E., 'Hugo Wolf' (1912); Heckel, K., 'Hugo Wolf in seinem Verhältniss zu Richard Wagner' (Munich 1905); Batka and Werner, 'Hugo Wolfs musikalische Kritiken' (Leipgiz 1911); Newman, 'Hugo Wolf' (London 1907); Schmitz, E., 'Hugo Wolf' (Leipzig 1907).

WOLF, Rudolf, Swiss astronomer: b. Fallanden, near Zürich, 7 July 1816; d. Zürich, 6 Dec. 1893. He was teacher of mathematics and physics in the realschule at Berne, 1839–55, and director of the observatory there in 1847. He was also professor of astronomy in the Berne University in 1853; professor of astronomy in the Polytechnikum and director of the observatory at Zürich in 1855, and later professor of mathematics and astronomy in the university there. He was famous for his investigations concerning the periodicity of sun spots and the accompanying magnetic variations, and wrote extensively on the history of science, especially astronomy. His 'Astronomical Miscellany' (1856–93) is a well-known series of papers, and his 'History of Astronomy' (1877) is a standard work of reference.

WOLF, wŭlf, **Simon,** American lawyer: b. Hinzweiler, Bavaria, 28 Oct. 1836; d. Atlantic City, N. J., 4 June 1923. He was graduated from the Ohio Law College, Cleveland, Ohio, in 1861, and served as recorder of deeds for the District of Columbia, 1869–78. He was judge of the Municipal Court for the District of Columbia, 1878–81, and in 1881–82 United States Minister to Egypt. While prominent in social and benevolent circles in Washington, he was identified with Jewish progress in America, was a founder of the B'nai B'rith Orphan Asylum at Atlanta, Ga., and for many years president of the Board of Delegates on Civil and Religious Rights of the Union of American Hebrew Congregations. In addition to various monographs, he published 'The American Jew as Soldier Patriot and Citizen' (1898); 'Biography of M. M. Noah' (1898); The Presidents I Have Known' (1917).

WOLF, a river in Wisconsin; rises in the northeastern part of the State, flows generally south, passes through Pewaugan Lake and enters the Fox River. Wolf River has been of great benefit in the development of the lumber industry in the northeastern part of the State. It is navigable for small steamers for about 150 miles.

WOLF, a typical wild species of the dog family (*Canidæ*). So closely related are wolves to the domestic and other true dogs (q.v.) that zoologists have been unable to find any satisfactory structural differences. As the distinctions are purely specific and largely founded upon the habits and character of the fur, all of the wolves are customarily placed in the extensive genus *Canis* along with the dogs and jackals. Excepting some of the domesticated varieties of dogs, wolves are the largest members of the family, and normally they howl and do not bark as do the dogs and jackals. Their natural range is throughout North America and Eurasia, but no true wolves are found in the Southern hemisphere, where they are replaced by the smaller carrion-eating jackals and fox-dogs. As they inhabit indifferently mountain-tops, plains and swamps, and are equally at home on the frozen Arctic shores and the tropical swamps of Mexico and India, they exhibit, as might be expected, a great range of variation. Generally they increase in size, vigor and courage northward, and the fur becomes more shaggy and thicker. The species and varieties have never been very satisfactorily discriminated and many zoologists consider that the large northern woodland wolf of both continents is a single wide-ranging variable species. Certainly these active animals are free to cross between the Old and New Worlds in the winter on the ice by way of Greenland or Alaska.

The American gray or timber wolf (*C. occidentalis*) when full-grown measures five and one-half feet in length, whereof 18 inches belong to the tail; its height is 33 inches, and its weight over 100 pounds. The general aspect

is that of a large dog, and, indeed, domestic dogs of the Indians were partly derived from this species and some of the European varieties from the native wolf. They are lank, long-limbed creatures with erect ears and drooping, rather bushy tails; the hair of the neck is generally more or less elongated and erectile. The color is very variable, the prevailing tone being gray, more or less marked with black; and becomes paler in winter and more reddish in summer. Southward the colors deepen, leading to the black wolf (*C. ater*) of Florida, the red wolf (*C. rufus*) of Texas and the dusky wolf (*C. nubilus*) of the central plains, while in the far North the Arctic wolf (*C. albus*) is nearly pure white with a black tail-tip. The gray wolf was formerly very abundant and troublesome in most parts of North America, but has more rapidly and completely succumbed to the march of civilization here than in Europe, and long since disappeared from even the forest-clad portions of the Eastern States. At the present time wolves are practically extinct in the country east of the Mississippi River, but still roam in large packs in the northern and western Canadian forests and wooded swamps, and are especially large and plentiful in Newfoundland and the Hudson Bay region. Owing to their activity and restless wandering habits small parties are likely to appear in the winter at places where none have been known for years. As the habits of all large wolves are essentially similar the following account of the European wolf (*C. lupus*), which has remained much more generally plentiful and troublesome than ours, will answer for the whole group:

Wolves inhabit a great variety of country, both hill and plain, especially thick forests and broken ground, with alternate morasses and dry patches, and in the South the steppes. They shelter in woods, marshes, canebrakes and maize fields, roaming over wide areas, often suddenly appearing where none have been seen for years, and as quickly vanishing—nor is this wonderful when it is remembered that they will cover from 25 to 40 miles in a single night. In the neighborhood of dwellings they only appear after twilight, but in secluded places carry on their hunting all day. Their food varies according to the season, consisting in summer almost exclusively of wild animals—foxes, hedgehogs, mice, birds, reptiles and even vegetables; of larger animals, elk and deer, while hares are soon exterminated where wolves abound. While readily associating and interbreeding with large domestic dogs which have run wild, they frequently attack and devour house dogs and even weak or injured members of their own species. They follow herds of lemmings in their migrations, and will devour carrion with avidity; but they do not appear to attack man unless in large numbers or pressed by hunger. Accounts of such attacks in the latter part of winter are frequent in the European press and are occasionally reported from the woods of Minnesota, Michigan and the Canadas. In winter they approach nearer to human habitations, doing much damage to flocks of sheep and poultry. When in packs they will attack horses and cattle. In the chase the wolf exhibits all the cunning of the fox, and in addition courage and the capability of hunting in packs. These will even divide in parties, one following the trail of the quarry, the other endeavoring to intercept its retreat. In mental qualities the wolf is in every respect the equal of the fox; his caution is so great that he regards every unfamiliar object with suspicion, will not pass through a door if he can leap over the wall, and will not, unless famished, attack a tethered animal lest it should be the bait of a trap. When he sees himself captured his courage and ferocity at once forsake him.

In spring and summer wolves are solitary or in pairs, in the autumn in families and in the winter in packs. The pairing season is in December and January, when the males fight savagely together; those who are fortunate enough to secure a mate remain with her till the young are well grown. The young are born in burrows usually excavated by the wolves themselves, and during her confinement the female is fed by the male. The period of gestation is 63 days, and from three to nine (usually four to six) cubs are found in a litter; these are blind for 21 days, and are suckled for two months, but at the end of one month are able to eat half-digested flesh disgorged by the mother. They quit the parents in November or December, but many remain together six or eight months longer; they are full grown in three years, and live from 12 to 15 years. Wolves can readily be tamed when taken young, and then exhibit many of the characteristics of domestic dogs.

Notwithstanding the spread of civilization, the wolf is still widely distributed. Excluding thickly populated regions, it extends over almost the whole of Europe; but Russia and Scandinavia are the only parts where it now occurs in any large numbers. In Asia it is spread over all the continent to the borders of India and the plains of China.

WOLF-FERRARI, vôlf fâr-rä'rê, **Ermanno,** Italian composer: b. Venice, Jan. 12, 1876; d. there, Jan. 21, 1948. The son of a German artist, August Wolf (1842–1915), and an Italian woman, Emilia Ferrari, he was at first sent to the Accademia di Belli Arti in Rome. However, after a serious illness, he decided to follow music, which had been his first choice for a career. In 1893 he went to Munich, where he studied for two years under Josef Gabriel von Rheinberger (1839–1901), a great contrapuntalist. After his return to Italy about 1895, the Philharmonic Society of Venice produced his oratorio, *La Sulamita,* in 1898, with considerable success. His first opera, *Cenerentola* (*Cinderella,* 1900), was received less favorably until it was revised as *Aschenbrödel* and given two years later in Bremen. In 1903 he produced *Le donne curiose* (*The Inquisitive Women*) which was to win for him an international reputation after its performance with Toscanini at the Metropolitan Opera House in 1912. His first comedy, *Il segreto di Susanna* (*The Secret of Suzanne*), written in a Mozartian style, was given its first performance in Munich, December 1909, and two years later at the Metropolitan. *I gioielli della Madonna* (*The Jewels of the Madonna*), for which he is perhaps best known, was presented in Berlin in 1911, was subsequently popular in England, and received its first American performance in Chicago in 1912.

Among his other works are *La vita nuova* (1902), oratorio; *I quattro rusteghi* (1906); *Thalita kumi* (1910), cantata; *Amor medico*

(Dresden, 1913; New York, 1914); *Gli amanti sposi* (Venice, 1925); *La Veste di Cielo* (given in Munich as *Das Himmelskleid* in 1927); *Sly* (Milan, 1927); *La vedova scaltra* (Rome, 1931), opera; *Il Campiello* (Milan, 1936), opera; and *La dama boba* (Milan, 1939). He also wrote *Idillio - Concertino* (1932), *Suite - Concertino* (1932), *Divertimento* (1938), Chamber Symphony in B Flat, opus 8; Serenade in E Flat, two violin sonatas, a piano quintet, and two piano trios.

Following the failure of *Cenerentola* in Venice and its successful revision as *Aschenbrödel* in Bremen, Wolf-Ferrari's works were for some time neglected in Italy and given première performances in Germany. Not until after the American performance of *Le donne curiose* and and *Il gioielli della Madonna* did the Italian critics recognize his international fame. In 1902 he was appointed director of Liceo Benedetto Marcello of Venice, a position he held until 1912.

WOLF FISH, large voracious sea fish of the family Anarhichodidae, named for its wolfish appearance and its disposition to fight hard when caught. There are three kinds of wolf fishes: northern wolf fish (*Anarhichas latifrons*) which inhabits for the most part the area north of the Arctic Circle; the spotted wolf fish (*A. minor*) found mostly within the Arctic Circle and south to Maine, prefers deeper water, and reaches six feet in length; and the common wolf fish (*A. lupus*) which occurs in the North Atlantic south to Cape Cod and occasionally to New Jersey, and feeds on echinoderms, mollusks, and crustaceans. The wolf fish of the North Pacific is the *A. orientalis;* the wolf eel is the *Anarhichthys felis.*

WOLFE, wo͝olf, **Catharine Lorillard,** American philanthropist: b. New York, March 8, 1828; d. there April 4, 1887. She inherited from her parents and grandparents a fortune of about $10,000,000, and expended a large portion of her income on benevolent works. Among her benefactions during her lifetime were liberal gifts to St. Luke's Hospital, New York; Union College, Schenectady; the Fordham Home for Incurables; charities of St. Johnland, Long Island; an Italian mission in New York; a newsboys' lodging house; Grace Church, New York; and generous contributions to American chapels in Rome and in Paris, as well as to many schools and churches in the United States. She financed William Hayes Ward's archaeological expeditions to Asia Minor in 1884. Through her will she left an endowment to Grace Church; and to the Metropolitan Museum of Art she left her collection of paintings, together with an endowment for maintenance and enlargement.

WOLFE, Charles, Irish poet: b. Blackhall, Dec. 14, 1791; d. Cove of Cork (now Queenstown), Feb. 21, 1823. He was graduated from Trinity College, Dublin, in 1814, was tutor there the next year, took orders in the English Church in 1817, and was curate of Donoughmore, Ireland. The poem on which his fame rests, *The Burial of Sir John Moore,* was published in *The Newry Telegraph* (1817). Wolfe was also author of several other poems, and his *Remains* with a brief memoir by John A. Russell were published in 1825.

WOLFE, James, English general: b. Westerham, Kent, Jan. 2, 1727; d. Quebec, Canada, Sept. 13, 1759. He was educated at Westerham and Greenwich, and in 1741 received a commission in the marines. In 1743 he took part in the famous Battle of Dettingen, and in 1745–1746, after having been made a brigade major, was present at the battles of Falkirk and Culloden. In 1747 he was wounded, though not seriously, at the Battle of Lawfeld, and from 1749 to 1757 was engaged in garrison duty in Scotland and England. In the mismanaged expedition against Rochefort, France, in 1757, Wolfe acted as quartermaster general and the only creditable movement in the affair was a night reconnaissance conducted by him which penetrated two miles into the enemy's country. His recommendation in favor of an immediate attack and his offer to take the place with 500 men and three ships were unheeded; but Pitt, the prime minister, becoming acquainted with the facts of the case, kept the young officer in view for some future enterprise. This occurred in the following year, when Wolfe was ordered to accompany the expedition under Jeffrey Amherst to Cape Breton, with the rank of brigadier general. A brilliant success was obtained in the capture of the strong fortress of Louisburg (q.v.), after a seven weeks' siege, and Wolfe became popularly known as the Hero of Louisburg. Pitt was then planning the overthrow of the French dominion in North America by the capture of their chief stronghold, Quebec, and with the instinct of genius singled out Wolfe as the most promising young officer in the army, to command the expedition, notwithstanding many older officers who might by virtue of seniority have claimed the honor. Wolfe was accordingly created a major general, and in June 1759 landed his forces on the island of Orleans, opposite Quebec. The system of defense adopted by his adversary, Montcalm, was such as to offer no point of advantage. The season during which operations could be continued rapidly advanced, but at last having dropped down the river and scaled the precipitous cliffs known as the Heights of Abraham at a point insufficiently guarded, at daybreak of September 13, Wolfe found himself on the Plains of Abraham, where, his supplies thus cut off, Montcalm had no choice but to give battle. After a short struggle the French were driven from the field in complete rout, Montcalm was one of 500 killed, the capitulation of Quebec followed five days after and its fall decided the fate of Canada. Wolfe died in the hour of victory. In person he had led the right column until wounded three times, when he was carried to the rear. He lived to hear the cry, "They run; see how they run!" and expired with the words, "Now I die contented." His body was taken to England and buried at St. Alfege Church, in Greenwich, and a monument was erected to him in Westminster Abbey.

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WOLFE, Thomas Clayton, American author: b. Asheville, N. C., Oct. 3, 1900; d. Baltimore, Md., Sept. 15, 1938. He attended public schools in Asheville and was graduated from the University of North Carolina in 1920. His great ambition was to become a playwright, and the university dramatic society encouraged him by producing his one-act play, *The Return of Buck Gavin,* with Wolfe acting the leading role. He continued his studies at Harvard University in George Pierce Baker's 47 Workshop, but his plays defied professional production. After receiving a master of arts degree in 1922, he accepted a position teaching English in the Washington Square College of New York University. He taught there intermittently until 1930, during which time he wrote and published his first novel.

Look Homeward, Angel (1929), a sprawling, autobiographical book, recreated Tom Wolfe's life through the period of his graduation from college. He described his family with extraordinary detail, giving them the fictitious surname of Gant; as a group, they emerged as a people of considerable violence, especially the mother, Eliza Gant. *Look Homeward, Angel* received tremendous praise from literary critics and started Wolfe on one of the most discussed literary careers of the 20th century.

The style of his second book, *Of Time and the River* (1935), was increasingly flamboyant and rhapsodic, confirming the author's distinctive talents. It was followed by *From Death to Morning* (short stories, 1935) and a small volume of literary autobiography, *The Story of a Novel* (1936). His career stopped abruptly in 1938 with his sudden death, but several volumes of writing appeared posthumously, including: *The Web and the Rock* (1939), *You Can't Go Home Again* (1940), *The Hills Beyond* (1941), and *Letters to His Mother, Julia Elizabeth Wolfe* (edited by John S. Terry, 1943).

WOLFE ISLAND, Canada, at the northeast end of Lake Ontario, bisects the outlet of the Saint Lawrence River, and is about 18 miles long, with a maximum width of seven miles, and an area of 34,806 acres. It belongs to Frontenac County, Ontario, is the largest of the famous Thousand Islands and is opposite Cape Vincent, New York State.

WOLFEBORO, N. H., town in Carroll County; altitude 573 feet; on Lake Winnepesaukee; 42 miles northwest of Dover; on the Boston and Maine Railroad. It is a trading center and a summer resort, with local industries. Brewster Academy, a college preparatory school for boys and girls, is located here. The town, upon its formation in 1759, was named in honor of Gen. James Wolfe (q.v.), British commander in the siege of Quebec, defended by the French under Montcalm. Pop. (1940) 2,636; (1950) 2,581.

WOLFENBUTTEL, vōl'fĕn-büt-ĕl, Germany, a town of Brunswick, on the Ocker River, seven miles south of the city of Brunswick. It dates from 1046, was besieged and taken in 1193 and 1542, and was the scene of a battle in 1641 during the Thirty Years' War. The library, built in 1723 in the form of the Pantheon at Rome, became famous for its literary wealth and because Gotthold Lessing (q.v.) was the librarian. It was here that Lessing edited the *Wolfenbüttel Fragments* (*Fragmente des Wolfenbüttelschen Ungenannten,* 1774–1778) written by Herman Samuel Reimarus (q.v.), which startled Germany's theologic world. The building was superseded in 1887 by a handsome new structure. One of the ancient churches contains tombs of the princes of Brunswick. Pop. (1939) 25,116.

WOLFF, vŏlf, **Albert,** German sculptor: b. Neustrelitz, Nov. 14, 1814; d. Charlottenburg, June 20, 1892. He began the study of sculpture in 1832 with Christian Daniel Rauch (q.v.), the greatest German sculptor of the day. In 1844, he was sent to Carrara, Italy, to execute the sculptures for the terraces of the Sanssouci Palace, Potsdam. After two years in Italy, he returned to his native country and assisted his former teacher in the completion of Rauch's Frederick the Great Memorial in Berlin. Wolff became a member of the Berlin Academy in 1866. His equestrian statues won in competition three times: King Ernst Augustus (Hanover, 1861), King Frederick William III (Berlin, 1875), and Gen. José Gervasio Artigas (Montevideo, 1885). Another famous work is his statue of Frederick William IV in Königsberg.

WOLFF or WOLF, Baron Christian von, German philosopher and mathematician: b. Breslau, Jan. 24, 1679; d. Halle, April 9, 1754. He was educated at the University of Jena, studying theology, mathematics, and philosophy, and became a lecturer at the University of Leipzig (1703–1706). The writings of René Descartes (q.v.) and Ehrenfried Walter von Tschirnhaus interested him especially, and he wrote a commentary which brought him into acquaintance with the distinguished German philosopher Gottfried Wilhelm von Leibnitz (q.v.). In 1707, Wolff was made professor of mathematics at the University of Halle. His rationalistic views incurred the hostility of certain theologians who denounced him, and in 1723 Frederick William I commanded him to leave Germany. Ultimately vindicated, he was appointed vice chancellor and professor at Halle by Frederick II in 1740, and in 1743 was made chancellor. Wolff's principal work consisted of his application of mathematical method to the investigations of physical science. The rationalistic thought which characterized his philosophic doctrine resulted in a popularization of the Leibnitzian teaching. While agreeing with many of the concepts of Leibnitz, he regarded the theory of pre-existent harmonies as hypothetical but asserted the possible interaction of body and soul. Like Wolff, Immanuel Kant (q.v.) in his *Critique of Pure Reason* divides philosophy into ontology, cosmology, rational psychology, and natural theology. His collected writings make up 22 volmes. Consult Pichler, H., *Über Christian Wolffs Ontologie* (Leipzig 1910).

WOLFF, Emil, German sculptor: b. Berlin, March 2, 1802; d. Rome, Italy, Sept. 29, 1879. He was a pupil of his uncle, Johann Gottfried Schadow, and having won a prize at the Royal Academy of Arts, went to Italy in 1822 as a pensioner of Frederick William III and ever after resided in Rome. Here he came under the influence of Bertel Thorwaldsen, and in 1871 was appointed director of the Academy of Saint Luke. He held high rank among German sculptors and executed many Greek mythological and genre statues which have been greatly admired.

In portraiture, busts of Niebuhr, Thorwaldsen, Winckelmann, and Bunsen are among his masterpieces. Among his noteworthy productions are *Hebe and Ganymed* (1834), *Victory Teaching Youth History* (1846), *Judith* (1868), and *Circe.*

WOLFF, Julius, German poet and novelist: b. Quedlinburg, Sept. 16, 1834; d. Charlottenburg, June 3, 1910. He studied literature and philosophy at Berlin, then entered the manufacturing business of his father, but later withdrew, and in 1869 founded the *Harz-Zeitung.* In 1870–1871 he served in the German Army and won the Iron Cross. After this he settled in Berlin and devoted himself to literary work. His chief works are *Aus dem Felde,* war poems (1871, 1907), *Der Rattensänger von Hameln* (1875), *Der wilde Jäger* (1877), *Tannhäuser* (1880), and *Lurlei* (1886); among his novels may be mentioned *Der Sülfmeister* (1883), *Der Raubgraf* (1884), and *Die Hohkönigsburg* (1902).

WOLFF, Oskar Ludwig Bernhard, German improvisator and novelist: b. Altona, July 26, 1799; d. Jena, Sept. 16, 1851. He studied medicine in Berlin and subsequently history and philosophy. He became professor of modern languages at Weimar in 1826, and of modern languages and literature at Jena in 1832. He published *Bilder und Lieder* (1840); *Naturgeschichte des Deutschen Studenten* (1841); *Träume und Schäume* (1844); *Die kleinen Leiden des Menschlichen Lebens* (1846); and edited several anthologies of German prose and poetry.

WOLFF'S AGENCY (Wolffs Telegraphisches Büro), a German news agency which ranked with Reuter's of London and Havas of Paris. Before the outbreak of World War I, Wolff's Agency was a private concern doing its greatest business in Germany and Austria, the Norse countries, and Russia. In 1917 the control passed into a syndicate of militarists representing the German government. It ended operations in February 1933 and was succeeded by the Nazi agency, the Deutsche Nachrichtenbüro (DNB).

WOLFHOUND, a dog kept and trained for the pursuit of wolves. The ancient Irish wolfhound, now extinct, was of two kinds: one was a tall, shaggy, swift-running dog, somewhat like the modern Scottish deerhound; the other more nearly resembled a mastiff, and similar dogs have been known in Spain under the name of wolf dogs. The modern Russian wolfhound is the beautiful borzoi (q.v.).

WOLFRAM VON ESCHENBACH, vôl'-främ fŏn ĕsh'ĕn-bäĸ, medieval German epic poet: b. Eschenbach, near Ansbach, Middle Franconia, Bavaria, about 1170; d. perhaps the same place, about 1220. He was of noble Bavarian family, and served various powerful overlords, such as the counts of Wertheim, and the Landgrave Hermann von Thüringen at whose court he lived about 1203, and who provided him with the material for Wolfram's *Willehalm,* namely, the *chanson de geste, La Bataille d'Aliscans.* After the death of Hermann in 1217, Wolfram is said to have retired to his native province, perhaps to Wildenberg (Wehlenberg); his remains are reported to have been interred in the church of Our Lady at Eschenbach. Of all the epic poets who wrote in Middle High German, Wolfram has the strongest personality, the most original artistry, and the most mature moral and religious feeling. Although in point of style and passion he is excelled by Gottfried von Strassburg, he stands alone in medieval German literature in the realism of his observation, the depth of his psychology, the sanity and originality of his views, and a broad toleration and sense of humor. Eight songs and three epics are the sum of his work, as far as it has been preserved. The greatest of these is the epic *Parzival* (composed early in the 13th century, preserved in 15 complete manuscripts), probably based on the Perceval in *Le contes del graal* of Chretien de Troyes (q.v.); but Wolfram mentions another authority, Kyot le Provençal, a singer, however, no trace of him can be found in either French or German sources. In this long biography, in 25,000 lines of verse, Wolfram presents a picture of tolerant spiritual knighthood, as distinguished from the traditional ideals of chivalry, such as his profoundly generous and balanced nature would evolve it. Thus, he exalts the calm happiness of the state of wedlock as opposed to the conventional intrigue and exaggeration of the minnesingers, and their cult of romantic affection. Again, in the epic fragment, *Sigune und Schionatulander,* also called *Titurel,* he decries the unnatural etiquette of the courts and their knightly *minne.* In the incomplete epic, *Willehalm,* the underlying idea is the principle of Christian toleration toward pagan opponents. Editions of the original text have been published by Lachmann, K. (Berlin 1891, 6th ed. 1926); Martin, E., (Halle 1900); Leitzmann, A., (Halle 1902, new ed. 1942); modern German translations by Simrock, K., (Stuttgart 1883); and Hertz (Stuttgart 1906). Consult Schulz, A., *Parcival-Studien* (by San Marte, pseud.), 3 vols. (Halle 1861–62); Martin, Ernst, E., *Zur Gralsage* (Strassburg 1880).

Jacob Wittmer Hartmann.

WOLFRAMITE, a native tungstate of iron and manganese in varying proportions, having the formula $FeWO_4$ and $MnWO_4$. It occurs in flat, monoclinic crystals, with eminent cleavage parallel with the clinopinacoid. It is brittle, has a hardness of 5 to 5.5 and a specific gravity of 7.1 to 7.5, or about that of iron. It has a submetallic luster, while it is almost or quite opaque and its color and streak are black or nearly black. It is thus distinguished from the closely related mineral hübnerite. It usually occurs in quartz veins, frequently associated with cassiterite or scheelite. It is of considerable commercial importance as a source of tungsten and the ferrotungsten used in making tungsten steel. Its best known localities have been in Bohemia, Saxony, and England, but increased demand for it has brought other localities into prominence, among which are those of New South Wales, Argentina, and Connecticut. Much so-called wolframite is really hübnerite.

WOLFSBANE. See Aconite.

WOLGAST, vōl'gäst, Prussia, town of Pomerania, on the left bank of the Peene River, four and a half miles from its mouth on the Baltic Sea, and 40 miles southeast of Stralsund by rail. Its harbor is shallow and larger vessels load and unload on the island of Rügen. Wolgast has the remains of an old castle, the ancestral

seat of the dukes of Pomerania. Its industries are weaving, boatbuilding, and the manufacture of leather and tobacco. Wolgast, which was strongly fortified early in the 12th century, was destroyed in 1628 by the Austrian general, Wallenstein, in 1630 by the Swedes, in 1637 by the Imperialists, and in 1638 again by the Swedes. In 1675 it was taken by Frederick William, the Great Elector of Brandenburg, was plundered by the Russians in 1713, and by the Swedes again in 1715. But small remains now exist of its former fortifications. Pop. (1933) 7,633.

WOLLASTON, wo͝ol'ăs-tŭn, **William Hyde,** English chemist: b. East Dereham, Norfolk, Aug. 6, 1766; d. London, Dec. 22, 1828. He was educated at Cambridge and was graduated in medicine in 1793. He practiced as a physician in Bury Saint Edmund's, and then moved to London, where he devoted himself to scientific research, becoming secretary of the Royal Society in 1804 and acting as president in 1820. He was the inventor of the camera lucida (q.v.), and also the goniometer, an instrument for measuring the angles of crystals, and the discoverer of palladium and rhodium (qq.v.) in 1803, and the malleability of platinum. Wollaston was a member also of the Geological Society of London, to which he bequeathed a sum providing for the Wollaston medal. This award which is bestowed in recognition of "researches concerning the mineral structure of the earth" is the highest honor the society confers. Many of his papers on research work were published in *Philosophical Transactions.*

WOLLASTON LAKE, Canada, a lake of Athabasca, in the Northwest Territory. It is about 50 miles long and has its outlet in the Mackenzie River.

WOLLASTON LAND, Canada, a region of Franklin district, lying west of Victoria Land, in the Arctic Ocean.

WOLLASTONITE, named for William Hyde Wollaston (q.v.), is one of the pyroxene group of minerals, crystallizing, therefore, in the monoclinic system. Its crystals are usually tabular, to which fact its name "tabular spar" is due. Crystals are, however, rather rare, the common occurrences being compact or in aggregates of brittle fibers, having a splintery fracture. Its hardness is 4.5 to 5, specific gravity 2.85. Its luster is vitreous to pearly and its usual color is white or gray. Some localities yield specimens which show excellent triboluminescence. It is a calcium metasilicate, $CaSiO_3$. Its most important American localities are in northern New York.

WOLLE, John Frederick, American organist and composer: b. Bethlehem, Pa., April 4, 1863; d. there, Jan. 12, 1933. He studied under David Duffle Wood in Philadelphia in 1883–1884, and under Josef Gabriel Rheinberger in Munich in 1884–1885. He was organist at the Moravian Church in Bethlehem in 1885–1905 and also of Packer Memorial Church at Lehigh University in 1887–1905; and for the following five years was professor of music at the University of California. He had begun, in 1898, the annual Bethlehem Bach Festivals which won international fame, re-established them in 1911, and was conductor from 1912 to 1933. He received the honorary degree of Mus. D. from Moravian College, University of Pennsylvania, and Princeton. From 1916 he was organist of Trinity Church, Bethlehem.

WOLLIN, vō-lēn', Germany, town and island of Prussia at the mouth of the Oder River; on the north side of the Haff; length 20 miles; breadth from three to ten miles. Fishing and cattle raising are the chief occupations. Pop. (1939), town, 4,942.

WOLLSTONECRAFT, wo͝ol'stŭn-kráft, **Mary.** See Godwin, Mary Wollstonecraft.

WOLSELEY, wo͝olz'lĭ, Sir **Garnet Joseph,** 1st Viscount, British soldier: b. near Dublin, June 4, 1833; d. Menton, France, March 25, 1913. He entered the army in 1852 as an ensign, served in the Burmese War of 1852–1853, went through the Crimean campaign and was severely wounded before Sevastopol. For his services here he was made a member of the Legion of Honor, and in 1855 was advanced to the rank of captain. He saw active service in India during the Sepoy Mutiny from 1858 to 1860, was attached to the Bengal command, took part in the brief China War of 1860, and in 1865 attained the rank of colonel. He was assistant quartermaster general and deputy quartermaster general in Canada from 1867 to 1870, and in the latter year led the successful Red River expedition against Louis Riel. On leaving Canada he received the appointment of assistant adjutant general at headquarters, a post which he held until 1873. In the Ashanti War, 1873–1874, his admirably planned march resulted in the capture of Kumasi, the native capital, and led to the securing of British authority on the Gold Coast. In 1875 he went to Natal as governor and general commanding, and in 1878 went to Cyprus in the capacity of high commissioner. Leaving Cyprus the next year he was again sent to South Africa, this time as governor and high commissioner of Natal and the Transvaal in order to finish the Zulu War and check the advance of Sekukuni (Sikukuni, Secocoeni), a native chief. On returning home in 1880 he was appointed quartermaster general of the army, a post which he held till 1882, when he was advanced to the rank of adjutant general, and as commander in chief conducted the campaign in Egypt against Arabi Pasha, which ended in the utter defeat of the latter at Tell-el-Kebir. For this he was raised to the peerage as Baron Wolseley of Cairo and of Wolseley, in the county of Stafford. He commanded the Nile expedition of 1884–1885, which was sent too late to relieve Gen. Charles Gordon in Khartoum. Nevertheless because of his efficient service he was created Viscount Wolseley of Wolseley on his return, and made a Knight of the Order of Saint Patrick. In 1890 he was appointed to the command of the forces in Ireland, becoming at the same time privy councilor of Ireland, and in 1895 succeeded the duke of Cambridge in the post of commander in chief in the United Kingdom. He has published *Narrative of the War with China in 1860* (1862), *The Life of John Churchill, Duke of Marlborough, to the Accession of Queene Anne* (1894), *The Decline and Fall of Napoleon* (1895), *The Story of a Soldier's Life* (1903). Consult Low, C. R., *A Memoir of Lieutenant-General Sir Garnet Joseph Wolseley,* 2 vols.

(London 1878); Maurice, F. B., and Arthur, G., *The Life of Lord Wolseley* (London 1924).

WOLSEY, wŏŏl'zĭ, **Thomas,** English statesman and cardinal: b. Ipswich, Suffolk, 1475?[1]; d. Leicester, Nov. 29, 1530. He was a son of a butcher and was sent to Oxford, of which he became a bachelor at 15, and was elected a fellow of Magdalen College about 1497. Being appointed master of a grammar school dependent on the college, he had three sons of the marquis of Dorset under his care, which led that nobleman to present Wolsey to the rectory of Limington, in Somerset. He was afterward chaplain to the archbishop of Canterbury, then to one of the governors of Calais, and finally was recommended to Henry VII, who made him one of his own chaplains. Under Henry VIII his progress in advancement was very rapid. In 1509 he was made dean of Lincoln; in 1510 became rector of Torrington, Devonshire; in 1511, canon of Windsor, registrar of the order of the Garter and privy councilor; in 1513 dean of York and bishop of Tournay (being then in France); in 1514, bishop of Lincoln and then archbishop of York. In 1515 Pope Leo X elevated him to the dignity of cardinal, and at the end of the same year Henry made him lord chancellor. His nomination in 1518 to be the pope's legate *a latere* completed his ecclesiastical dignities, by exalting him above the archbishop of Canterbury. At the time when the rivalry between the Emperor Charles V and Francis I rendered the friendship of Henry of great importance, Wolsey was treated with the greatest respect by both sovereigns, receiving pensions from each, as well as a third from the pope. He ultimately, however, favored the side of Charles, who settled upon him the revenues of two bishoprics in Spain and flattered him with hopes of the papal chair, which induced him to involve Henry in a war with France. Insatiable in the pursuit of ecclesiastical emolument, in 1519 he gained the administration of the see of Bath and Wells, and the temporalities of the abbey of Saint Albans, his revenues now nearly equaling those of the crown. Part of them he expended in pomp and ostentation and part in laudable munificence for the advancement of learning. His love of splendor was signally displayed on the Field of the Cloth of Gold in June 1520; his love of learning in his foundation of several lectures, as well as the college of Christ Church at Oxford, and of a collegiate school in Ipswich. He built a palace for himself at Hampton Court, but this he in the end presented to the king. In 1522, on the death of Adrian VI, he failed to secure elevation to the papacy, and on both occasions attributed his failure to Charles V, to whom he ever afterward entertained a strong aversion. The critical affair of the divorce of Queen Catherine was one of the first steps to his fall. With Cardinal Campeggio he was appointed to determine the legitimacy of Henry's marriage with her, and lost the favor of the king by exposing himself to the suspicion of causing delays in the settlement of the question. He fell still more into disfavor by advising the king against marrying Anne Boleyn, and of course roused the hostility of Anne herself and her friends. Leading nobles, deeming this a good occasion for contriving his ruin, caused him to be accused of having in the exercise of his duties of papal legate violated the statute of praemunire (1529), and he was convicted. The dukes of Norfolk and Suffolk were sent to require the great seal from him; he was ordered to quit York Place, his palace in London and to retire to Esher, in the diocese of Winchester; and his lands, goods and chattels were declared forfeited. Henry still assured him of his protection. Part of his revenues were restored to him and he was even reinstated in the diocese of York. But Henry did not continue his protection long. Toward the close of the year 1530 he was arrested at his mansion of Cawood, in the diocese of York, where he had retired, and was ordered to be conveyed to London on a charge of high treason. Illness and mental distress obliged him to stop at Leicester, where he died a few days afterward. Shortly before his death he is said to have exclaimed to the officer appointed to conduct him: ". . . if I had served God as diligently as I have done my king, He would not have given me over in my grey hairs." There has been considerable disposition in later writers to vindicate the character of this minister; and it must not be forgotten that, in the reign of Henry VIII, who had broken his heart; of Mary, the daughter of the much injured Catherine; and of Elizabeth, whose mother, Anne Boleyn, was the chief instrument of his downfall, scant justice could be expected to be rendered to the better traits of his mixed character.[2] If he was loose in his morals, grasping in his ambition and rapacious, he was liberal and even profuse toward his dependents, and in his patronage of letters. He was enlightened far beyond the period in which he lived. As a diplomatist it is very difficult to say whether his abilities or industry were the most remarkable, and it is to him that England is indebted for the first notion of a vigorous police and for a regular system in the administration of justice.

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WOLVERHAMPTON, wŏŏl'vĕr-hămp-tŭn, England, a manufacturing town, the "metropolis of the Black Country," is built on an eminence amid a network of railways and canals, 13 miles northwest of Birmingham and 126 northwest of London. The town stands on the western edge of the great coal and iron mining district of South Staffordshire, so that the vicinity on the south and east is covered with collieries, ironstone mines, blast furnaces, forges, iron foundries and rolling mills, while on the north and west there is pleasant green country. It was first called Haentune and later Wulfran Hamton after Wulfrun, King Edgar's sister, had founded in 996 Saint Peter's Church, which continued collegiate till 1846. It was rebuilt during the 13th,

[1] The date 1471 is sometimes given as a result of a report by Cavendish that the cardinal washed 59 men's feet at his maundy in 1530. However, judging from letters and his father's will, the 1474 or 1475 date is considered more likely correct.

[2] He had a son and a daughter by a woman by the name of Lark, who later married a "Leghe of Aldington." The son took the name Thomas Wynter; the daughter entered a nunnery at Shaftesbury.

14th and 15th centuries and enlarged and elaborately restored. The church is a fine cruciform Gothic edifice, with several notable features and monuments. The other public buildings are all modern and include the town hall, corn exchange, market hall, agricultural hall, hospitals, post-office, art gallery, drill hall. The free grammar school, founded in 1512, occupies handsome buildings and there are also a bluecoat school (1696) and an orphanage (1850). In 1757 Wolverhampton was described as "a great manufacturing town in all sorts of toys, and particularly of locks in the greatest perfection"; locks —some 2,000,000 yearly—are still its specialty. The other manufactures include tin plate, japanned goods, enameled hollow wares, edge tools, gas and water tubes, electro plate, papier-mâché, and chemicals. Pop. (1947) est. 155,610.

WOLVERINE, GLUTTON, or **CARCAJOU,** a carnivorous mammal (*Gulo luscus*), of the weasel (Mustelidae) family, but differing greatly in appearance from the light and slender weasels typical of that family. The wolverine is a short, thick, heavily-built animal about two and one-half feet long, whose short legs, subplantigrade feet and short, bushy tail add to a decidedly bear-like aspect of body. On the body and especially on the tail the hair is long, coarse and rough, blackish-brown with a pair of yellowish lateral bands meeting at the root of the tail above. The teeth are 38 in number and the molars are remarkable for their massiveness. The wolverine is a northern animal entering the United States only along the Canadian border, and even there vary rarely.

Apparently there is no distinction between the glutton of northern Europe and Asia and the American wolverine, and in both Old and New Worlds this brute is hated alike by woodsmen and trappers for its voracity, native meanness and cunning. It has the reputation of being the most powerful mammal of its size in existence, and in dogged courage is said to have no equal. Those who have had experience with it place it ahead of even the coyote in craftiness and the ingenuity which it exhibits in finding and robbing the stores of man and beast. It systematically follows the lines of traps set by fur hunters and robs them of both baits and captured animals; but is itself one of the most difficult of animals to take, and succeeds in repeatedly springing and robbing traps set for it, even when most cunningly concealed. Nor is its thieving confined to things edible; sometimes every portable article in a camp equipment will be carried away and hidden by a wolverine. It devours enormous quantities of food and its European name indicates that it is typical of greedy voracity. It lives on hares, squirrels, beaver, mice, foxes, all kinds of ground birds and their eggs, reptiles, insects, and even such large game as reindeer, which it is enabled to secure by its perseverance, great strength and cunning. The wolverine finds its most congenial home in the great northern forests, but its range extends beyond the tree line to the Arctic shores. Early spring is the mating season, and four or five young are born in June or July in a nest at the bottom of a burrow. The savage courage with which the female will defend her young is almost proverbial among trappers, who dread few animals so much as a mother wolverine with her family. Consult Coues, *Fur-bearing Animals* (Washington 1877); Seton, E. T., *Life Histories of Northern Animals* (New York 1909).

WOLVERINE STATE, a popular name for the State of Michigan, so called for its abounding in early days with wolverines.

WOMAN, Education of. See EDUCATION OF WOMEN.

WOMAN SUFFRAGE. Early History of Women's Rights Movement.—All political revolutions have had for their primary object the desire of the revolutionists for a voice in their own government. Most of these revolutions have been the work of men. But women have assisted in all of them. Yet when a voice in the government has been obtained men have almost always claimed the right to speak for women as well as themselves. Women in the mass, living in isolated homes, in the early days absorbed in all their engrossing household duties, with little or no education, pecuniary independence or organization, bound by social customs and the traditions of ages, have generally submitted without question to this assumption of authority.

There are preserved in history, however, several instances to show that individual women, and men too, protested at times by voice, by pen and by petition. During the last seven centuries and even in far earlier times treatises have been written from time to time, mainly by men, in which they called for the education, development and emancipation of women. (See Plato's *Republic,* 5th century B.C., for the earliest instance.) Old manuscripts on the rights of women are in existence, most of them dated in the 16th and 17th centuries. In Italy, where the universities were open to women in the 14th and 15th centuries, women early demanded equality of rights. In England, which was the cradle of representative government, the records show that as early as 1499 women signed a petition for the right to vote, and this was followed by others as time went on.

Mistress Margaret Brent brought this spirit with her to the American colony of Maryland, where in 1647, as heir of Lord Calvert, a brother of Lord Baltimore, and executor of their estates, she demanded "place and voyce" in its assembly. Representation in England was based on property and this was also the law in the American colonies. Although the demand of Mistress Brent was refused, the records show that some women property-owners voted in Virginia, and that in Massachusetts under the Old Province Charter women property-holders voted from 1691 to 1780. When a constitution was adopted they were excluded from a vote for governor and legislature but retained it for other officials. In those days, however, voting restrictions were such that less than one-fourth of the men could vote. So the exclusion of women, burdened as they were with household cares, did not seem as discriminatory as it did in later years.

The American Revolution, one of whose fundamental principles was "no taxation without representation," could not fail to rouse in women a sense that they were entitled equally with men to representation. That it did so is evidenced by the famous letter of Abigail Adams to her husband, John Adams, while he was sitting in the Continental Congress: "I long to hear that you

have declared an independency, and, by the way, in the new code of laws, which I suppose it will be necessary for you to make, I desire you would remember the ladies and be more generous and favorable to them than were your ancestors. Do not put such unlimited power into the hands of husbands. Remember all men would be tyrants if they could. If particular care and attention are not paid to the ladies we are determined to foment a rebellion and will not hold ourselves bound to obey any laws in which we have no voice or representation." Abigail Adams was not alone in these thoughts. There were other women who felt as she did, among them Mrs. Corbin, sister of Richard Henry Lee, of Virginia, who in 1778 presented a petition for the right to vote.

It is not likely that Mary Wollstonecraft heard of these protests, but in 1790 she published in London her remarkable book, *Vindication of the Rights of Women.* In the French Revolution of 1793 Condorcet and other leaders proposed conferring political rights on women.

In the 18th century the idea and the hope of political liberty were everywhere permeating the minds of men and found practical expression through the French and American Revolutions. The Declaration of Independence was written as a guide for all countries, and with this and the Constitution of the United States was begun the greatest experiment ever made in representative government. The makers of these documents, however, did not contemplate giving women a voice in government. The Constitution did not in fact confer suffrage on any one but left those who already possessed it entirely free, under the jurisdiction of the state governments, to grant or withhold it from any class of citizens.

Religious qualifications for voting had practically ceased with the colonies. Some of the new states set up property or educational requirements and others imposed both; all of them restricted voting to *male* citizens except New Jersey, whose constitution gave the franchise to "all inhabitants worth $250, etc." In 1790 a revision of the Election Law used the words "he or she," thus emphasizing the inclusion of women in the electorate. Enough women voted to gain the enmity of the politicians and in 1807 the legislature passed an act limiting the suffrage to "white male citizens." This was clearly illegal, as the constitution could be changed only by action of the voters.

In the third decade of the new government most of the states, influenced by Jackson, Jefferson and others of democratic tendencies, removed the restrictions which barred working men from voting. This made the discrimination against women glaringly apparent. In 1826 a talented and wealthy young Scotchwoman, Frances Wright, having heard glowing accounts of this land of individual liberty, came here and associated herself with Robert Dale Owen, then making some advanced social experiments, in the publication of his paper. She was greatly surprised to learn that women had no part in the government and for several years in the paper and on the platform she urged the enfranchisement of women and was the first to bring the question before the public. She was followed in 1836 by Ernestine L. Rose, daughter of a rabbi in Poland, who had been banished because of her progressive ideas. She was only 26, handsome and eloquent, and her lectures on the science of government were largely attended. She, too, was amazed at the subordinate position of women and not only advocated their full enfranchisement but also the repeal of the other discriminatory laws under which they suffered. In the winter of 1836–37 she circulated a petition in Albany, N. Y., for a law to enable a married woman to hold property. Although she got only five signatures, she carried these to the legislature and addressed that body. Her work soon attracted attention, and by 1840 she had associated with her Elizabeth Cady Stanton and Paulina Wright Davis, two brilliant young married women, and Lucretia Mott, a well known social reformer in Albany. In many localities there began to be signs of an awakening on the part of women. Margaret Fuller, of Boston, in her writings and addresses in 1840 demanded political rights for women and published her book, *The Great Lawsuit, Man vs. Women.* In 1847 Lucy Stone, recently graduated from Oberlin College, began speaking for the rights of women.

Meanwhile larger forces were moving in the field of human rights. The anti-slavery question was growing more momentous. In 1828 Sarah and Angelina Grimké, of South Carolina, emancipated their slaves, came North and by their impassioned speeches aroused public sentiment. Garrison soon entered the contest and the American Anti-Slavery Society was formed. From the beginning women were prominently identified with this movement and the first Women's Anti-Slavery Convention was held in New York in 1837. The names of Lucretia Mott, Lydia Maria Child, Maria Weston Chapman, Abby Kelly, Abby Hopper Gibbons and many others soon became widely known. Women began to take part in the business meetings and public debates of the society. This aroused violent opposition and in 1839 the society was rent in twain on this point. The half sustaining the right of women to participate comprised Garrison, Phillips, Pierpont, Pillsbury, Thompson, Foster, Stanton, Gerrit Smith—nearly all of those who eventually carried the abolition of slavery to success. Thenceforth these men became the champions of women's rights, including that of the ballot, and women added to their appeal for the slaves another appeal for their own legal and political liberty.

The question of woman's right to participate publicly in the movement was carried to the World's Anti-Slavery Convention in London, in June 1840, which refused to recognize the eight women delegates from the United States, who included Lucretia Mott and Mrs. Wendell Phillips. It was at this time that Mrs. Mott and Elizabeth Cady Stanton, a bride, whose husband, Henry B. Stanton, was a delegate, decided that on their return to the United States they would organize a movement especially for the rights of women. Mrs. Mott remained several months lecturing in England and Scotland and found considerable sentiment in favor of permitting women to vote, especially among the Friends, or Quakers.

A wave of reform was sweeping over Europe about the middle of the 19th century and it reached the shores of the United States. It carried the desire for liberty of thought, speech and action and for the redress of wrongs to humanity. This nation was seething with discussion of temperance as well as slavery. Such temperance laws as had existed had been repealed and there

was no regulation of the liquor business. The question of slavery had become acute by the admission of Texas into the Union as a slave state and it was intensified by the Fugitive Slave Law. Women were as vitally interested in these questions as were men and they could no longer remain silent and inactive. Their first timid attempts at speaking in public and taking part in conventions in both the temperance and the anti-slavery movements were met with a determined attempt by the men to suppress them. They were literally silenced at conventions, excluded from committees and forced to hold separate meetings.

The Society of Friends, or Quakers, had divided on the slavery question and, as this sect had always recognized equality of rights, their women especially resented the discriminations that were being made. In 1848 Elizabeth Cady Stanton went from her home in Seneca Falls, New York, to visit Lucretia Mott at the neighboring home of a mutual friend, Mary Ann McClintock. Mrs. Mott's sister, Martha C. Wright, came from Auburn. The four women talked over the situation and Mrs. Mott and Mrs. Stanton decided to put into effect the resolution they had made in London eight years before to call a convention for a public discussion of the rights of women. In June of that year these four issued a "Call" for the first woman's rights convention in all history and published it, unsigned, in a local paper. They then prepared a declaration of rights modeled after the Declaration of Independence and a set of resolutions which demanded practically every right that women are enjoying at the present day, including suffrage. The convention met in Seneca Falls on July 19th and 20th, in the Wesleyan Methodist Church. James Mott, of Philadelphia, the husband of Lucretia, and one of the most prominent Friends in the country, presided. As many as the church would hold were present; the declaration and resolutions were discussed and adopted, and thus began the movement for woman suffrage which has continued without cessation.

So much attention was aroused that the convention adjourned to meet on August 2nd in Rochester, the nearest city. The newspapers gave wide publicity and in a short time press, pulpit and platform were denouncing the women. But the seed had been sown and from that time on there was no stopping its growth.

The women in New York had continued to besiege the legislature until, in April, 1848, the common law rule was changed to allow wives to hold property. The women then devoted themselves to securing equal guardianship rights over children for mothers, juster divorce laws and woman suffrage. By this time women in other states were carrying forward the same reforms.

In April, 1850, a woman's rights convention was held in Salem, Ohio, and a memorial was adopted calling upon the State Convention which was about to draft a new constitution to put in a clause for woman suffrage. In 1850 the constitution of Indiana was revised and under the leadership of Robert Dale Owen the laws for women were liberalized beyond any then existing. In that same year a convention, national in character, exclusively to discuss the rights of women, was held in Worcester, Massachusetts. Nine states were represented by speakers. Letters were read from Emerson, Alcott, Whittier, Gerrit Smith, Joshua R. Giddings, Mrs. Swisshelm, Elizur Wright, Mrs. Stanton and others. The question was always thereafter a leading one in Massachusetts.

In May 1851, Susan B. Anthony met Mrs. Stanton for the first time. It was the commencement of 50 years' continuous friendship and effort under their leadership to obtain equality of rights for women. Their first conventions were held in the interest of temperance but they became convinced almost at once that women must have the vote in order to do effective work. In 1852 a woman's rights convention was held in Syracuse, New York, with delegates from eight states and Canada. From this time more and more such conventions took place in various parts of the country.

The movement for the rights of women had many strong supporters but it had to combat the traditions, customs and prejudices of the age. Life for the vast majority of people ran in narrow grooves. The Bible was accepted literally as placing women in an inferior position. The Church spoke with much authority and for the most part commanded women to remain in the limited sphere supposed to be fixed for them by divine decree. They had been deprived of education and business experience. Women as a whole accepted this position without much protest. The mass of men could see only disadvantage to themselves in granting more rights to women. Those who were connected in any way with matters against which reform movements were directed were bitterly hostile to giving power to women. The political party leaders were adamant against it. A large class of conservative men were opposed to any change; another class wanted to maintain their authority over women; another feared the effect on the home, children, family life; another regarded women as angels, goddesses, queens, to be kept on a cloud, a pedestal or a throne.

Suffrage Movement in United States.—Notwithstanding an opposition which in volume, complexity and emotional content was perhaps never faced by any other reform, the movement for woman suffrage was slowly gaining ground when the outbreak of the Civil War banished all other questions from the public mind. After the war was over and the women again took up their cause they found it complicated by the rights of the emancipated Negroes and were compelled even by those who had been their strongest supporters to yield their claims to those of Negro men. The civil, legal and political results of the 14th and 15th amendments to the National Constitution tended still further to hinder the effort to obtain the franchise for women.

Before the Civil War women had thought of no way to win the vote except by having the word "male" taken out of the constitution of every state by consent of a majority of the voters. The 14th and 15th amendments showed them that there was a speedier and easier way. At first it was thought that women might have the right to vote under the 14th Amendment. In 1871–72 women tried to vote in various parts of the country, Susan B. Anthony among them. She was arrested, tried and fined. Mrs. Virginia L. Minor, of Saint Louis, was refused registration and carried her case to the United States Supreme Court (Minor v. Happersett), where an adverse decision was rendered against her in 1875. This ended hope of an easy solution of the problem and threw women back on the remedy of a specific suffrage amendment.

An Equal Rights Association had been formed right after the Civil War to promote the interests of both Negroes and white women; but in 1869 the latter were forced to recognize the necessity for a separate organization if they were not to be entirely sacrificed. At the close of a meeting of this association in New York City, women who had come from 19 states to attend it met where now the Metropolitan Life building stands, on May 15, 1869, and formed a National Woman Suffrage Association, whose object was to secure a 16th Amendment to the Federal Constitution which would enfranchise women. Mrs. Stanton was made president and Miss Anthony chairman of the executive committee. Lucy Stone, Julia Ward Howe and others objected, however, to the Federal Amendment method and formed another body, known as the American Woman Suffrage Association with Henry Ward Beecher president and Lucy Stone chairman of the executive committee. This body worked principally to obtain the suffrage through amendments to state constitutions. Both societies held national conventions every year thereafter.

In 1890 the two bodies united under the name National American Woman Suffrage Association and both methods of work were followed. Mrs. Stanton was elected president of the new organization; Miss Anthony, vice president at large; Lucy Stone, chairman of the executive committee. In 1892 Miss Anthony was elected president and the Rev. Anna Howard Shaw, vice president at large. Miss Anthony resigned in 1900 at the age of 80, and Mrs. Carrie Chapman Catt was elected in her stead. In 1904 Dr. Shaw was made president. In 1915 she resigned and Mrs. Catt was re-elected and remained president until her death. The association disbanded Jan. 9, 1950.

Until 1895 the work of the National Association was conducted principally from the home of Miss Anthony in Rochester, New York. In 1900 regular headquarters were opened in New York City under the supervision of Mrs. Catt. In 1914 the National Woman Suffrage Publishing Company, Inc., was formed, of which Miss Alice Stone Blackwell was recording secretary for many years.

Representatives of the National Association had hearings before the committees of every Congress from 1869 to 1919. A remarkable galaxy of women was developed in the last half of the 19th century. The first woman physician, Elizabeth Blackwell, was graduated in 1848, and the first woman minister, Antoinette L. Brown (Blackwell), was ordained in 1853. Among many others were Harriet Hosmer, Maria Mitchell, Harriet Beecher Stowe, Mary A. Livermore, Julia Ward Howe, Lucy Stone, Clara Barton, Frances E. Willard, May Wright Sewall, Jane Addams, Mrs. Stanton, Miss Anthony, Dr. Shaw and Mrs. Catt. All of them were suffragists.

The leaders soon became convinced that they could not hope for action by Congress until the experiment of woman suffrage had been made by some of the states. They, therefore, directed their work along both lines. The first territorial legislature of Wyoming had given suffrage to women in 1869 and that of Utah had done so in 1870. Wyoming came into the Union as a state in 1890 with woman suffrage in its constitution. In 1893 the electors of Colorado by a majority vote granted woman suffrage. In 1895 Utah adopted a constitution for statehood containing equal suffrage by a vote of over 10 to 1. In 1896 in Idaho an amendment to the state constitution to enfranchise women received a large majority.

These victories roused the opponents of woman suffrage, of whom there were many, and the combination of corporations, liquor interests and party "machines" which resulted was impossible to overcome. There was nothing for it for a time but the slow process of educating public sentiment to demand that the voice of women should be heard. Altogether 56 campaigns were waged to amend state constitutions. A volume would be required to tell the story of their hardships and disappointments. It is the record of a struggle which has rarely been equalled.

At length came the great political "insurgent" movement in the Western states, and, as a direct result, the winning of a woman suffrage amendment in 1910 in the State of Washington. California adopted a number of reform amendments at the election of 1911, including one for woman suffrage. With this triumph the movement passed its crisis. In 1910 the National American Association presented to Congress a petition of about half a million names for a Federal amendment.

In 1912 the states of Kansas, Oregon and Arizona adopted woman suffrage amendments. In Arizona every county gave a majority with a favorable vote of about two to one. Alaska gave votes to women by unanimous vote as soon as its first legislature met in the spring of 1913.

The enfranchisement of women in Nevada and Montana at the 1914 elections made all of the Western states white on the suffrage map except New Mexico. Victory at the polls was by no means easy, as in no state did the opposition ever put forth stronger effort and in none were the physical hardships of campaigning so great, owing to the high mountains, vast distances and scattered population, the voters having to be reached on far away ranches and in isolated mining camps. The vote nevertheless was a large one.

In 1917 came the great victory in New York. Although the first movement for woman suffrage in the world had begun in this state in 1848 and had never ceased, and although it had been the first state ever to have presented to its legislature a petition to submit an amendment to the voters, this request had been annually refused by every legislature beginning with that of 1854. The women at last became so strongly organized that by 1915 an amendment could no longer be withheld. It was defeated, however, by the voters in November of that year. The women immediately demanded its resubmission, which was granted.

The suffragists then built up the largest state organization of women ever known, approximately half a million in New York City and an equal number in the rest of the state. Although immersed in the vast work of World War I, they made a record campaign, one feature of which was the securing of a petition for the vote by 1,015,000 women in the state over 21 years of age. On Nov. 7, 1917, the amendment received 675,389 affirmative votes, later increased to 703,129 by those of the soldiers, who voted two to one in favor; 600,776 negative votes were cast. It therefore carried by 102,353.

The success in this influential state gave great prestige to the movement. Three more important victories quickly followed in Michigan, South Dakota and Oklahoma. Oklahoma made the unparalleled record of carrying an amendment with

the handicap of a constitutional requirement that it must receive not only a majority of the votes cast on it but a majority of the highest number cast for any candidate at the election. This was one of the most remarkable victories ever achieved for woman suffrage. Each of these campaigns required a vast amount of money and work by the women.

Arkansas in 1917 granted to women the same vote as men at all primaries, including those for presidential electors. In 1918 the Texas legislature gave this same primary franchise to women.

The presidential election of 1916 had aroused nation-wide interest in the question of votes for women, as it was generally accepted that that election had been decided by the equal-suffrage states. The injustice was widely recognized of permitting the women of one section of the country to help choose the president of the United States and denying this privilege to those of other sections. The National Association decided therefore that the time was ripe for pushing its long cherished plan to obtain so-called presidential suffrage for all women everywhere. The federal Constitution empowers every legislature to determine the manner in which the presidential electors of the state shall be chosen and it is the universal custom to have this done by popular vote. In many states when the legislatures assembled in January, 1917, they found themselves confronted by a request from the women that a law should be enacted giving them the right to vote for these presidential electors, which could be done by a simple majority of the legislatures. They had granted this in Illinois in 1913; women had voted at the election of 1916 and their votes had been accepted in the Electoral College without question.

By April, 1917, this presidential vote had been conferred by the legislatures of North Dakota, Nebraska, Indiana, Ohio, Michigan and Rhode Island. The first three added municipal and county suffrage as Illinois had done. The Vermont legislature in March passed a bill giving only municipal suffrage to women. Tennessee included it with presidential suffrage in 1919.

In the winter of 1919 the legislature of Indiana enacted a law for presidential suffrage and it was granted during the winter and spring by the legislatures of Vermont, Wisconsin, Maine, Minnesota, Missouri, Tennessee, Iowa and Ohio.

By Jan. 1, 1919, women of 30 states, two less than two-thirds, possessed the right to vote for 330 of the 531 presidential electors. Sixty senators and 154 representatives were elected partly by the votes of women.

So much had been accomplished by exclusively state action.

The National American Association had performed a great task in obtaining woman suffrage in so many states. But it regarded this as merely preliminary to securing a federal amendment, a means for bringing pressure on Congress. Hearings before committees of Senate and House on a federal amendment had been held ever since 1869. Senator A. A. Sargent, of California, presented in 1878 the amendment which thereafter was introduced into every Congress: "The right of citizens of the United States to vote shall not be denied or abridged by the United States or by any State on account of sex." The appeals and arguments of the women were treated by the committees in a purely academic spirit and it was difficult to get any kind of a report. From 1878 to 1896 there were six favorable majority reports from Senate committees, two from House committees and four adverse. Thereafter none of any kind was made until 1913—after the victories in Kansas, Arizona and Oregon.

But by 1914 the movement for woman suffrage entered upon a new era and began to be regarded seriously by politicians. Only once before then had the amendment been brought to a vote in the Senate—January 25, 1887—and the vote resulted in 16 ayes, all Republicans; 34 noes, 11 Republicans and 23 Democrats, with 26 absent. The second vote was taken March 19, 1914; ayes, 35; noes, 34, lacking 11 of the necessary two-thirds majority.

A federal amendment for woman suffrage was never discussed in the House of Representatives until January 12, 1915. The vote stood 174 ayes, 204 noes.

In 1916 a nation-wide campaign was put on to obtain from the presidential nominating conventions an endorsement of the Federal Suffrage Amendment. Dr. Anna Howard Shaw, honorary president, and Mrs. Carrie Chapman Catt, president of the National Association, were present at the Republican Convention in Chicago and the Democratic Convention in Saint Louis, with many other women leaders. Both conventions failed to endorse the amendment but put a plank in the platforms declaring in favor of woman suffrage by action of the states.

When war was imminent in 1917, Mrs. Catt summoned the Association's Council of One Hundred and pledged to the government the services of the Association with its millions of members. The following April Dr. Shaw was selected by President Wilson and the Council of National Defense as chairman of the Women's Committee to organize and direct the war work of the women of the nation.

Another organization formed in 1913, called first the Congressional Union and later the National Woman's party, also had headquarters in Washington to work for the amendment and used militant methods, "picketed" the White House, and burned President Wilson's speeches.

By September, 1917, both Democrats and Republicans admitted that a federal amendment was inevitable and the opponents realized that all they could hope for was to postpone it as long as possible. After much opposition the measure was put on the House calendar for Jan. 10, 1918. The evening before the vote was to be taken President Wilson urged his party to support it. After a long discussion the vote stood 274 ayes, 136 noes. The amendment had received one more than the two-thirds necessary to carry it.

The contest was now carried into the Senate. The committee unanimously reported it and in a short time promises were secured for the needed two-thirds, lacking only three or four. Then occurred an unprecedented misfortune in the death of 10 senators, seven of them pledged to vote for the amendment. Finally it was decided to take a vote on October 1st. On September 30th President Wilson went in person to the Senate and made an eloquent appeal for the amendment in the name of true democracy. The vote stood 62 to 34, lacking two votes of the necessary two-thirds majority.

Later the amendment was again placed on the calendar and Feb. 10, 1919, was set for another vote. President Wilson cabled from Paris to a number of senators and William Jennings Bryan

came to Washington to intercede for it but all pressure was in vain. The amendment was lost, but by only one vote.

Both political parties would have considered it a calamity not to be able to have a vote on the Federal Woman Suffrage amendment until the regular session in December 1919. President Wilson relieved their anxiety by calling a special session of the newly elected Congress to meet May 19th.

The amendment was introduced in the Senate May 23rd by four members and placed on the calendar for June 3rd. The roll was called on June 4th. With the "pairs" that had been arranged the entire 96 members of the Senate were recorded and they stood; 66 ayes, 30 noes, six more than the two-thirds majority needed.

Before the federal amendment could become effective it had to be ratified by the legislatures of 36 states, three-fourths of the whole number. The large majority of them had adjourned before June 4th but several were still in session and of these Illinois, Wisconsin and Michigan ratified in a few days; Pennsylvania and Massachusetts a little later. Mrs. Catt, president of the National Association, at once began telegraphing to the governors of many states requesting them to call special sessions for the purpose of ratification. This was favored by leaders in both political parties in order that the vote might be completed in time for the women of the entire country to vote in the general elections of 1920. Governors Alfred E. Smith of New York, and Henry J. Allen of Kansas, were the first to call special sessions and they were quickly followed by others. Eight states ratified in regular session, 29 in special session, an unparalleled record.

On Aug. 26, 1920, Secretary of State Bainbridge Colby proclaimed the Suffrage Amendment a part of the federal Constitution. Thus women obtained suffrage in the United States.

In Other Countries.—The suffrage movements in the United States and Great Britain have run in parallel lines since their beginning in each country in the 1830s. The Worcester (Massachusetts) convention of 1850 was reported in the New York *Tribune* and attracted the attention of Mrs. John Stuart Mill who wrote an article about it which appeared in the *Westminster Review* in 1851. That year Mr. Mill began his powerful writing on the subject. When a member of Parliament he proposed it in an amendment to the Reform Bill of 1867 and presented a petition of 1,499 names headed by Harriet Martineau, Florence Nightingale, Frances Power Cobbe, Josephine Butler and Mary Somerville. It was lost by 73 to 196. The women then organized societies in Edinburgh, Bristol, Birmingham, Manchester and London, and later a National Association was formed, including Ireland. As president of the London branch, Mrs. Henry Fawcett began her 52 years of continuous service in this cause. In 1869 Parliament granted the municipal franchise to women taxpayers. Jacob Bright introduced the first separate bill for woman suffrage in 1870 but its progress was blocked by the government. There was a good prospect that women would be included in the Reform Bill of 1884, which enfranchised agricultural laborers, but they were kept out by the efforts of Gladstone.

From 1866 the movement for woman suffrage in Great Britain and Ireland never ceased and it was supported always by the most eminent men and women. Petitions for it were signed by hundreds of thousands. After 1886 there was always a majority in favor of it in the House of Commons but the government, whether Liberal or Conservative, systematically prevented the bills from reaching a final vote. While many minor objections were made, the fundamental reason for the defeats was the fear of each party that it might lose and the other gain by the enfranchisement of women. Through the years there were collateral gains, as in the United States. The laws relating to wives and mothers were improved; local franchises were given to women; a vote and eligibility for school boards; municipal suffrage; a vote for county councils; they were admitted to various official positions; the universities were opened to them. In 1907 they were made eligible as mayors and members of city and county councils.

In the early '90s Mrs. Emmeline Pankhurst and her daughter Christabel organized a revolt in which many women joined. Their society, the Women's Social and Political Union, adopted militant methods, which grew more violent as their treatment by the government became more rigorous, but little progress was made in obtaining woman suffrage from the Parliament. The opponents had an excuse for their opposition which did not exist before. The situation was at its worst when World War I broke out in 1914. The Women's Social Political Union closed its headquarters and disintegrated, Mrs. Pankhurst personally devoting herself to the recruiting of soldiers. The old National Association, of which Mrs. Fawcett had for many years been president, immediately placed its large equipment and well trained forces at the service of the government and carried on for four and a half years what was probably the largest organized work of women during that war. By the autumn of 1916, the long time demand for a reform in the franchise laws could no longer be deferred and a conference of members of Parliament from all parties was appointed to prepare the new measure. There was scarcely a question as to the inclusion of women. Prime Minister Asquith, who had been their most powerful opponent, now sanctioned and promoted it. Lloyd George urged it. The conference reported in February, 1917. The Representation of the People's Bill, as it was called, conferred complete franchise on all women who were on the local government list; on the wives of all men who were on this list and on all women holding a university degree provided they were 30 years old. The bill included Ireland. The reason given for fixing this age limit was that that number of new voters was the greatest addition to the electorate that could be handled at one time. This was very unsatisfactory to the suffragists but they accepted it as all they could get just then.

There were many parliamentary delays and it was not until December that the bill came before the House of Commons for final reading. The suffrage clause was carried by a vote of more than two to one and the bill sent to the House of Lords. Here it also passed by two to one; the final vote was taken Feb. 6, 1918, and it immediately received the signature of King George. A few years later (in 1928) the age limit for the parliamentary vote was removed and women now vote on exactly the same terms as men.

In granting the franchise to women Great Britain followed all her dominions and colonies

except India and South Africa. Full suffrage was granted to white women in South Africa, Cape Colony, East Africa, Natal, the Transvaal and Rhodesia in 1919 and in the Orange River Colony municipal suffrage was granted to women in 1914. In New Zealand, Australia and Canada women had the school and municipal franchise at an early date. The parliament of New Zealand gave complete suffrage in 1893; that of South Australia in 1895; of West Australia in 1900. In 1901 the six Australian states federated and in June, 1902, the National Parliament gave the women of the entire commonwealth the vote and eligibility for that body. The parliament of New South Wales granted state suffrage in 1902; that of Tasmania in 1903; that of Queensland in 1905 and that of Victoria in 1908.

There had long been a movement in Canada for the full enfranchisement of women, led at first by the National Suffrage Association and later also by the National Council of Women. The patriotism and efficiency of women during World War I increased public sentiment in its favor and accelerated the action of the state governments. Full suffrage was granted by the legislatures of Manitoba, Alberta, Saskatchewan, and by popular vote in British Columbia, in 1916; by the legislatures of Ontario in 1917; by Nova Scotia and New Brunswick in 1918; by the council of the Yukon in 1919. Quebec, however, did not give provincial suffrage until after World War II. In 1918 the Dominion Parliament conferred national suffrage on all women.

At the beginning of the present century, there was very little suffrage for women anywhere in the world outside of the United States and Great Britain and her dominions and colonies. In various parts of Europe women property holders could vote by male proxy at local elections and in a few countries at parliamentary elections. In Russia, among the peasant classes, women voted almost as freely as men at village elections, either as owners of property or as proxy for their husbands. Sweden in 1862 gave women ratepayers a vote for all officials except members of Parliament—more than women possessed anywhere else in the world at that time. Widows and spinsters in Finland had local voting rights as early as 1865. Iceland gave women taxpayers the municipal vote in 1882. The ancient little kingdom of the Isle of Man, with its independent government and its laws requiring only the sanction of the ruler of Great Britain, gave full suffrage to women property owners in 1880 and to women ratepayers in 1892.

In 1906 the newly formed government of Finland granted equal and universal woman suffrage. In 1901 Norway gave the municipal and in 1907 the full suffrage to women with a very small taxpaying qualification, which in 1913 was entirely removed. In 1913 Iceland gave full suffrage. Denmark granted the municipal franchise in 1907 and adopted a new constitution with universal and equal suffrage in 1915.

The International Woman Suffrage Alliance was formed in 1904 under the leadership of Mrs. Catt. The International Council of Women organized in 1888 made woman suffrage a part of its work in that same year. These two great associations, with millions of members, through their congresses and propaganda, spread the doctrine of suffrage among the women of all nations. A movement for enfranchisement of women was making progress in many of them at the time World War I began in 1914. It was supposed at first that this would delay it for years but it had just the contrary effect, largely because of the loyalty, work and sacrifices of women during the long contest. This has been referred to in the case of Great Britain, Canada and the United States. Universal suffrage was the first result of the Russian Revolution of 1917.

Developments Since World War I.—As the determination to secure self-government spread among the central countries of Europe following World War I—Hungary, Austria, Bulgaria, Rumania and Germany—women were included in the electorate by common consent, and this was true of the smaller nations on gaining independence. The Constitution of Germany, which went into effect in August, 1919, gave universal suffrage to women. The fear of an uprising in Sweden caused the conservative upper house of its Parliament, which long had blocked the way to woman suffrage, to yield to the inevitable and it was granted in full in 1919. The Parliament of the Netherlands, fearing a revolution, hastened to enfranchise women as a conservative and stable element in 1919. The Belgian Parliament, gathered together after the country was restored to its people, gave municipal and communal suffrage to women in 1919.

This impulse to enfranchise women, which was undoubtedly stimulated by the war and women's patriotic efforts in behalf of their countries everywhere, soon died down, however, and the remarkable gains of the early postwar years were not repeated in the years between World Wars I and II. The struggle continued, however, and the international and national women's organizations were indefatigable in their efforts.

When the formation of the League of Nations was under way in Paris, a representative delegation of women appealed for the recognition of women and it was considered a great feminist victory when an article was inserted in its Charter stating that all posts and positions in the League should be open to women. Their representation consisted, however, of very few delegates. A number of women held positions in the Secretariat, but none of them filled places of high responsibility.

The women's agitation finally resulted, however, in the setting up, in 1937, of a special Committee of Experts appointed by the League to study the status of women throughout the world. This Committee included representatives of seven countries, France, Great Britain, Sweden, Belgium, Hungary, Yugoslavia, and the United States. Of this Committee four were women (three lawyers and a member of Parliament) and three were men. It undertook a vast task of research in the fields of Common, Civil, Hindu and Moslem Law. The advent of World War II unfortunately brought a stop to its activities in 1940.

In the meantime the struggle for the vote in Europe continued. The republics of France and Switzerland remained the only countries of importance in Europe (outside of Portugal) where woman suffrage did not exist in any form. The reason in the case of Switzerland was because suffrage had to be granted by a majority of the individual men in each canton and it was defeated wherever submitted by Parliament. In France a bill passed the House of Deputies several times by a large majority, only to be defeated each time by the Senate. In Italy municipal suffrage was granted to a limited extent to women in

1925. Newfoundland adopted a bill in the same year giving equal suffrage and eligibility to office.

Some small progress was also made in the Latin American Republics of the Western Hemisphere, thanks to the activities of the Inter-American Commission of Women, a body composed of one governmental representative from every country in the Western Hemisphere (except Canada). Uruguay gave women the vote in 1934, El Salvador in 1939, Cuba in 1940, and the matter was discussed in many other countries.

With the advent of World War II there came a great change in public sentiment. World War II was total war. In this war civilians and noncombatants were on the firing line as well as soldiers. After the occupation of large sections of Europe and the removal of all available manpower to Germany, the occupied countries were largely turned over to their women-folk. They had to do their own work and men's work as well. That they did it magnificently is matter of common knowledge. At the war's end it was natural enough, therefore, that their heroism and valor should be rewarded by taking them into political partnership. And that was precisely what happened, in Europe, and gradually in other parts of the world as well.

In France General De Gaulle announced that women would vote in the first elections; and they did, and men and women together voted votes-for-women into the new French Constitution. In Italy women were granted full franchise and quickly took advantage of it. Portugal gave limited voting rights to women in 1945. Belgium enfranchised its women in 1950.

In the South American countries the same wave of appreciation of women's civic value spread. Following El Salvador's and Cuba's lead in 1939 and 1940 came the Dominican Republic in 1942, Guatemala in 1945, Brazil, Ecuador and Panama in 1946, Argentina and Venezuela in 1947, Chile in 1949.

The same ferment was also operating in the Far East. China and Japan both enfranchised their women in 1946, India, Burma, and the Philippines in 1947 and Korea in 1948.

Women (in 1950) had equal suffrage and eligibility to governmental office in Albania, Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Burma, Byelorussia, Canada, Channel Islands, Chile, China, Cuba, Czechoslovakia, Denmark, Dominican Republic, Ecuador, El Salvador; also in Finland, France, the French Union, Germany, Great Britain, Guatemala, Iceland, India, the Irish Free State, Isle of Man, Italy, Japan, Korea, Luxembourg, Mongolia, Netherlands, New Zealand, Norway, Israel; likewise in Pakistan, Panama, Philippines, Poland, Rumania, Russia, Thailand, Spain, Sweden, Turkey, Ukraine, Uruguay, Venezuela, the United States and Yugoslavia. In all these countries they are elected to the parliament, or other national assembly, and to other offices. In the following countries they have partial suffrage, with eligibility to office: Greece (limited), Hungary (municipal suffrage and eligibility), Mexico (local), Portugal (limited), South Africa (limited to whites), Syria (limited, no eligibility), Trinidad, Windward and other islands (unequal suffrage, no eligibility).

In the following countries women (in 1950) were still denied the right to vote: Afghanistan, Bolivia, Colombia, Costa Rica, Egypt, Ethiopia, Haiti, Honduras, Iran, Iraq, Lebanon, Liberia, Nicaragua, Peru, Saudi Arabia, Switzerland, Transjordan and Yemen.

A further aid to this climax to the woman suffrage movement is the work of the Commission on the Status of Women of the United Nations. Set up under the provisions of the Charter of the United Nations in implementation of its declarations in support of equal rights and "fundamental freedoms for all, without distinction as to race, sex, language or religion," the Commission consists of fifteen members representing as many different countries (namely, Australia, China, India, Syria, Turkey, Greece, Russia, France, Denmark, the United Kingdom, Haiti, Costa Rica, Mexico, Venezuela and the United States). It has adopted a broad program of work for woman's rights, including extension of full suffrage rights to women in all parts of the world where they do not now have such rights, together with full eligibility to public office on the same terms as men. It is also seeking to increase women's participation in public office and public life generally by a campaign of education to develop a greater sense of civic responsibility on the part of women and a greater awareness on the part of men of the importance of women's contribution in these fields. It is anticipated that the few remaining non-suffrage countries will soon enfranchise women, thereby establishing one of the essential bases for genuine political democracy throughout the world.

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See also in files of Commission on Status of Women of United Nations answers to questionnaires addressed to governments members of United Nations.

Consult also *The Woman Citizen* (New York), organ of the National American Woman Suffrage Association of the United States; *Jus Suffragii* now the *International Woman Suffrage News* (London), the International Woman Suffrage Alliance organ; *The Common Cause* (London), organ of the British National Union of Societies for Equal Citizenship.

Dorothy Kenyon,
United States Delegate to the Commission on the Status of Women, United Nations.

WOMAN'S CHRISTIAN TEMPERANCE UNION, a reform organization founded at Cleveland, Ohio, in 1874; it was the outcome of a woman's crusade against the liquor traffic in the Middle States from 1870 to 1873. The "W. C. T. U.," as the organization is popularly called, had regular associations in every State and Territory, with a total membership of about 600,000. An international association was founded in 1883 largely through the efforts of Frances E. Willard and now has auxiliaries in 51 countries and provinces. The headquarters of the American association are at Evanston, Ill. The white ribbon is the general badge of the organization.

WOMAN'S MEDICAL COLLEGE OF PENNSYLVANIA, the first college in the

world regularly organized for the medical education of women, was incorporated March 11, 1850, and began its first session Oct. 12, 1850.

The students of the college were for many years shut out from the clinical advantages offered to men students by various hospitals in the city, until in 1869, the Pennsylvania Hospital, by throwing open its clinical lectures to them, set an example which was soon followed by other institutions. In 1888 an out-practice maternity service was established under college control to afford practical experience in obstetrics, and in 1907 the corner-stone of a permanent general hospital was laid.

In 1925, commemorating the 75th anniversary, the corporation initiated a movement to obtain an expansion fund for new buildings and endowment, and in September 1930 the institution, with both medical school and hospital division, occupied its new and modern building at East Falls, Philadelphia.

The plan of instruction at the college has advanced along the recognized lines of progress in medical education.

The Woman's Medical College of Pennsylvania has drawn its students from nearly every State in the Union and from many foreign countries. It is now the only medical school in the United States exclusively for women. Its aim has always been to provide a medical education which will qualify its students particularly well for the fields of activity in which the majority of women physicians are found to engage, and it believes from the record of its alumnae that this aim is still being fulfilled.

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WOMAN'S RELIEF CORPS, an organization created in 1883 by the mothers, wives, daughters and sisters of Union soldiers of the Civil War of 1861–1865, for the purpose of aiding and assisting the Grand Army of the Republic, and to "perpetuate the memory of their heroic dead," to "extend needful aid to the widows and orphans," to "find them homes and employment and assure them of sympathy and friends," to "cherish and emulate the deeds of our army nurses."

WOMB, The. In anatomy and physiology, the womb or uterus is one of the generative organs of the female. In its cavity the impregnated ovum is received, retained and supported during the development of the foetus, and from this cavity the child is expelled at the time of parturition. In the virgin, the womb is pear-shaped, flattened from before backward, and is about three inches in length. It is divided into body and neck. The fundus or upper extremity of the body is broad and convex, and is directed forward. From this portion the body gradually narrows to the neck, the lower rounded and constricted portion of the womb, which is directed downward and backward in the line of the axis of the inlet of the pelvis and around its circumference is attached to the upper end of the vagina. See EMBRYOLOGY, HUMAN.

WOMBAT, a burrowing marsupial of the phalanger family and genus *Phascolomys,* natives of Australia and Tasmania. The species most commonly known (*P. wombat*) is two to three feet long, with a very short tail, clumsy form, stout limbs, blunt muzzle and rough hair of variable tint. In their general form and actions the wombats resemble small bears, having a similar shuffling plantigrade walk; but they are even shorter in the legs and broader in the back than those animals. The dentition resembles that of rodents. They live on the ground and in burrows or holes among rocks, feeding on roots, grass and other vegetable substances. They sleep in the day, seeking their food at night, and are usually gentle in their habits, though their large chisel-like incisors enable them to bite strongly if provoked. Wombats exhibit small intelligence, but are gentle, and capable of domestication to a limited extent. They are hunted for their flesh, which is highly esteemed, and is said to resemble pork. Several species exist, besides the one above mentioned. *P. ursinus* is brownish gray, like the third species, the hairy-nosed wombat (*P. latifrons*), which differs from the other two in having smooth silky fur, a hairy muzzle, and large pointed ears. It inhabits southern Australia. The largest living wombat (*P. platyrhinus*) is about three feet long, but remains of a large extinct genus (*Phascolonus*), which must have been nearly as large as a tapir, have been found in Queensland. Consult authorities mentioned under MARSUPIALS.

WOMBWELL, wo͝om'wĕl, England, a town in the West Riding of Yorkshire, about five miles southeast of Barnsley, with extensive coal mines in the neighborhood. Pop. 19,035.

WOMEN, Education of. See EDUCATION OF WOMEN.

WOMEN, Legal Rights of. During the earliest times of which we have records, the legal rights of women were narrowly circumscribed. By the Mosaic law the rights of the wife were quite subordinate to those of the husband, and daughters could inherit only where there were no sons. Under early Roman law (3d century B.C. and later), the husband could condemn his wife to death for adultery and without public trial. Owing to abuses the law later took away the power of the husband to condemn his wife to death, but provided that the father might put to death a daughter taken in adultery, with the important proviso that her paramour be killed at the same time. Usually a daughter could be forced into marriage by the father, while he had no such power over a son. However, with the rise of Christianity the rigor of the law in relation to women was greatly abated, and in certain particulars they were shown more leniency than men. For instance, ignorance of the law if the offense did not involve good morals was accepted as a valid defense for women because of the weakness of the sex. Further, a wife could not be convicted in a criminal action for theft from her husband—a provision which persists in a slightly modified form in the law of the United States and other countries to the present day. The power of initiative in divorce—previously held by the husband only—became the privilege also of the wife and she was empowered to send her husband a divorce whenever the circumstances warranted such action. Women, whether married, unmarried, or widowed, could legally dispose of prop-

erty by will the same as men, and daughters were allowed to inherit equally with sons. In ancient Greece, the legal rights of women were subordinate to the men as in the early Roman law. The Germanic and other laws of this period were in many particulars equally severe. From an early date in England unmarried women could legally make a contract or a will, could sue or be sued, and needed no guardian as in Roman law. Formerly, in England, criminal laws against women were very severe and rigorously enforced, death being the penalty for bigamy and manslaughter and even for larceny. Women were first admitted to practice law in England by the Sex Disqualification (Removal) Act of 1919. This privilege was later extended to women in Scotland. The Matrimonial Causes Act of 1923 abolished discrimination against married women in England by placing both spouses in the same position with regard to dissolution of marriage on the ground of adultery. Mild chastisement of a wife by a husband, once sanctioned by law, is now prohibited. In 1885 by the Criminal Law Amendment Act, the age of consent of females in England was raised to 16. Right of primogeniture, now almost totally superseded elsewhere, still persists in parts of the United Kingdom and works hardship to female heirs. It was not abolished in England and Wales until Jan. 1, 1926. The law of Scotland is in most respects similar to that of England, but testamentary capacity is given to females by Scots law at a much earlier age than by English law. In many of the Eastern countries even today the law has made very few advances from olden times, and women lack legal equality with men. In Turkey, however, the civil code, adopted in 1926, radically reforms the marriage law and property rights of women.

In the early history of the United States women suffered from the rigor of the law. As late as toward the close of the 17th century women were refused any rights to an education, were punished for speaking in public, and occasionally old women were hanged as witches. It was not until a century later that women were given the right to a few months' education a year in primary schools, and not until 1819 did the government give any systematic financial aid toward the education of women. Statutory modifications of the severities of the common law with regard to married women began in the United States in 1848, New York taking the initiative. The other States followed rapidly, and within a comparatively short time most of the legal disabilities of married women were swept away. (See CURTESY; DOWER; HUSBAND AND WIFE.) Under the Constitution of the United States or by the common law women had no legal right to practise law. By statute, however, they may now do so in the Supreme Court of the United States, and also in the highest courts of all the States. It has been held in a number of State courts, in the absence of statutory or constitutional provisions to the contrary, that women may practise law in the entire absence of statutes authorizing it. Other decisions, however, hold to the contrary. By statute some States provide that no persons shall be precluded from practising any profession or employment (except military) by reason of sex; others by legislation or by constitutional restriction provide that women shall not be permitted to work in certain industries, as coal mining, a regulation manifestly for their own protection. By statute in a number of States, a married woman may act as a guardian, administratrix, or executrix. A large majority of the States regulate by law the hours which women are permitted to labor in most industries, usually 8 to 10 hours a way, with various restrictions on night work. Minimum wage laws for women have been passed in a number of States, and these have been held constitutional by the Supreme Court. (See LABOR LEGISLATION.) During the early history of the United States the age of consent of females was nearly everywhere deplorably low, but legislation has raised this age so that in many States it is at present 18 years, with a general average of about 16. In the case of wills of personal property, testamentary capacity in the various States is often fixed at a lower age for females than for males. For example, in New York State the age for females is 16 years while it is 18 for males. (See TESTAMENT.) In 1911 the first mothers' pension law was passed (Missouri) and up to Oct. 3, 1926, Forty-one of the remaining States had adopted this form of remedial legislation. (See PENSIONS.) In a number of States today statutes expressly exempt women from arrest in all civil actions. The rigor of the early criminal law in the United States in its treatment of women has almost entirely disappeared. The tendency is decidedly toward leniency. With the recent extension of the franchise to women, the favorable indications for even wider extension soon, and the corresponding increase in their political power, together with the growing number of women legislators, it is safe to predict that women will add considerably in the near future to the legal advantages they have already secured. See WOMAN SUFFRAGE.

EDWARD F. DONOVAN.

WOMEN, Medical Education of. See MEDICAL EDUCATION IN THE UNITED STATES.

WOMEN IN INDUSTRY. The work of women is one of the oldest things in the world. Although the kinds of work they have done and the conditions under which they have worked have changed radically over the centuries, the basic reasons why women work have remained the same. Women work to provide subsistence for themselves and for those dependent on them. In the 18th century, women worked for the most part in their own homes, where they carried on the tasks involved in sheltering, feeding, and clothing their families. The invention of machines, the growth of large industrial, commercial, transportation, and educational systems, the development of frontier lands, and the duration of the Civil War and World Wars I and II—all these brought about drastic changes in the labor conditions of working women in the United States. Once holding a monopoly of certain occupations then considered rightfully theirs, they saw men take over much of the work they used to perform and themselves entered many occupations once considered the distinct province of men. Instead of performing highly skilled work in their own homes, as women did formerly, over 19 million women were in the labor force in the United States in 1951. This number, not far from one third of the adult woman population in the country, did not include the many seasonal summer workers. Most of the women workers were employed in routine clerical occupations or in factory or service jobs, often

Table 1—WOMEN IN THE LABOR FORCE OR GAINFULLY OCCUPIED, 1910–1940, BY SOCIAL-ECONOMIC GROUP[1]

Census social-economic group	1910	1920	1930	1940[2]	Per cent distribution, 1940	Women as per cent of all workers, 1940	Per cent change, 1910–1940
Clerks and kindred workers	1,081,181,	2,191,422	3,071,507	3,655,274	29	41	+ 238
Semiskilled workers	2,175,257	2,260,256	2,528,298	3,582,205	29	33	+ 65
Service classes	1,940,603	1,569,680	2,307,817	2,689,986	21	64	+ 39
Professional persons	718,548	988,255	1,447,775	1,535,452	12	45	+ 114
Proprietors, managers, and officials (except farm)	123,006	157,380	242,995	378,075	3	10	+ 207
Farm laborers	1,274,865	695,712	580,465	345,761	3	9	— 73
Farmers (owners and tenants)	273,140	265,577	262,645	153,763	1	3	— 44
Laborers (except farm)	105,493	199,871	156,401	129,750	1	2	+ 23
Skilled workers and foremen	96,733	101,554	81,145	103,812	1	2	+ 7
Total	7,788,826	8,429,707	10,679,048	12,574,078	100	24	+ 61

[1] Women 14 years of age or over (except new workers) in labor force in 1940, and gainfully occupied in 1910–1930; based on data from U.S. Bureau of the Census, condensed from U.S. Women's Bureau Bulletin No. 218, *Women's Occupations Through Seven Decades,* Appendix Table 1 and Text Table 5.

[2] Complete figures for employed workers; experienced workers seeking work and those on public emergency work distributed according to occupational distribution shown in a 5 per cent sample of these groups; new workers, never formerly employed, omitted.

those of the less skilled and more monotonous types.

Occupational Distribution and Progress.—As shown in Table 1, the occupational distribution of women workers has altered widely. In general, a great shift occurred from manual labor and the older hand skills to the so-called white-collar jobs—a development which led to greater demands for technical and professional training. A later development saw considerable declines in agriculture and great increases in manufacturing. After World War II, the number of women clerical workers and factory operatives was far above that of prewar years (see Table 2).

Manufacturing and Mechanical Industries.—As the use of machines increased, the modern factory system developed and absorbed much of the work formerly done in the home, such as the manufacture of textiles and clothing and the processing of food. As the family need for such home occupations declined, the need to purchase goods increased, and the factory offered women the means of supporting themselves and of continuing their contribution to the family income.

Factory production employed more than 4.2 million women in 1951. While the largest groups were employed in two of women's traditional industries (textiles and clothing), there were few manufacturing industries in which no women worked. They had even made spectacular advances in plants producing electrical and other machinery, iron and steel and other metal products, chemicals, and automobiles During World War II, many such plants made changes in machines or in operations to fit jobs for women's performance—for example, by installing cranes, hoists, or other lifting devices, easily sliding conveyors, lighter jigs or other fixtures, or bench vises to hold parts during operation; by adjusting machines, chairs, or control buttons to women's height and reach; or by adding such further safety devices to the machines as new guards or automatic stops.

Mercantile and Clerical Pursuits.—With mass production of goods, mass distribution is necessary. Goods must be sold to wholesalers, retailers, and consumers, and their transportation is a complicated business. Thus the need for sales people and clerical workers grew. In 1951, about 4.9 million women were clerical workers, and almost 1.3 million were in sales occupations. Clerical work was becoming increasingly mechanized, especially in large establishments.

Professional Service and Management.—Over the years, women have made substantial advances in the professions. Teachers and nurses, always the principal groups, constituted three fourths of the professional women in 1940, but in several professions less important numerically the numbers of women had increased markedly since 1900.

Table 2—EMPLOYED WOMEN BEFORE, DURING, AND AFTER WORLD WAR II, BY MAJOR OCCUPATION GROUP (APRIL OF EACH YEAR)[1]

(in thousands)

Occupation group	1940[2]	1945	1947	1951
Clerical workers	2,530	4,900	4,130	4,931
Operatives and kindred workers	2,190	4,610	3,420	3,737
Service workers (except private household)	1,350	1,980	1,770	2,143
Private household workers	2,100	1,670	1,690	1,872
Professional and technical workers	1,570	1,510	1,540	1,784
Sales workers	830	1,440	1,320	1,264
Farmers, farm managers, foremen, and laborers	690	1,930	910	813
Proprietors, managers, and officials (except farm)	450	800	780	1,039
Craftsmen, foremen, and kindred workers	110	300	160	211
Laborers (except farm)	100	170	80	97
Total	11,920	19,310	15,800	17,890

[1] Based on census data adjusted by the U.S. Bureau of Labor Statistics: *Monthly Labor Review,* 65:2. Estimates of employment by occupation for April 1940 and April 1945 were adjusted to be consistent with revised census totals of agricultural and nonagricultural employment. Estimates since 1940 are subject to sampling variation, which may be large where numbers are relatively small.

[2] Approximately 400,000 employed workers whose occupations are not reported were apportioned according to the distribution of those whose occupations were reported.

Table 3—OCCUPATIONS WITH 100,000 OR MORE EMPLOYED WOMEN 14 YEARS OF AGE AND OVER, 1940 [1]

Rank	Occupation	Number of women employed	Per cent of total employed persons
1	Servants, private-family	1,420,469	91.3
2	Stenographers, typists, and secretaries	988,081	93.5
3	Teachers (not classified elsewhere)	772,044	75.7
4	Clerical and kindred workers (not classified elsewhere)	630,471	35.7
5	Salesmen and saleswomen (not classified elsewhere)	515,539	40.8
6	Bookkeepers, accountants, and cashiers	446,205	52.1
7	Operatives, apparel and accessories	425,534	77.5
8	Housekeepers, private-family	362,431	99.2
9	Waiters and waitresses, except private-family	356,036	67.6
10	Trained nurses and student nurses	348,277	97.9
11	Farm laborers (unpaid family workers)	223,279	19.2
12	Barbers, beauticians, and manicurists	206,592	49.7
13	Clerks in stores	201,281	42.5
14	Telephone operators	189,002	94.6
15	Launderers and laundresses, private-family	186,183	98.2
16	Servants, except private-family	174,724	55.3
17	Laundry operatives and laundresses, except private-family	167,967	77.7
18	Operatives, cotton manufactures	167,155	47.0
19	Farmers (owners and tenants)	151,087	3.0
20	Dressmakers and seamstresses (not in factory)	133,627	98.3
21	Cooks, except private-family	116,310	42.0
22	Operatives, knit goods	115,106	66.9
23	Boardinghouse and lodginghouse keepers	100,355	90.5

[1] Source: U.S. Department of Commerce, Bureau of the Census, *Sixteenth Census of the United States: 1940; Population:* Vol. 3, *The Labor Force,* Part 1, *United States Summary,* Table 58.

Such professions included those of social and welfare workers; librarians; editors and reporters; and lawyers, judges, and justices. By 1951, there were 1.8 million women in the professions.

The closely allied group of nonfarm proprietors, managers, and officials, though employing only 5 per cent of all women workers, had more than doubled from 1910 to 1940 and saw a further notable increase by 1951

Service Industries.—These fields of work employed more than 4 million women in 1951. Although almost half of these women were in household employment, notable gains had been made in other service industries.

A major development has been the growth of new service industries; in 1940, for example, beauty shops employed 206,592 women. Because people move about more freely than they did formerly, the hotel and restaurant industries have grown; in 1940, they employed 356,036 waitresses. As fewer housewives came to employ home laundresses, the number of such workers declined greatly and in 1940 was not very far above the number of laundry operatives and laundresses not in family employ (see Table 3).

Economic Features of Women's Work.—Among the economic features connected with one aspect or another of women's work, wage levels, responsibility for support, and union organization are especially significant.

Wage Levels.—When the woman worker as an individual was a newcomer to industrial work, she had no measure either of the market value of her labor or of the adequacy of a given wage to meet her needs, and she did not realize that her acceptance of a low-paid job might operate to undercut wage levels in general. She, as well as her employer, placed a low money value on her services, partly because she had performed work at home without pay. Moreover, her choice of occupation was relatively restricted. She thus accepted jobs at almost any wage rather than be unemployed.

Once women had begun working at low wage levels, many factors operated to keep their wages low. The range of their occupations remained narrow, and often their opportunities to become fitted for the more advanced industrial skills were limited. Even when they did work comparable with that of men, women were paid less than men and often were not promoted to the better jobs. Furthermore, industries employing large proportions of women (such as textiles, clothing, and shoes) have been among those most conspicuous in migrating from sections of the United States where workers are organized and relatively well paid, and where progressive labor legislation protects their working standards, to sections where labor is cheap and abundant and where employers are legally required to adhere to comparatively few safeguards for their workers.

An added factor that was formerly of considerable significance in keeping wages low, in particular areas and in certain industries affecting chiefly women, was industrial homework This is the distribution by factories of materials to be processed at home according to factory specifications.

Considerable progress has been made toward assuring the woman worker more adequate wages, better working hours, and improved conditions of work, both by the establishment of standards through federal and state legislation and by means of union activity.

Personal Status and Responsibility for Support.—The proportion of women 14 years of age and over in the labor force of the United States increased from 20.4 per cent in 1900 to 32.7 per cent in 1951. The extent to which women have gone to work increased most notably in the age group 20 to 44 before World War II. After the war substantial increases occurred among those from 45 to 64, of whom 14.1 per cent were in the labor force in 1900, 21.6 per cent in 1940, and 33.8 per cent in 1951. Continuation of these trends points to the need for placement facilities that will enable the mature woman to use her skills advantageously, and for aids and services for the employed homemaker so that she can carry her double job effectively. A notable increase has occurred in the extent to which married women are employed. In 1900, less than 6 per cent of the married women were in the labor force; in 1940, about 17 per cent. As a result of further increases during World War II, married women outnumbered single women in the labor force for the

first time in the history of the United States. This situation continued after the war, and, in 1951, 27 per cent of the married women in the population were in the labor force.

Society accepts quite generally the fact that the single woman worker ordinarily supports herself, and many studies indicate that she contributes largely to the support of others, such as aged parents or young sisters or brothers. Many of the increasing numbers of married women workers also must help to meet the high costs of sheltering, feeding, and clothing the family. Sample studies indicate that an appreciable proportion of the women workers in the United States who live in family groups are the only wage earners contributing to household expenses.

Union Organization among Women Wage Earners.—Although there were instances of vigorous union activity among women workers as early as the 1820's, their organization proceeded slowly. This may be explained in part by the concentration of women workers in occupations not highly organized even among men—domestic and personal services, clerical occupations, professional services, and trade. Moreover, in industry women were largely engaged in semiskilled occupations which were difficult to organize on the traditional craft union basis. In the 1930's and 1940's, women shared in the increase in union membership that was stimulated by the extensive organization of mass production industries and by the establishment of the National Labor Relations Board. The increase in the employment of women during World War II also added many of them to union rolls, but the full number cannot be determined, since many unions do not record their membership by sex.

Labor Legislation Safeguarding the Employment of Women.—Nearly all the states have on their statute books special labor laws designed to secure for women workers such important employment safeguards as minimum wages, reasonable working hours, and good working conditions. Labor laws for women have developed gradually since the middle of the 19th century and have been constantly extended and strengthened. Support for such legislation has come from many sources, including civic and church groups, women's organizations, labor unions, and social-minded individuals. These groups, aware of the concentration of women in the low-wage industries and of their relatively weak bargaining power, have looked to legislation to improve the economic position of women and to safeguard their health.

The impetus toward such legislation was greatly aided by the fact that many progressive employers, by operating their plants on reasonable hour schedules, by paying fair wages, and by maintaining high standards of safety and sanitation, proved that, with proper management, good employment standards are an advantage rather than a handicap to industry.

Hours of Work.—The first hour law, enacted by New Hampshire in 1847, was a 10-hour statute applying to both sexes. It did not set a maximum workday, but merely established a standard for a day's work and permitted workers to contract for longer hours. The first hour law applying to women as a special group was enacted in Ohio in 1852; it set a 10-hour standard. The first enforceable hour law for women was a 10-hour statute enacted in Massachusetts in 1874 and amended in 1879.

Once it had started, the movement for hour regulation gained momentum, and by 1951 only five states—Alabama, Florida, Indiana, Iowa, and West Virginia—had placed no limits on the hours that women might work. At the same time, the maximum working hours established in state laws were gradually reduced to more reasonable limits. By 1951, 24 states and the District of Columbia had set 8 hours a day or 48 hours a week or less, or both criteria, as the maximum length of time a woman might be employed in one or more industries; 9 states had set a maximum 9-hour day. In 9 states the maximum workday for women was as long as 10 hours in one or more industries. One state set a weekly but not a daily maximum. A total of 22 states and the District of Columbia required a day of rest each week for women in one or more industries.

The number of industries or occupations covered by such laws in 1951 varied greatly. Some laws were so limited as to affect only small groups of wage-earning women; others were wide in scope, bringing thousands of women under their protection. Women workers in manufacturing and mechanical industries, in some of the service industries, and in mercantile establishments were the groups most commonly covered. Women in agriculture and in private household employment were rarely included.

In 1951, 17 states, the District of Columbia, and Puerto Rico placed some limitation on the employment of women at night. Included in this group were 13 states that prohibited night work by women in one or more industries. The hours from 10 or 11 P.M. to 6 A.M. were those during which night work was most commonly prohibited.

Other Working Conditions.—In some states a few occupations have been prohibited for women because of considerations of health and welfare. The occupation most commonly prohibited is mining. The earliest such law was enacted in Illinois in 1879, and by 1951 almost all mining states prohibited such employment for women.

In 1951, 7 states regulated the weight that a woman might lift or carry regardless of type or place of employment, while 2 states regulated weights in core rooms only. In 6 states employment of women for various periods before and after childbirth was prohibited. Laws requiring seating accommodations for women workers were in effect in 46 states, the District of Columbia, and Puerto Rico.

Homework legislation dates from 1884, when New York sought to abolish the tenement workshop system by prohibiting the manufacture of cigars and other tobacco products in tenement houses in large cities. This law was declared unconstitutional. Control of homework was then attempted through regulation of sanitary conditions and through imposition of minor restrictions by means of a licensing system. In the 1930's, several states provided for outright prohibition of homework on certain commodities. By 1951, 21 states and Puerto Rico had homework laws, and 9 of these states prohibited such work entirely in one or more industries. The other 12 states in this group and the District of Columbia regulated homework in order to protect public health and safeguard the welfare of the worker.

Minimum Wage.—The purpose of the minimum wage movement in the United States has been to secure by law a wage for women workers that is at least adequate to maintain health. A federal investigation made early in the 20th cen-

tury showed that thousands of women and minors were earning grossly inadequate wages. The first state minimum wage law was enacted by Massachusetts in 1912, and 8 states passed similar laws in 1913. By the end of World War I, minimum wage laws were in effect in 12 states and the District of Columbia.

In 1923, the progress of minimum wage legislation suffered a severe setback when the United States Supreme Court declared the District of Columbia law unconstitutional in its application to adult women. As a result of this decision, the laws of 5 states and Puerto Rico were rendered inoperative either by court decision or by a ruling of the state attorney general

The depression of the 1930's renewed interest in minimum wage legislation. To reduce production costs, employers had cut wages to the lowest possible level—often far below a level adequate to maintain health—and low-paid homework and sweatshop work had increased. To alleviate this situation, 7 states enacted minimum wage laws in 1933, and 1 in 1936. In 1937, the Supreme Court declared the State of Washington's minimum wage law constitutional and reversed the 1923 decision on the District of Columbia law. States whose laws had been rendered inoperative as a result of the 1923 case were advised by their attorneys general to resume enforcement after the 1937 decision. A number of other states enacted new laws; one such state, Connecticut, amended its law in 1939 to cover men as well as women and minors.

By the beginning of World War II, 26 states, the District of Columbia, Alaska, Hawaii, and Puerto Rico had minimum wage laws on their statute books. During the war period, when all efforts were concentrated on winning the war, progress in state minimum wage legislation was limited mainly to the extension of coverage of laws already in effect. New York and Rhode Island amended their laws in 1944 and 1945, respectively, to extend coverage to men.

After the war ended, the minimum wage movement resumed its peacetime importance. Massachusetts in 1946, and New Hampshire in 1949, amended their laws to include men. In 1949, the laws of both states were amended to set a statutory rate applicable to men as well as to women and minors; wage board provisions in the laws remained in effect. In the immediate postwar period, many states began to revise their wage orders in order to adjust wage rates to the increased cost of living. In 1950 alone, 16 wage orders were revised and became effective in 7 states and Puerto Rico. The provisions of state minimum wage laws in effect as of 1951 were chiefly of benefit to workers in intrastate trade and service industries, since most such workers were not covered by the minimum rate of 75 cents per hour established by the federal Fair Labor Standards Act, as amended in 1949.

Equal Pay.—One important type of labor legislation for women received its greatest impetus during World War II. Equal pay laws, which before the war had been in effect only in Montana and Michigan, were proposed in other states as women in great numbers took jobs in war industries and performed work customarily done by men. During the war period, Washington, Illinois, New York, and Massachusetts enacted such laws. Rhode Island followed in 1946; Pennsylvania and New Hampshire in 1947; and California, Connecticut, Maine, and Alaska in 1949.

By the end of 1949, equal pay laws covering one or more types of private employment were in effect in 12 states and Alaska. In Illinois and Michigan, such laws applied only to manufacturing industries; those in the other 10 states had broader coverage. The Montana law covered teachers and other persons in public employment as well as those in private employment. In addition, special equal pay laws for teachers were in effect in one fourth of the states.

See also WOMEN'S BUREAU, FEDERAL.

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See also complete list of current publications of the Women's Bureau.

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WOMEN IN THE AIR FORCE (WAF). Women have been an integral part of the United States Air Force since the passage of Public Law No 265 in 1948. They serve in every major command in the continental United States, as well as in Hawaii, Japan, Newfoundland, Great Britain, France, Germany, Iceland, Alaska, Panama, Italy, Okinawa, Guam, and the Philippines.

Women are utilized in 34 of the 44 different air force career fields. The exceptions are occupations which would normally be unsuitable for women: fire fighting, marine, rescue and survival assignments, construction, utilities, munitions and weapon maintenance, rocket propulsion, armament systems maintenance, weapons, and guided missile systems. In addition, 6 of the fields in which women are utilized contain 20 jobs in which women may not be used because they involve, for the most part, duties in aircraft engaged in combat missions. Such duties are the only ones legally forbidden to women in the air force. There are also a few jobs, such as train crew men and railroad equipment supervisors, which are not authorized. Jobs such as those of 1st sergeant, athletic duties, and the band are limited to assignment for duties with WAF units. Moreover, women are not expected to drive trucks heavier than 1.5 tons.

Single women between the ages of 18 and 34, inclusive, with no dependents under 18 years of age, are accepted for initial enlistment in the WAF. Parental consent is required for those under 21 years of age. A woman with prior service in the armed forces is eligible for enlistment in the WAF if her age does not exceed 35 plus the years of prior service completed since 1943. Enlistment periods are for three, four, five, and six years.

WAF officers are obtained either through officer candidates school, open to civilian or enlisted women between the ages of 20½ and 26½ years who are high school graduates, or from civilian applicants for direct reserve commissions. Civilian women with college degrees, together with civilian experience of varying length and responsibility, may qualify for direct reserve commissions in grades from 2d lieutenant to lieutenant colonel, inclusive. Grades higher than 1st lieutenant require that the woman must be over 32 years of age and outstanding in a field of urgent need.

WOMEN IN THE MARINE CORPS. The service of women in the United States Marine Corps began in World War I, when a few hundred women reserves filled clerical jobs. In World War II, a peak strength of 18,838 officers and enlisted women served in hundreds of different jobs. Women have been an integral part of the corps, however, only since June 12, 1948, when Congress authorized their permanent status.

Women marines serve in the fields of administration, supply, motor transport, disbursing, communications, classification, recruiting, public information, photography, special services, and aviation. They perform jobs at all major marine posts and stations in the continental United States and Hawaii, supporting the operations of the male marines in the field.

WOMEN IN THE NAVAL SERVICE. During World War I, the United States Navy Department, for the first time in its history, permitted the enlistment of women in the Naval Reserve. These women were officially classified as Yeoman (F), and at the end of the war were entitled to all benefits accruing to veterans. In World War II, under authority of legislation enacted on July 20, 1942, women were enlisted and appointed to commissioned status in the Women's Reserve of the United States Naval Reserve, to serve only for the period of the "duration plus six months." These women held ratings and ranks identical with those of enlisted men and male officers and were known as WAVES (Women Accepted for Volunteer Emergency Service). At peak strength, in August 1945, the WAVES numbered approximately 86,000, and were serving in the continental United States and Hawaii at nearly every type of naval shore activity. The purpose of Public Law No. 625 (Women's Armed Services Integration Act), enacted on June 12, 1948, was to provide within the military establishment a nucleus of officers and enlisted women upon which to build in the event of an emergency. The WAVES thereby became an integral part of the regular navy as well as of the Naval Reserve.

WAVES are subject to the same regulations and requirements for advancement and promotion as men and enjoy the same benefits and privileges. They serve in military billets within authorized allowances at continental shore stations and selected overseas bases. Women officers are commissioned in the line and in such staff corps as the Medical Corps and the Supply Corps, and are assigned in accordance with a carefully considered policy of rotation providing a wide variety of naval job experience. Insofar as possible, each officer is given an opportunity to become expert in naval shore administration and to develop technical knowledge in at least two fields in which women officers are utilized. Line officers are assigned to duty in such fields as personnel administration, public relations, training, publications, intelligence, logistics, and communications. Enlisted women serve in 28 of the navy's 62 ratings or major job fields within such occupational groups as administrative and clerical, aviation, medical, and dental. Their duty is limited only by restrictions imposed by law or as determined by consideration of their psychological or physical limitations; they may not serve in aircraft on combat missions, or on ships other than hospital ships and transports, or in billets classified as "heavy duty." Women officers may not have permanent commissioned rank above that of commander; the officer detailed as assistant chief of naval personnel for women, however, holds the rank of captain while so serving. Qualified professional women serve in the Navy Nurse Corps, which is governed by separate legislation.

WOMEN'S ARMY CORPS. In May 1942, Congress created the Women's Army Auxiliary Corps (WAAC) to serve as an auxiliary to the United States Army and function with it, but not of it. It authorized an eventual enrollment of 150,000 members, but initial plans permitted the enrollment and training of only 25,000 women. Details of training, duties, and organization had been planned by Mrs. Oveta Culp Hobby, the first director of the corps, in consultation with army officers. The first WAAC training center was opened at Fort Des Moines, Iowa, on July 20, 1942, with 784 carefully selected young women. Some 1,200 army officers and men were detailed

to instruct the corps and to help develop it into an efficient auxiliary to the regular army.

The first full WAAC companies went into the field in November 1942 to perform a variety of jobs, including those of clerks, stenographers, typists, librarians, switchboard operators, dieticians, postal clerks, teletype operators, and linguists. Proof that the experiment was successful came in less than six months, when an executive order permitted the corps to be built up to its authorized strength of 150,000. Additional training centers were established at Daytona Beach, Fla.; Fort Oglethorpe, Ga.; Fort Devens, Mass.; and Ruston, La.

In January 1943, the first detachment of WAACS to go overseas arrived in North Africa to be part of Gen. Dwight D. Eisenhower's headquarters staff. It included selected stenographers, clerks, typists, bilingual telephone operators, and women who could drive staff cars and light trucks.

Effective Sept. 1, 1943, Congress established the Women's Army Corps (WAC), replacing the auxiliary organization. Women now assumed a completely military status and were established as members of the Army of the United States, for the "duration plus six months." Soon WACS were being detailed to almost every branch of the army. They served in Europe, Africa, China, India, Australia, New Guinea, and, ultimately, Japan and Korea. An increasing number of women were enlisted and trained for hospital duty, as ward attendants, laboratory technicians, psychiatric social workers, medical and surgical technicians, and physical therapists.

The value of trained and enthusiastic women to the United States Army was established through Public Law No. 625, enacted on June 12, 1948, which made the WAC a permanent organization in order to provide a nucleus with which, in case of emergency, expansion could be accomplished.

The composition of the WAC corresponds to that of other army organizations. Women hold grades from private through master sergeant, as well as warrant grades, and they serve as commissioned officers through the rank of lieutenant colonel. The director of the corps is the only colonel. Advancement is based on a carefully planned career management system that permits the training, experience, and promotion of members on a thoroughly supervised basis. Officers are secured from the ranks as well as from civilian life.

WOMEN'S BUREAU, Federal, a bureau in the United States Department of Labor. First established in 1918 as the temporary Woman-in-Industry Service, it was made a permanent bureau by congressional act of June 5, 1920. The act authorized the bureau to "formulate standards and policies which shall promote the welfare of wage-earning women, improve their working conditions, increase their efficiency, and advance their opportunities for profitable employment."

The bureau is concerned with women in all fields of employment: manufacturing, service, trade, household employment, farm work, business, and the professions. It is equally interested in the welfare of the young girl, the woman who is both homemaker and wage earner, and the older worker.

The program of the bureau is shaped by changes in economic conditions, whether these are produced by war or peace, periods of full employment or recessions. During World War I, as the Woman-in-Industry Service, it was the agency to which government and private industry turned for assistance in their efforts to draw women into a labor market being depleted by the entrance of men into the armed services. In World War II, it acted in the same capacity. Following both wars, it was occupied largely with the problem of the transfer of displaced women war workers to satisfactory places in the civilian economy.

With the outbreak of hostilities in Korea, the bureau once more became concerned with the role of women in a period of emergency. Its obligations were set forth by the secretary of labor in General Order No. 48, issued on Sept. 29, 1950. This directive, which established within the Department of Labor a Defense Manpower Administration and a Women's Advisory Committee on Defense Manpower, delegated to the Women's Bureau the functions of planning, advising, formulating policy, and conducting studies with regard to all aspects of emergency problems pertaining to the recruitment, training, and utilization of women.

Under normal conditions as well as in periods of emergency, the bureau assumes as a fundamental obligation the furnishing of factual data on which policies for working women can be developed. Such data is used extensively by women's organizations, educational associations and institutions, employment counselors, civic and religious groups, trade unions, state labor department officials, and others who look to the bureau to render this service and to furnish leadership in focusing attention on the problems of working women. The bureau disseminates its findings through published reports on technical studies, news releases, leaflets, articles, exhibits, correspondence, and the participation of the staff in conferences.

Assisting the headquarters personnel of the bureau is a five-member field staff. Though stationed in Washington, D.C., these representatives spend a major portion of their time in regions of the United States where the need for bureau service develops. Their function is twofold:

(1) They give consultative and advisory assistance to employers, trade unions, civic groups, women's organizations, and others on such matters as employment standards for women, factory adjustments of women who are newcomers to the labor force, problems of absenteeism, equal pay, and minimum wage.

(2) They keep the headquarters personnel informed of significant developments affecting women workers, thus enabling the bureau to make informed selections of future areas of investigation.

The bureau's program is carried out through four principal types of activities: research, legislation, information, and international cooperation.

Research.—The bureau's technical experts carry on continuous research of various kinds to help the bureau formulate policies and programs. Some studies are designed to give information on the demand for and supply of women workers in selected occupations, or to analyze long-time trends in women's employment. Others, many of which are based on first-hand field investigations, are concerned with wages and working conditions in individual industries,

training opportunities, and women's responsibilities for family support.

The bureau's research facilities are not limited to the collection of data for reports, but are often utilized in obtaining special information for state departments of labor, women's organizations, trade unions, and others conducting projects designed to benefit working women. The bureau also maintains a reciprocal program of cooperation with other federal agencies, and it analyzes data collected by these agencies in the light of their relationship to or effect on women workers.

Special Studies of Employment Opportunities.—Within the bureau's research division is a section whose chief function is the preparation of studies which furnish information on trends in the future outlook for women in specific occupations. It has issued reports on the outlook for women in home economics occupations; social work; medical and other health services; police work; and such major fields of science as chemistry, physics, mathematics, and biology. Although such studies are directed to vocational advisers and college deans of women, they are used widely by other groups and individuals.

Women's Occupations through Seven Decades (1947), an authoritative study based on analyses of decennial census data, traces the occupational progress of women from 1870 to 1940. An illustrated popularized version of this study, entitled *Women's Jobs: Advance and Growth,* appeared in 1949.

Among other major employment studies is *Women in Higher-Level Positions* (1950), a bulletin reporting on 860 women in higher-level positions in department stores, banks, home offices of insurance companies, and manufacturing establishments in three areas: Chicago, Philadelphia, and the Boston-Hartford area. Based on an examination of management records and on personal interviews with management and women workers in 237 establishments, this study furnished data on such subjects as the extent to which higher-level jobs were open to women, the qualifications demanded, and the factors favoring or deterring women's advancement. Another bureau publication dealing with women's advancement to higher-level positions is *Women in the Federal Service,* Part 2 (1950), a bulletin giving data on the occupations of a selected group of women at the higher levels of salary and responsibility in the federal government. Part I of this series (1949) discussed the employment of women in the executive branch of the federal government between 1923 and 1947, and furnished data on numbers in and distribution among the various agencies, and on salaries, length of service, age, turnover rates, and the effects of veterans' preference.

The bureau has also made a survey of part-time job opportunities for women. The results of this survey, published in 1951, reported on the number and kinds of part-time jobs held by women, on the reasons why women sought part-time work, and on the advantages of part-time schedules to employee, employer, and the community.

Studies of Wages and Working Conditions.—The bureau has issued reports on maternity benefits available under employer and union plans, industrial injuries to women, women's jobs in the telephone industry, and local programs relating to household employment.

Other Reports.—Among other subjects on which the bureau has published reports are state minimum wage laws and orders, working women's budgets, and the legal status of women in the United States. A useful reference work is the *1952 Handbook of Facts on Women Workers.*

Leaflets and Popular Pamphlets.—The bureau has published leaflets on equal pay, mimimum wage, job training, the older woman worker, and the economic responsibilities of women workers. Two widely used illustrated pamphlets are *Your Job Future after High School* and *Your Job Future after College.*

Legislation.—The Women's Bureau administers no laws, but it has always recognized and supported labor legislation as a means of ensuring and safeguarding good working conditions and other standards for women in the labor force. To assist those interested in furthering legislation on such subjects as minimum wage, hours of work, equal pay, and working conditions, the bureau maintains a division on women's labor law and civil and political status. This division is concerned not only with the enactment of new legislative standards, but also with effective administration of existing standards. To help state officials carry out these objectives, the bureau analyzes existing laws affecting women workers and makes recommendations on proposed laws. When requested to do so, it aids in the development of standards and language for draft bills. Periodically, the bureau issues digests of legislation and materials designed to help state minimum wage administrators in the revision of their cost-of-living budgets.

Since 1935, the bureau has collected data and written reports on the political and civil status of women. Such work became increasingly significant after the establishment of the United Nations Commission on the Status of Women in 1946.

Equal Pay.—A pioneer in advocating the principle of equal pay, the bureau disseminates current information and gives technical assistance to state departments of labor, women's organizations, trade unions, and others interested in enacting state or federal equal pay laws or in amending state legislation. It has developed and made available a revised draft state bill, a popular leaflet, an analysis of existing laws, a bibliography of published articles on the subject, and a summary of congressional action on federal equal pay bills.

Minimum Wage.—The bureau convenes annual conferences of state minimum wage administrators and throughout the year gives technical and consultative assistance to these officials, to women's organizations, to trade unions, and to others on various aspects of minimum wage legislation or proposed legislation. In addition, it prepares and publishes analyses of existing laws; in 1950, it issued a major bulletin analyzing state minimum wage laws and orders over an eight-year period.

Information.—The bureau's special services and publications division issues news releases, special articles, radio scripts, and leaflets on such subjects as women's hours of work, their wages and working conditions, their opportunities for advancement, their eligibility for jury service, and their wage-earning responsibilities in relation to their families or other dependents. As a phase of its public service activities, the bureau publishes monthly its *Facts on Women Workers* and, as the occasion arises, prepares pictorial displays for conferences and conventions.

Conferences.—The bureau's director and staff

members participate in a number of conferences held by key women's organizations, educational and religious associations or institutions, state departments of labor, trade unions, and other groups, sometimes as technical advisers but more often as speakers. The bureau itself convenes meetings of its Labor Advisory Committee, a body composed of 14 trade union women. These meetings enable the bureau to receive at first hand information on current employment and other developments which affect women workers.

A major conference was that called by the director of the bureau in November 1950 to consider problems relating to women workers both during the emergency period and on a long-range basis. Prominent men and women from state departments of labor, business, industry, women's and civic organizations, educational institutions, and trade unions participated in the discussions. Subjects explored at the conference included women's role in the defense effort, the training of women, job and promotion opportunities for women, the contribution of legislation to acceptable job standards, the dual role of married women workers, and issues relating to women's citizenship.

International Cooperation.—The bureau exchanges information and publications with government agencies, women's organizations, and interested individuals in many foreign countries, and conducts training courses for women labor officials on such subjects as women's employment, working conditions, and labor legislation. Courses of study, usually lasting four months, include orientation at United States Department of Labor headquarters and field work under the auspices of state departments of labor. The bureau also cooperates with the Department of State in bringing to the United States for courses of study representatives of key women's groups in various countries.

International Agencies.—The director and staff members of the bureau often serve in an advisory capacity to United States representatives at sessions of United Nations commissions and committees, particularly the Commission on the Status of Women. At sessions of this commission, the bureau's specialist on the legal status of women has furnished technical data and consultation on such subjects as the nationality of married women, equal pay for equal work, property and political rights, and educational and professional opportunities. In 1949, the bureau completed a detailed United Nations questionnaire on the legal status and treatment of women in the United States.

The bureau also cooperates closely with the International Labour Organization, and the director has served as delegate or adviser at a number of its conferences and meetings. In addition, the bureau provides consultative service and prepares materials pertaining to the status of women in the United States for the Inter-American Commission of Women.

FRIEDA S. MILLER,
Director, Women's Bureau.

WOMEN'S CLUBS, General Federation of, an association organized in 1890 "to unite women's clubs and like organizations throughout the world for the promotion of education, philanthropy, public welfare, moral values, civics and fine arts." In March 1889, at the celebration of its 21st anniversary, the Sorosis Club of New York City had called a meeting of 61 clubs in 18 states for the purpose of forming a closer association among them. The resulting federation was established on March 20, 1890, and its first convention was held on April 23. By the 1950's it had grown to a membership of approximately 11,000,000 women in 15,000 clubs, and state, national, and international affiliated organizations.

National headquarters are in Washington, D.C. The official publication is the *General Federation Clubwoman,* published monthly except in June, July, and August. The federation conducts annual contests in which individual clubs compete for prizes to be used for community projects.

WOMEN'S RESERVE OF THE UNITED STATES COAST GUARD RESERVE. Created by an act of Congress approved on Nov. 23, 1942, the World War II organization popularly known as SPARS was instituted to take over duties in the shore establishment of the Coast Guard, thereby releasing officers and enlisted men for sea duty. The term "Spar" was derived from the Coast Guard motto, *Semper Paratus* (Always Ready). At peak strength early in 1945 there were approximately 900 officers and 9,000 enlisted SPARS. The highest ranking officer was a captain. The SPARS were demobilized on June 30, 1946.

WOMEN'S RIGHTS. See WOMAN SUFFRAGE; WOMEN, LEGAL RIGHTS OF.

WONDER-WORKING MAGICIAN, The (*El Mágico Prodigioso*), a play by Pedro Calderón de la Barca. The superficial resemblance between Calderón's play and Johann Wolfgang von Goethe's *Faust* has made this one of the best-known Spanish dramas. Goethe, who was ignorant of Calderón's play when he wrote the first part of *Faust,* but jealous of the Spanish playwright's extraordinary popularity during the early decades of the 19th century, said with much truth and some bitterness, "It is the subject of Doctor Faust treated with incredible vulgarity" (1812). In Calderón's work, Cipriano, a passionate young gentleman, is distracted from the pursuit of love by his studies, but upon seeing beautiful Justina, he becomes enamored and makes a pact with the Devil in order to win her. He is inspired by no yearning for knowledge or power over natural forces, but becomes simply one more of the countless victims of unbridled passion found in Spanish literature of the golden age, the immediate prototype being Friar Giles of Antonio Mira de Amescua's *El Esclavo del Demonio* (1612). In *Faust,* on the other hand, we have an old man who has lost faith in science and divine power and makes a pact with the Devil in order to obtain rejuvenation. Only the incriminating charter is common to the two plays. Calderón wrote his drama for a religious celebration in the town of Yepes in 1637. For his plot he had recourse to the legend of St. Cyprian and St. Justina of Antioch, who suffered martyrdom in the 4th century of the Christian era. The historical element is slight; and, although intended to tell a pious tale, the play soon degenerates, after the spirited opening scenes made familiar to English readers by Percy Bysshe Shelley's inspired rendering, into a typical Spanish play of love intrigue, with unpardonable concessions by way of irrelevant buffoonery to the burghers of Yepes, for whose benefit, likewise, the author adopted a humbler style than when writing for

the palace. Like other plays of the time, notably Calderón's *La Vida es Sueño* and *El Condenado por Desconfiado,* of doubtful authorship, it offered a defense of the doctrine of free will, the only weapon which Cipriano and Iustina used successfully against the evil one.

MILTON A. BUCHANAN.

WONDERFUL HISTORY OF PETER SCHLEMIHL, The (Ger. PETER SCHLEMIHLS WUNDERBARE GESCHICHTE), by Adelbert von Chamisso—first published in Germany in 1814, in the United States in English translation in 1825—one of the most famous fairy tales of German Romanticism. The fundamental idea, that a man can lose his shadow, Chamisso probably took from folklore, and he made it a fascinating means of putting the reader in an atmosphere hovering between the real and the fantastic. The meaning which Chamisso gave to the shadow seems to be social repute, which men imperatively demand of each other without testing it for its true value. Schlemihl, a Hebrew name, originally meaning friend of God, Theophilus, was also used euphemistically by the Jews for a man who is denied all success in the world. Our Peter Schlemihl exchanges his shadow for the gold sack of Fortunatus, but only to fall a victim to unhappiness very soon, since men withdraw from him on account of his defect and he himself becomes involved in guilt. Yet when the devil wants to return his shadow to him in exchange for his soul, Schlemihl, as the friend of God, rejects the proposal and discards the magic gold sack. He seeks refuge in nature and travels about the world in seven-league boots. When overtaken with sickness he is reconciled with his fellow men who take care of him and in his sickness do not look for his shadow. Finally, however, he returns to his studies of nature and finds his deepest satisfaction in communion with her and his own better self.

Undoubtedly the story contains features and experiences of Chamisso's own, but the poet himself protested against carrying the comparison between him and the hero of his story too far. Consult edition in *Deutsche National-Literatur* (1882–1898, vol. 148, with excellent introduction and references).

EWALD EISERHARDT.

WONDERS OF THE INVISIBLE WORLD, by Cotton Mather (q.v.), an account of Salem witchcraft trials, published 1693. It argued the justice of verdicts based on the evidence. Robert Calef (q.v.) rebutted with *More Wonders of the Invisible World* (1700).

WONSAN, wûn-sān, or **GENSAN,** city, Korea (Chosen), a port of the east coast, midway between Vladivostok and Pusan, connected by railway with Seoul and by steamers with ports in Japan, Siberia and China. It is never closed in winter and the harbor is deep and spacious. Its superb scenery and fine climate make Wonsan a favorite summer resort. Gold and copper from the mines in the neighborhood and agricultural products are exported. Wonsan was heavily damaged during the fighting in 1950 and after. Pop. (1938 est.) 67,363.

WOOD, wo͝od, **Alexander,** Scottish physician: b. Cupar, Fife, Dec. 10, 1817; d. Edinburgh, Feb. 26, 1884. He was graduated from Edinburgh University with the degree of M.D. in 1839; and shortly afterward became one of the medical officers at the Royal College Dispensary in Edinburgh. He was one of the most prominent members of the Royal College of Physicians and Surgeons there, being president of that organization in 1858–1861, and representing it in the general medical college in 1858–1873. His most important contribution to the practice of medicine was the introduction of the use of the hypodermic syringe for administering drugs; this he first brought into notice by the publication of a pamphlet in 1855, entitled *New Method of Treating Neuralgia by the Direct Application of Opiates to the Painful Points.*

WOOD, Anthony (or ANTHONY À WOOD), English antiquary and biographer: b. Oxford, Dec. 17, 1632; d. there, Nov. 29, 1695. He was educated at Merton College, Oxford, and gave his life mainly to matters connected with the history of the university. His researches resulted in his *History and Antiquities of the University of Oxford* (pub. 1791–1796). It was written in English; but as it was thought proper that it should appear in Latin for the information of foreigners, it was translated into that language under the inspection of Dr. John Fell, dean of Christ Church, and published (1674) at the Oxford Press, as *Historia et Antiquitates Universitatis Oxoniensis.* Wood's *Survey of the Antiquities of the City of Oxford* was edited by Andrew Clark in 1889–1899. In 1691–1692 appeared his *Athenae Oxonienses,* an account in English of the writers and bishops educated at Oxford from 1500 to 1690, but for his criticisms of the earl of Clarendon in this work he was expelled from Oxford. The Oxford Historical Society published an edition of his autobiography and diaries by Clark in 1891–1901.

WOOD, Clement, American author: b. Tuscaloosa, Ala., Sept. 1, 1888. A graduate of Alabama and Yale universities, he began practicing law at Tuscaloosa in 1911, taught in New York schools for several years, and in 1934 became an officer of the Bankers Fiduciary Trust. A voluminous writer, he has published works in poetry, history, biography, and fiction.

WOOD, Edmund Burke, Canadian jurist and legislator: b. near Fort Erie, Ontario, Feb. 13, 1820; d. Winnipeg, Oct. 7, 1882. He was graduated at Overton College in 1848 and was called to the bar of Upper Canada. He served in the legislative assembly in 1863–1867, and from 1867 to 1872 he served in both the Ontario legislature and the Canadian House of Commons, a dual representation being then permitted. He was provincial treasurer in the Macdonald administration in 1867–1871. He resigned his seat in the Ontario legislature in 1873 and was returned to the Canadian House of Commons. In 1874–1882 he was chief justice of Manitoba.

WOOD, Eleazer Derby, American soldier: b. New York, 1783; d. Fort Erie, Ont., Sept. 13, 1814. He was graduated from West Point in 1806, and in the second war with England conducted the defense of Fort Meigs in 1813, and was brevetted major for gallantry. He participated in the Battle of Niagara or Lundy's Lane, July 26, 1814, and was brevetted lieutenant colonel. In the sortie of Sept. 13, he fell

at the head of his command. A monument to his memory was erected at West Point.

WOOD, Ellen Price, English novelist, best known as Mrs. Henry Wood: b. Worcester, England, Jan. 17, 1814; d. London, Feb. 10, 1887. She began her literary career by contributing to *Bentley's Miscellany* and the *New Monthly Magazine.* In 1867 she became editor and proprietor of *Argosy* magazine. Her books display ingenuity of plot, constructive skill, keen character drawing, and descriptive power. Among them are *East Lynne* (1861), successful both as a novel and a drama, and still popular; *Mrs. Halliburton's Troubles* (1862); *The Channings* (1862); *The Shadow of Ashlydyat* (1863); *Roland Yorke* (1869); *Within the Maze* (1872); *Edina* (1876); and the *Johnny Ludlow Stories* (1868–1880).

WOOD, Fernando, American politician: b. Philadelphia, Pa., June 14, 1812; d. Hot Springs, Ark., Feb. 14, 1881. He removed to New York in 1822, received an excellent education, entered the shipping business, and retired with a very comfortable fortune in 1850. He then turned to municipal politics. He was elected Tammany mayor of New York in 1854 and re-elected in 1856. Internal strife in the Tammany organization forced him to resign his membership. He then started a rival organization known as Mozart Hall and was again elected mayor in 1859 over the Tammany and Republican candidates. During this last term of office he was severely criticized for advocating that New York City secede from the Union at the opening of the Civil War. Later, however, he gave his full support to the administration's war policy. He served in Congress 1863–1865 and 1867–1881.

His son, Henry A(lexander) Wise Wood (1866–1939), made many inventions important to the printing trade, notably the autoplate, a machine for making newspaper plates which formerly had been made by hand. Interested in aeronautics, he founded the magazine, *Flying,* of which he was editor (1911–1919), and became the first president of the American Society of Aeronautical Engineers.

WOOD, Francis Carter, American pathologist: b. Columbus, Ohio, Dec. 30, 1869; d. Englewood, N. J., Jan. 5, 1951. He was educated at Ohio State University and at the College of Physicians and Surgeons, Columbia University, New York City, and later studied at the universities of Berlin and Vienna. He specialized in cancer research and pioneered in the use of X-ray and radium treatment. For many years he was pathologist at St. Luke's Hospital, New York City, and was professor and director of cancer research under the George Crocker Special Research Fund at Columbia University.

WOOD, George Bacon, American physician: b. Greenwich, N. J., March 12, 1797; d. Philadelphia, Pa., March 30, 1879. He was graduated from the University of Pennsylvania in 1815 and from its medical department in 1818. From 1822 to 1831 he was professor of chemistry at the Philadelphia College of Pharmacy, and of materia medica there 1831–1835. He held the chair of materia medica at the University of Pennsylvania 1835–1850, and of the theory and practice of medicine there 1850–1860, endowing an auxiliary faculty of medicine in the university in 1865. With Dr. Franklin Bache he compiled *The Dispensatory of the United States* (1833; 17th ed. 1894).

WOOD, Grant, American painter: b. Anamosa, Iowa, Feb. 13, 1891; d. Iowa City, Feb. 12, 1942. Grant Wood spent his childhood on a farm in Iowa but, upon his father's death in 1901, moved with his family to Cedar Rapids. After finishing high school, he combined his earning a living as a metalworker, illustrator, and by odd jobs, with the periodic study of art at the Minneapolis Handicraft Guild, the University of Iowa, and the Art Institute of Chicago. Later, having become an art teacher in the Cedar Rapids public schools, he made four trips to Europe in the 1920's and during his second visit studied at the Académie Julian. His third trip was for the purpose of holding a one-man show at the Galerie Carmine in Paris. On his fourth trip he was much impressed by the early Flemish and German paintings he saw in Munich. The severe honesty and intensity of these works and the glazing technique by which they were produced strongly influenced his later work.

Wood's best-known paintings were done after his last trip to Europe. During and immediately after his students days abroad, he had followed French fashions in his painting, briefly turning even to surrealism. Upon his return from his Paris exhibition, however, he suddenly realized that Iowa and its people were what he really knew and they came to occupy his attention as material for art for the rest of his life. He became a leader in the painting of the American Scene that largely dominated artistic activity during the 1930's in the United States.

The regional emphasis in Wood's art implies a primary concern for subject matter. His work is realistic, with a literal presentation of precise detail. His color is clear; his outlines firmly defined; and his surfaces glossy. His technique recalls American folk painting and Currier & Ives prints but is nevertheless an honest expression of an individual personality. Although he was occasionally criticized as being photographic, the trees and other natural forms in his work were often arbitrarily forced into a fixed pattern that suggests a self-conscious stylization. In many of his best paintings the pictorial material was simplified into almost pure abstraction although the meaning was always easily understood. Fine examples of his work include *Woman with Plants, Stone City, American Gothic, Daughters of Revolution, Arbor Day,* and *Dinner for Threshers.*

Blanchard Gummo,
Professor of Art, Bucknell University.

WOOD, Mrs. Henry. See Wood, Ellen Price.

WOOD, Sir Henry Evelyn, English general: b. Cressing, Essex, Feb. 9, 1838; d. Harlow, Essex, Dec. 2, 1919. He was educated at Marlborough College and entered the navy in 1852. During the Crimean War he served in the naval brigade and was wounded in the assault on the Redan. In 1855 he entered the army as cornet and served in India 1858–1860, receiving the Victoria Cross for conspicuous valor (1859). He served in the Zulu War (1879); in the Transvaal War, 1881; and in Egypt in 1882. In 1893 he entered the War Office as quartermaster general, became full general in 1895, and field marshal in 1903.

WOOD, Horatio C., American physician: b. Philadelphia, Pa., Jan. 13, 1841; d. there, Jan. 3, 1920. He was graduated in medicine from the University of Pennsylvania in 1862, and was professor of botany there 1866–1876, and clinical professor of diseases of the nervous system from 1875 to 1901; professor of therapeutics 1876–1906, and thereafter emeritus professor of therapeutics. In addition to many professional papers he was the author of *Thermic Fever* (1872); *A Treatise on Therapeutics* (1874); *A Study of Fever* (1875); *Nervous Diseases and their Diagnosis* (1887); *Syphilis of the Nervous System* (1889).

WOOD, Irving Francis, American Biblical scholar and educator: b. Walton, N. Y., May 27, 1861; d. Aug. 29, 1934. He was graduated at Hamilton College in 1885, at Yale University in 1892, and took the degree of Ph.D. at the University of Chicago in 1902. He taught at Jaffna College, Ceylon, in 1885–1889; was appointed professor of ethics and Biblical literature at Smith College in 1893, and later held the chair of Biblical criticism and comparative religion (emeritus 1929). He is joint author of *The Bible Story* (5 vols., 1906); *The Days of the Kings of Israel* (1908); *The Bible as Literature* (1914); and *The Book of Life* (8 vols. 1923); and author of *The Spirit of God in Biblical Literature* (1904).

WOOD, James Frederick, American Roman Catholic prelate: b. Philadelphia, Pa., April 27, 1813; d. there, June 20, 1883. He was educated in England and on returning to the United States entered the banking business. In 1836 he went to Rome to study for the priesthood and after his ordination in 1844 became an assistant rector of the cathedral at Cincinnati, and afterward pastor of Saint Patrick's Church. In 1857 he became bishop of Philadelphia, where he completed the magnificent cathedral in Logan Square. He also established at Overbrook the Seminary of Saint Charles Borromeo. He was created archbishop in 1875. He was especially opposed to the introduction of political issues from other countries to the United States.

WOOD, John George, English naturalist and Anglican clergyman: b. London, July 21, 1827; d. Coventry, Warwickshire, March 3, 1889. He was graduated from Merton College, Oxford, in 1848, and took orders in the English Church. In 1856–1862 he was chaplain to Saint Bartholomew's Hospital, in 1858–1863 a reader at Christ Church, Newgate Street, and for seven years from 1869 conducted the festivals of the Canterbury Diocesan Choral Union. During 1879–1888 he delivered numerous lectures on natural history in Great Britain and America. His numerous works contributed very greatly to popularize natural history. Among them are *The Illustrated Natural History* (1851); *Bees* (1853); Routledge's *Illustrated Natural History* (1859–1863), his most important work; *Common Objects of the Microscope* (1861); *Our Garden Friends and Foes* (1863); *Homes Without Hands* (1864–1865); *Fresh and Salt Water Aquarium* (1868); *Natural History of Man* (1868–1870); *Bible Animals* (1869–1871); *Insects at Home* (1871–1872); *Insects Abroad* (1874); *Man and Beast: Here and Hereafter* (1874); *Field Naturalist's Handbook* (1879–1880); *Half-Hours in Field and Forest* (1884); *Half-Hours with a Naturalist* (1885); *Romance of Animal Life* (1887). Consult *Life* by his son the Rev. T. Wood (London 1890).

WOOD, John Seymour, American lawyer: b. Utica, N. Y., Oct. 1, 1853; deceased. He was graduated at Yale in 1874 and at Columbia Law School, 1876. He was editor of the *Bachelor of Arts Magazine* (1896–1898), and has published *Gramercy Park: A Story of New York* (1892); *A Daughter of Venice* (1892); *College Days* (1895); *A Coign of Vantage* (1896); *Yale Yarns* (1897); *An Old Beau, and Other Stories; A Nippon Garden* (1915).

WOOD, Leonard, U.S. soldier and administrator: b. Winchester, N. H. Oct. 9, 1860; d. Boston, Aug 7, 1927. The year after graduating from the Harvard Medical School he became a physician in the United States Army. In 1886, as first lieutenant and assistant surgeon, he served in the campaign against Geronimo and was awarded a medal of honor for his services. In 1898, when the war with Spain began, he received authority to raise, and was commissioned as colonel of, the first volunteer cavalry commonly known as the Rough Riders. Theodore Roosevelt was lieutenant colonel of this regiment and succeeded to its command on General Wood's promotion. Colonel Wood commanded the regiment at Las Guasimas and the second cavalry brigade consisting of the first volunteer cavalry (Rough Riders) and the first and tenth regular regiments of cavalry at San Juan Hill. On July 8, 1898, he was, on the recommendation of his superiors, appointed brigadier general of volunteers for services at San Juan and Las Guasimas. On the surrender of the city of Santiago, he was appointed governor of the captured city and later, on the relief of General Lawton, he was made governor of all the captured territory embracing the eastern portion of Cuba, including the province of Puerto Principe and Santiago. In this capacity, he was responsible for improving the food supply and sanitation of the province, building public works, and maintaining order. On Dec. 7, 1898, he was appointed a major general of volunteers in recognition of his services as governor of the captured territory. On April 13, 1899 he was mustered out as major general of volunteers and reappointed on the same day as brigadier general of volunteers and continued in this grade until Dec. 5, 1899, when he was again appointed as major general of volunteers and designated to relieve Maj. Gen. John R. Brooke as military governor of Cuba. General Wood continued in this capacity until its transfer as an organized republic to the duly elected Cuban government through its representative, Thomas Estrada Palma, the duly elected president, on May 20, 1902.

During this period of reorganization school laws were written, sanitary regulations were enforced throughout the island, laws of public works and charities were revised and rewritten, an entirely new railroad law was prepared and put in force and most extensive judicial reforms accomplished. Especially great attention was given to sanitation, schools and courts. It was under General Wood's supervision that Maj. Walter Reed and his assistants, Doctors Carroll and Lazear of the medical department, conducted the great work which led to the dis-

covery of the means of transmitting yellow fever and consequently of its control. The death rate of the island was greatly reduced and the system of public education established proved to be admirable.

On 4 Feb. 1901, General Wood was appointed a brigadier-general of the regular army. During his incumbency of the office of military governor of Cuba, the post-office cases occurred which led to the indictment, trial and conviction of Rathbone and others and incidentally, through their friends, resulted in an effort to defeat General Wood's confirmation as major-general. He was, however, confirmed by an overwhelming majority, 8 Aug. 1903. In the fall of 1902 he was one of the representatives of the United States government at the Imperial German manœuvres. In March 1903, at his own request, he was detailed for duty in the Philippine Islands and continued in foreign service until November 1908. While there, he was in command of the Department of Mindanao and the first civil governor of the newly organized Moro province, which included the Mohammedan section of the Philippine Islands. After numerous campaigns he was successful in quelling the organized opposition to occupation by the United States. He later received the assignment of commanding general of the Philippine division, which position he held until relieved from duty in the islands. On his return to the United States, he was assigned to the command of the Eastern Department, which command he exercised until his detail as chief of staff, United States army, 22 April 1910. In the same year, he was designated special Ambassador of the United States to the Argentine Republic, on the occasion of the celebration of the 100th anniversary of that country's independence. Upon completion of his duties as chief of staff (1914), he was reassigned to the command of the Eastern Department, which he held until 1917, when he was appointed in command of the southeastern department, a subdivision of his old command. In 1908 General Wood began his vigorous work on preparedness and pushed it through the length and breadth of the land on all possible occasions. The work was advanced with increasing vigor from year to year and reached its climax in 1913, with the establishment of the training camps of Plattsburgh. While in command of the Southeastern Department, General Wood selected 12 of the National army cantonments for the training of the National army.

While at Camp Funston General Wood organized and trained the 89th division and later on the 10th regular division, with a number of pioneer regiments and special organizations. He was sent overseas on a tour of observation, was quite seriously wounded, was in a French military hospital for some weeks and returned to the front and completed his tour of observation. When the 89th division was ordered to the front General Wood accompanied it to the sea and was there relieved and sent back to Camp Funston, where he organized and trained the 10th regular division and was in command of it at the time of the armistice.

The degree of LL.D. was given General Wood by Harvard University (1899); Williams College (1902); Pennsylvania (1903); Princeton (1916); University of the South and University of Georgia (1917); University of Michigan (1918); Union College, New York, and Wesleyan, Connecticut (1919). He received the degree of Doctor of Military Science from Norwich University and from Pennsylvania Military College (1912). General Wood holds a Congressional Medal of Honor (Geronimo campaign); is fellow of the Royal Geographical Society; member of the Society of the Cincinnati; the Society of Colonial Wars, Sons of the Revolution, Foreign Wars, Indian Wars, and of the Spanish-American War. He is fellow of the Academy of Sciences of Havana and Governor-General of the Mayflower Society of the United States. When he represented the United States at the German manœuvres in 1902 and the French and German manœuvres in 1908, he was named Grand Officer of the Legion of Honor, permission to accept which distinction was withheld by the United States. Authority to wear this decoration was granted subsequently in the general order which authorized American officers to wear foreign decorations. In 1920 General Wood was a prominent candidate for the Republican Presidential nomination, receiving as high as 314½ votes on a single ballot at the Chicago Convention. In 1921 he was chosen head of the University of Pennsylvania; but was granted leave of absence that he might undertake the duties of governor-general of the Philippines, to which post he was appointed by President Harding. His administration of the Philippines has been criticised because of his opposition to Philippine self-government. In the main it was upheld as necessary in the circumstances of the island's development. He was author of 'The Military Obligation of Citizenship' (1915); 'Our Military History' (1916); 'National Defense' (1917); and 'Universal Military Training' (1917). Consult Hobbs, W. H., 'Leonard Wood' (1920); Holme, J. G., 'Life of Leonard Wood' (1920); Wood, E. F., 'Leonard Wood' (1920); *Literary Digest*, 20 Aug. 1927, pp. 42–51, 'Taps for Leonard Wood.'

WOOD, Robert Williams, American physicist. b. Concord, Mass., 2 May 1868. He was graduated at Harvard University in 1891, studied at Johns Hopkins University in 1891–92, and at the University of Berlin in 1892–94. He was connected with the faculty of the University of Wisconsin in 1897–1901; and since 1901 has been professor of experimental physics at Johns Hopkins University. He was appointed major in the Officers' Reserve Corps in August 1917, and was later engaged in scientific service in France. He was the originator in 1898 of the electrical method of thawing frozen water mains and service pipes; has made important researches in the theory of light, for which he was awarded the Rumford medal of the American Academy of Arts and Sciences; and for his work in color photography he received medals from the London Society of Arts in 1900, the Franklin Institute in 1907, and the Dresden International Exhibition in 1909. He is joint author with A. C. Train of 'The Man Who Rocked the Earth' (1915); and author of 'Physical Optics' (1905; rev. ed., 1934); and of two books of humorous verse, 'How to Tell the Birds from the Flowers' (1907); 'Animal Analogues' (1908).

WOOD, Thomas John, American soldier. b. Munfordville, Ky., 25 Sept. 1823; d. Day-

ton, Ohio, 25 Feb. 1906. He was graduated from West Point in 1845, served under General Taylor in the Mexican War and was on frontier duty in Texas 1849–55. At the outbreak of the Civil War he was promoted lieutenant-colonel in the Federal army and later brigadier-general of volunteers. He commanded a division at Shiloh and Corinth and also at Chickamauga and Missionary Ridge, and for gallantry at the latter engagement was brevetted brigadier-general. He commanded the Fourth corps at Nashville and for his services there was brevetted major-general in 1865. In June 1868 he was retired from the service.

WOOD, Thomas Waterman, American artist: b. Montpelier, Vt., 12 Nov. 1823; d. New York, 1903. He studied art in Boston in 1848, afterward continuing his studies in Europe. In Düsseldorf he was the pupil of Hans Gude. He was well known as a portrait painter and for several years traveled about the country in this capacity, finally settling in New York in 1866. After removing to New York Mr. Wood devoted himself almost entirely to genre painting, in which he chose familiar subjects in American life. He became a member of the National Academy in 1871, and from 1878–87 was president of the American Water Color Society. He was president of the National Academy of Design from 1891 to 1899. He also was one of the founders of the New York Etching Club, and was a regular contributor to its exhibitions, most of his etching being after his own paintings. Three of Mr. Wood's paintings, 'The Contraband,' 'Recruit' and 'Veteran,' exhibited at the Academy of Design in 1867, now are among the pictures at the Metropolitan Museum of Art. Many of his portraits are in the Chamber of Commerce collection. During the last decade of his life Mr Wood visited Europe three times, copying the best masters in London, Paris, Saint Petersburg and Cassel, giving especial attention to Rembrandt and Murillo. With these copies and with original works of his own he founded the Wood Art Museum in his native town.

WOOD, Walter, English author: b. Bradford, Yorkshire, 10 March 1866. He was for more than 10 years attached to the staff of the Yorkshire *Daily Observer* and has published 'Barrack and Battlefield' (1897); 'Famous British Warships and Their Commanders' (1897); 'With the Flag at Sea' (1901); 'Wellington's Dispatches' (1902); 'The Enemy in Our Midst' (1914); 'Fishermen in Wartime' (1918); 'Adventures with Big Fish' (1925).

WOOD, Walter Abbot, American inventor: b. Mason, N.H., 23 Oct. 1815; d. Hoosick Falls, N.Y., 15 Jan. 1892. Having early given his attention to the improvement of farming implements, he in 1850 introduced the Mauny harvesting machine with original improvements. He continued to improve mowers and reapers and in 1884 disposed of 48,300 machines. His inventions were covered by about 30 patents, and he was awarded first prizes at the World's Fair in Paris in 1867, in Vienna in 1873, in Philadelphia in 1876 and in Paris in 1878.

WOOD, William, English colonist in America: b. about 1580; d. Sanwdich, Mass., 1639. He came to America in 1629, returned to England in 1633, but not long after again sailed for Massachusetts, where he settled first at Lynn, which he represented in the General Court in 1636, and afterward (1637), at Sandwich, of which he became town-clerk. In 1634 he published in London 'New England's Prospect,' the first printed account of Massachusetts. The perfect copies extant contain a map of the region. The prose narrative is interspersed with rimed descriptions of natural history. This curious work was reprinted in 1764 (Boston) and 1865 (also Boston; Prince Society).

WOOD, William Charles Henry, Canadian historian: b. Quebec, 7 June 1864. He was educated in England and in Germany, entered the Canadian militia in 1887, and in 1907 became lieutenant-colonel of the Eighth regiment. Royal Rifles. In 1917 he was given the rank of lieutenant-colonel in the Officers' Reserve. He has written 'The Fight for Canada' (1904); 'Logs of the Conquest of Canada' (1909); 'One Sea, One Fleet and Canada' (1910); 'Wolfe' (1912); 'In the Heart of Old Canada' (1913); 'The Passing of New France' (1914); 'Select British Documents of the War of 1812' (3 vols., 1915; 'Laurenciana: Lands and Waters of the Maritime Saint Lawrence' (1918); 'Elizabethan Sea-Dogs' (1918); 'Captains of the Civil War' (1921); 'Adventures in the Wilderness' (1925); and contributions to periodicals.

WOOD. Wood is the hard, fibrous substance between the pith and bark of a tree. The word derives from *widu,* Anglo-Saxon for «tree.» It is a universally useful raw material, being employed in construction, arts, chemicals, fibers for textiles, and even food. There are more than 4,000 separate and distinct articles made of wood. Of recent date conversion of wood to its components, cellulose and lignin, has broadened wood's horizon. (See also Wood Chemistry and New Uses.)

At first, supplying warmth for comfort and heat for cooking purposes, it has from prehistoric times been used as a source of material for housing, shelter, and construction throughout the world. Still later it was used for ship and boat building and piling to support docks, wharves, and piers, and as crossties to support railway tracks and hold them in position. Within later years, the usefulness of wood has greatly expanded, and been better appreciated by the public as well as by technicians. The Second World War gave a new significance to the importance of wood, because it is directly needed for everything that «floats, fights or flies.» Normally about 15 per cent of the American lumber supply is used for packaging, boxing, and crating of foods, machinery and other materials. More than twice the amount of normal requirements, however, is needed for these and many special service purposes in wartime. Many thousands of small boats, landing craft, submarine chasers, patrol boats, and merchant vessels are made of wood. Some of the fastest planes, including the British Mosquito bomber, are made of plywood (q.v.). The demands of wood for the manufacture of plywood and paper have advanced more rapidly than that of any other forest product. With the development of heat-resistant and moisture-resistant glues, plywood is being used for the construction of boats, planes, and many purposes for which it heretofore could not be used.

Wood Construction.—The advantages of wood for construction purposes may be summarized as follows: In proportion to weight, wood is stronger than many other materials of

wide availability and use; is worked easily with tools and lends itself to manufacture and fabrication into many shapes, sizes and designs; is an excellent nonconductor of heat; its grain and appearance render it susceptible to artistic and architectural designs, thus adding to the beauty and attractiveness of furniture, interior and exterior finish, panelling, flooring, etc.; is comparatively inexpensive; is abundantly available in many shapes, sizes and forms, and is a renewable resource. By pursuing intelligent forest management policies, ample supplies can be grown for the future.

Properties of Wood.—The basic technical properties of wood include hardness, durability, density or specific gravity, strength (in various forms), pliability, workability, beauty of grain and texture.

Bark.—The bark serves chiefly as a protective covering. It usually forms from 7 to 15 per cent of the whole contents of the stem. It is much thinner on young than on old trees and is much thicker at the base than farther up the tree. There are successive layers of bark in the same way that successive layers of wood are laid on each year, but they are very indistinct.

The bark often serves as a means of identification. It is very thin in the spruce, cedars, birches, cypress, larch, longleaf pine, etc. It is usually thick in the case of Douglas fir, white pine, yellow poplar, redwood and some of the oaks.

The bark of many trees is of high value. For example, the bark of the cork oak (*Quercus suber*) of southern Europe supplies our cork of commerce; the bark of the hemlocks and most of the oaks is of high value for tanning purposes. Birch bark formerly was used for canoes; other barks are of high medicinal or fuel value. The fibrous inner bark of basswood is often used in the manufacture of fiber cloth, rough carpets and mattings.

Sapwood and Heartwood.—Inside the bark is the sapwood, usually light in color, varying in width from one-half to several inches. Within the sapwood and in the center of the tree is the heartwood, generally much darker in color.

The heartwood has practically no other function than that of mechanical support. On the other hand, the sapwood is a «living» part of the tree, serving largely to store up the starch and to conduct the unelaborated sap from the roots up to the leaves. At the extreme outer periphery of the sapwood is the cambium layer where the growth of the tree in diameter takes place by cell division during the growing season.

In young trees the percentage of the sapwood is the greatest. It varies, however, with the species. The following species have thin sapwood as a rule: redwood, catalpa, locust, red cedar and yew. The following generally have wide sapwood: hickory, maple, ash, beech and some of the pines. In some species, such as cottonwood, willow, spruce, fir and hemlock, there is little difference in appearance between heart and sapwood.

Hard and Soft Woods.—All woods may be divided into two broad classifications, namely, hardwoods which are the deciduous or broadleaf trees, and the softwoods which are the evergreen or coniferous trees. However, there are some hardwoods that are evergreen and there are some conifers that are deciduous, that is, their leaves fall at the end of the annual growing season. These terms do not necessarily refer to actual hardness or softness of the woods in question.

Except in the tropics, trees increase in girth by laying on a distinctive annual ring each year around the periphery of the stem. The width of the annual rings depends upon the species, conditions of growth, etc. Trees grow relatively fast in the spring and slowly toward the end of the growing season. The wood elements are frequently coarser during the first part of each year's growth. This gives rise to the differentiation between spring and summer wood and is brought out very markedly in the southern pines and in Douglas fir. The spring wood is light in weight and in color, whereas summer wood is dark in color and heavy. This can also be readily seen in any flat-grained lumber of many species. In laying on each new layer of wood, some woods produce a very striking or pleasing grain, such as in mahogany, walnut, black cherry and teak. Certain woods, like beech, birch and maple are very heavy and therefore have exceedingly high fuel value. These three woods are also widely used for furniture and flooring. The heartwood of other species like the cedars, redwoods, black locust, black walnut, black cherry and cypress are exceedingly durable, that is, they are very resistant to the influences of decay, when exposed to dampness. There is no definite relationship, however, between hardness or density, and durability because some of the lightweight and soft cedars are far more durable than the heavy, dense and close-grained beech, maple and birch. All woods last indefinitely when kiln-dried and used for interiors where they are protected from dampness.

Uses.—Medium density woods are abundantly available and easily sawed and worked and therefore lend themselves to construction, carpentry and woodworking purposes. Therefore, southern pine and Douglas fir are widely used for these purposes. The soft pines, particularly the white pine, Idaho or western white pine, sugar pine and ponderosa pine are very soft, even textured, close grained, workable, and therefore are widely used for doors, sash, boxes, interior finish, foundry patterns and flasks, and similar purposes. Lignum vitae is one of the heaviest and hardest woods and is in great demand for bowling balls; balsa wood (q.v.), growing extensively in Ecuador and Peru, is even lighter than cork and is widely used for some highly specialized purposes such as airplanes, and life rafts. Teak (q.v.) from Burma is regarded as the best wood for certain shipbuilding purposes, such as decking, because it seasons well and warps and twists very little. Quebracho wood (q.v.) from Brazil and Paraguay is one of the heaviest and hardest known woods and is widely used in South America as crossties and as a source of tannin to condition leather. Oak is hard and heavy and is the most important wood used for crossties as well as for furniture. Spruce has long, strong, soft fibers and is one of the woods most desired for paper. Spruce in clear, straight grain is also needed for airplanes. Yellow poplar is soft and workable and seasons well, and therefore is in great demand for many woodworking and finishing purposes. It is also widely used for plywood cores. Curly and birdseye maple is specially prized for furniture and cabinet woods. Quartered oak, red gum and sycamore present a striking and pleasing grain

or silvery sheen which commands attractive prices.

Redwood, western red cedar and cypress are exceedingly durable and therefore, provide shingles, posts, poles, greenhouses and acid resisting tanks. Willow is light in weight and makes a good artificial limb. Soft, workable and lightweight woods like white pine, ponderosa pine and sugar pine are in great demand for boxes. Hickory is strong, tough and pliable, and therefore makes some of the best skis. Ash is strong for its weight and straight grained, and makes excellent handles for rakes, hoes and many other tools as well as baseball bats. Douglas fir grows in large symmetrical logs that are admirably suited for conversion, by the rotary process, into veneers and then into plywood and laminated wood. Rock elm is tough and is used for hockeysticks and barrel hoops. Some woods, like walnut and mahogany, are even grained, have a beautiful color and finish and are widely used for wood carvings, furniture, paneling, and interior finishes. The longleaf pine of the South yields a large amount of resin when tapped and is the source of rosin, turpentine and other chemical products. The sugar maple provides a sap which can be converted into sugar and a sweet syrup. The bark of the cinchona trees produces quinine. Rubber is obtained from the milky sap or latex of the rubber tree.

Each wood has its own peculiar characteristics and properties. Their availability, cost of production, and properties determine the usefulness of each species of wood. Much research is being conducted on the principal species by government, state, private and educational agencies to increase their usefulness. The largest laboratory of this kind in the world is operated by the United States Forest Service at Madison, Wisconsin. (See also FORESTRY IN THE UNITED STATES.)

Structural Characteristics.—Wood varies widely in its structure. The variations found in its structure form the basis for the identification of wood and largely decide the general character of its utilization. The principal features of wood structure include physical, mechanical, and chemical properties. Substitutes have been introduced to imitate certain types of wood, especially for decorative effects. Ingenious but generally unsatisfactory methods have been devised to imitate the color and grain of the more valuable woods such as black walnut, mahogany, rosewood and Circassian walnut. However, these imitations are never perfect reproductions and are easily recognized by the trained eye. Methods of graining cheap woods to imitate quartered white oak or other woods have been devised but are usually considered unsatisfactory.

Wood structure refers to the relative size, shape, appearance, and form of the wood elements. These characteristics vary with each species. This explains why some species are heavier, stronger, tougher, and stiffer than others; why some are cross or straight grained, hard or soft; and why some have a tendency to check and split, whereas others season rapidly and without injury. For example, the structure of oak with its wide wood rays is responsible for its pleasing effect when it is quarter sawed and polished to display the grain. The sapwood differs considerably from the heartwood in structure and appearance. Some species have a very thin sapwood, such as redwood, catalpa, red cedar and yew. Young trees have a much higher percentage of sapwood than old, mature veterans. Hickory, maple, ash, beech, and some of the pines generally have large portions of their trunk in sapwood. In some species, like cottonwood, willow, spruce, the true firs, and hemlock, there is comparatively little difference in appearance and value between the heartwood and sapwood.

The usual darker color of heartwood is caused by the deposition of certain tannins, gums, resin, etc. Hence the heartwood is commonly heavier, harder, and more durable, and it contains much less moisture. Therefore, heartwood in some species is much more valuable than sapwood. In some phases of utilization, however, as for spools, spokes, and handles, only sapwood is desired. For example, handles used for axes, hammers, hoes and shovels, cut from second-growth hickory and ash sapwood, are (because of custom) preferred on American markets. White maple, or the sapwood of the maple tree, is usually preferred to the heartwood. In many species, however, sapwood may degrade lumber sawed from it. For example, two kinds of wood may be cut from the same red gum tree; the lumber cut from the heartwood is known as red gum lumber, whereas that cut from the sapwood is generally referred to as sap gum. Sapwood may be treated with preservatives more readily than heartwood. This is very important in some species. Most American railroad crossties, poles, posts, and frequently piling and mine timbers are treated with chemical preservatives to prolong their life in service.

The hardwoods are generally divided into two broad classifications, that is, those which are ring porous, like oak, ash, hickory, elm, chestnut, and catalpa, and those which are diffuse porous such as red gum, yellow poplar, willow, birch, maple, basswood and beech. The former have wide bands of large pores in the springwood. The diffuse porous woods are more homogeneous and continuous in their structure and texture. Approximately 83 per cent of the annual lumber production from American forests is of coniferous growth which satisfies the large demand for lumber for construction and general building purposes. The hardwoods are more specialized in their applications, being used chiefly for furniture, cabinet work, implement, tool and vehicle stock, automobiles, interior finish and flooring.

Seasoning.—A knowledge of wood structure is very important for understanding how best to season lumber and other forest products. Wood as found in the tree may contain from 20 to 60 per cent moisture. Seasoned by usual methods in a yard the moisture content, in relation to the dry wood content, may be reduced to 15 or 20 per cent. Thoroughly kiln-dried lumber normally runs from 5 to 10 per cent moisture, depending on its use. The purposes of seasoning are to decrease the danger from decay and therefore increase the durability of wood; to prevent warping, twisting, checking, and shrinkage after the wood is placed in service; to increase its strength and stiffness and decrease its weight and therefore economize on transportation charges. When green or freshly sawn, lumber is exceedingly susceptible to fungus and insect attacks. Lumber is ordinarily seasoned by exposing it to the air with adequate facilities for the passage of air currents to assist in the gradual elimination of moisture. Nowadays more lumber is kiln-dried to hasten the process

of seasoning than in the past. Adequate temperature and moisture control must be maintained in order to secure the best results. Particularly must the character of wood structure be thoroughly known in order to regulate the methods of artificially seasoning wood by drying it in kilns. The rapidity of seasoning varies with the structure of the wood, the size and shape of the lumber or pieces to be seasoned, as well as the method of seasoning and piling. For example, some hardwoods are much more difficult to season than most softwoods; 4-inch stock seasons far more slowly and with more difficulty than 1-inch lumber. White pine dries more quickly than oak because of differences in structure and density. Softwoods generally require from two to five months or more for air seasoning, whereas hardwoods may require from six to ten months or more.

Weight or density of wood also varies very widely. Fuel value is in almost direct relationship to weight. Weight influences transportation charges to the market, and it has already been explained that both logs and lumber may be shipped long distances to market. Some woods cannot be floated or driven on streams because of their weight and the likelihood of sinking. Some of our heaviest hardwoods are hickory, persimmon, white oak, hard maple, beech, ash, and rock-elm. Among the heaviest softwoods are longleaf pine, western larch, and Douglas fir. The lightweight hardwoods include the cottonwoods, aspen, yellow poplar, butternut, willow, chestnut and catalpa; lightweight softwoods are redwood, the cedars, white pine, eastern hemlock and the true firs.

Strength, hardness, cleavability, flexibility and toughness, are important mechanical properties of wood.

Chemical Properties.—The chemical utilization of wood within recent years has emphasized the importance of the chemical properties of wood. Each species varies both in its physical and in its chemical characteristics. The field of chemical utilization has only begun as far as its ultimate possibilities are concerned. When wood is dried in extreme temperatures it is found to contain about 99 per cent organic matter and about 1 per cent inorganic matter. The latter comprises the ash when wood is burned. Wood is found to contain largely carbon and oxygen with a small amount of hydrogen and very small quantities of nitrogen, potassium, sodium, calcium, and magnesium. The wood fibers consist of a skeleton of cellulose which includes varying amounts of lignin, tannin, resin, and gums. Cellulose is readily converted into some of the simpler sugars.

Durability.—This is a very important quality of wood; it may be described as the ability to resist decay. This characteristic is especially desirable in wood which is to be used for railroad crossties, poles, posts, mine timbers, piling, and foundations. Durability is often the determining factor in the value of some species that may be exposed to certain soil, weather, or moisture conditions conducive to decay. It is the purpose of the preservative treatment of wood to lengthen its life in service. Wood does not naturally decay. Specimens have been taken from the piling driven by Caesar about 2,000 years ago for a bridge crossing the Tiber River near Rome which are still sound. All decay is caused by fungi or bacteria which live on the constituents of the wood, causing dry rot, heart rot, and punk in both living trees and lumber and wood materials manufactured from trees. Fungi live and propagate when environmental factors such as heat, moisture, and oxygen are favorable. Whenever any or all of these are absent, decay is not possible. Among the most durable tree species are black locust, the cedars, cypress, redwood and black walnut. White oak, cherry, persimmon, longleaf pine, Douglas fir and western larch are also durable. Among the least durable species are black gum, basswood, the poplar, aspen, beech, maple, birch, willow, and lodgepole pine. Some other species occupy intermediate positions.

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WOOD-BORING BEETLES, beetles which lay their eggs in or upon wood, into which the larvae begin to bore immediately after hatching and from which they derive their sole sustenance. Many are useful to man, since they confine their boring to stumps and fallen branches, helping to reduce them to vegetable mold. But others, such as species of the families *Cerambycidae* (q.v.) and *Buprestidae* are destructive of living trees. Typical of these pests are the apple-tree borer (*Saperda candida*) and the locust-tree borer (*Cyllene robiniae*). The true bark-borers mostly belong to a family, the *Scolytidae,* closely related to the weevils (q.v.). They form elaborate burrows on the inner surface of the bark, consisting of galleries radiating in all directions from a central chamber. (See also BARK-BEETLES.) The method of combating these beetles must be suited to the habits of the particular species. In general, infected wood should be burned or the larvae picked out and destroyed. Egg laying should be prevented as far as possible by painting tree trunks with soap-suds, kerosine emulsion, or similar repellants. Woodpeckers perform a valuable service in destroying larvae. Consult Leconte and Horn, *Cleoptera of North America* (Washington 1883); Harris and Flint, *Insects Injurious to Vegetation* (New York 1884); Packard, *Insects Injurious to Forest and Shade Trees* (Washington 1890).

WOOD CARVING, sculpture in wood, either in low relief or in the round. On the whole the grain and structure of wood make it more suitable for carving in relief than for large statues; some woods without much distinct grain can be carved almost as marble or stone; in other woods the artist must carefully adapt his design to the grain of the wood. Wood used for carving must be carefully seasoned and specially prepared; one method of seasoning it is to soak it, when newly cut, in running water, thus washing away all the sap, and then to dry out the water; an ancient method was to smoke it with wood smoke; still another method is to dry the wood in hot rooms, after pieces of paper have been glued on the ends to prevent the sap from drying out at the ends too rapidly. The woods most commonly used for carving are oak, chestnut, walnut; cedar in ancient times; sandalwood and other perfumed woods in the East; pine, fir and similar soft woods; the last mentioned being especially fitted for carving on a large scale.

History.—Wood carving has occupied an important place in the early development of the fine arts in most nations; although it was almost unknown in Babylonia, Assyria and Persia, it was common in Egypt in early times, in India, in China, and in Japan; and is now practised by many savage and semi-savage races. Particularly the Maori and Polynesian races use an abundance of wood carving, not only on the walls and beams of their dwellings, but also on their paddles, weapons, etc. Their representations of beasts and men are usually grotesque, but they also carve complicated geometrical figures, spirals, etc., of real beauty and freedom of design. The oldest example of wood carving which is now preserved is Egyptian, a life-size statue of a man known as the Sheikh-el-Beled, dating from 4,000 B.C., which gives evidence of marked technical skill; several other smaller pieces of Egyptian carving are also preserved. No specimens of Greek and Roman wood carving have been preserved, but the classical writers leave no doubt that wood was used in the early days of art in both Greece and Rome and many of the sacred statues were undoubtedly of this material. Wood carving reached its highest development in the Middle Ages. The best early specimens of mediæval carving are found in the Scandinavian countries, on several church doorways, dating from the 9th to the 13th centuries; these are carved on pine and the designs consist mostly of interlacing scroll work, combined with figures. The art reached its highest point in France, Germany, England and Italy in the 14th and 15th centuries. The best examples are found in the furnishing of churches, the pulpits, choir stalls, altar screens, etc. The most careful attention to detail, and artistic combination of figures, leaf and scroll work, combined with dignity of design, mark the best mediæval wood carving. Wood was used for the images of saints and for effigies on tombs; and also for larger pieces of carving, such as roofs of churches and other edifices, often richly decorated with figures or foliage designs. In the Renaissance period wood carving was lavishly used in church decoration, choir stalls, confessionals, desks and pulpits; in Italy ceilings were also elaborately carved; but the designs, though elaborate and skilfully worked out, began to lose the dignity of the mediæval carvings, and to indicate a low ebb of taste. In recent times the art of wood carving has lost entirely its former importance. It is best developed among the Swiss peasants, where it is a regularly organized business; and is to some extent preserved among workmen in the provincial towns of France. In Switzerland it is used mostly for clocks, small articles of furniture, toilet articles, etc. In England and the United States wood carving has recently been revived to some extent as a valuable part of art training or of general manual training.

Consult Bond, F., 'Wood-Carving in English Churches' (2 vols., Oxford 1910); Hasluck, P. N., 'Wood Carving' (Philadelphia 1908); Jack, 'Wood Carving, Design and Workmanship' (1903); Maskell, Alfred, 'Wood Sculpture' (London 1911), the best general work on the subject; Lessing, J., 'Holzschnitzerlien des 15 und 16 Jahrhundert' (Berlin 1882); Rowe, Eleanor, 'Practical Wood Carving' (new ed. 1930); Cousins, F. and P. M., Riley, 'The Wood Carver of Salem' (1916); Howard, F. E., 'English Church Woodwork' (1917); Hudson, H. A., 'Mediæval Woodwork of Manchester Cathedral' (1924).

WOOD CHARCOAL, most important, though not the purest, kind of charcoal. Wood consists of carbon, hydrogen and oxygen, the last two being in the proportion to form water. When heated in the open air, it burns completely away, except a small white ash; but if the supply of air be limited, only the more volatile matters burn away and most of the carbon remains. This is the principle of the process of charcoal-burning in countries where wood is abundant. A number of billets of wood are built up vertically in two or three rows into a large conical heap, which is covered over with turf or moistened charcoal-ash, holes being left at the bottom for the air to enter. A hollow space also is left in the middle of the heap to serve as a flue for the gaseous matters which are evolved. The heap is set on fire by throwing burning pieces of wood into the central opening near the top of which a kind of grate made of billets of wood is placed to prevent the burning fuel from falling at once to the bottom. The combustion then proceeds gradually from the top to the bottom, and from the centre to the outside of the heap; and as the central portions burn away, fresh wood is continually thrown in at the top, so as to keep the heap quite full. The appearance of the smoke shows how the combustion is proceeding: When it is going on properly, the smoke is thick and white; if it becomes thin, and especially if a blue flame appears, it is a sign that the wood is burning away too fast and the combustion must then be checked by partially stopping up the holes at the bottom, or by heaping fresh ashes on the top and sides and pressing them down well, so as to diminish the draught. As soon as the combustion is completed, the heap is entirely covered with turf or ashes and left to cool for two or three days. It is then taken to pieces and the portions still hot are cooled by throwing water or sand on them. One hundred parts of wood yield on the average 61 to 65 parts by measure, or 24 parts by weight, of charcoal. (Consult Watts, 'Dictionary of Chemistry.') The charcoal thus prepared is the best suited for fuel. In England a large quantity of charcoal is obtained in the dry distillation of wood in cast-iron cylinders for the preparation of crude acetic acid; the charcoal thus prepared is preferable for making gunpowder, but inferior for other purposes. A peculiar kind of charcoal of reddish-brown color, hence termed *charbon roux,* is prepared in France for manufacture of the gunpowder used in sporting, by subjecting wood in iron cylinders to the action of superheated steam under a pressure of two atmospheres; powder made with this charcoal absorbs moisture more rapidly than ordinary gunpowder.

The general properties of wood-charcoal are that it is black and brittle and retains the form of the wood from which it was derived; it is insoluble in water, infusible and non-volatile in the most intense heat; has power of condensing gases and, from its power of destroying bad odors, it has been regarded as possessing considerable antiseptic properties. It is

frequently stated that charcoal is a poor conductor of heat, but a good conductor of electricity; these properties depend on the nature of the charcoal, the lighter wood, such as willow, yielding a porous charcoal, with little power of conducting heat or electricity; while boxwood yields a very compact charcoal which is a good conductor of heat and electricity. Charcoal never consists entirely of pure carbon, the degree of purity varying directly with the temperature: thus, charcoal charred at 480° contains 65 per cent carbon, while that charred at 750° contains 80, and that charred at 2730° contains 96; but the loss of charcoal occasioned by these high temperatures is very great, the three percentages of charcoal corresponding to these temperatures being 50, 20 and 15.

The uses of wood-charcoal are numerous and extensive. It is very largely used as a fuel, taking in many countries the place of coal. From its being proof against all ordinary chemical agencies, a superficial charring is frequently resorted to for protecting wood from decay, as in the case of piles driven into mud or into the beds of rivers to serve as foundations. For the same purpose, it is a common practice to char the interior of tubs and casks destined to hold liquids. In a finely-divided state it is commonly regarded as an antiseptic; and there is no doubt that the offensive effluvia from animal matter in an advanced stage of putrefaction disappear when the putrefying substance is covered with a layer of charcoal; but in reality the decay goes on without emission of any odor until at length the whole of the carbon is dissipated as carbonic acid gas, and the hydrogen as water while the nitrogen remains as nitric acid. It has been shown that the action consists in a rapid process of oxidation, dependent on the power which finely divided charcoal possesses of condensing oxygen. In a finely divided state, charcoal not only condenses gases to a marvelous extent, but has the power of absorbing coloring matters, bitter principles, etc.; hence it is of extensive use in the laboratory. From the rapidity of its absorbing action, Stenhouse has proposed to use a respirator filled with charcoal to protect the mouth and nostrils in an infected atmosphere; and the employment of trays of powdered wood-charcoal in dissecting-rooms, in the wards of hospitals and in situations where putrescent animal matter is present, is found to exert a most beneficial influence in sweetening the atmosphere by absorbing and decomposing the offensive gases. These properties render charcoal a valuable material in the construction of filters, not only for decolorizing, but likewise for purifying water for domestic use. It is employed successfully to prevent the escape of noxious vapors at the ventilating openings of sewers, as it allows free passage of air, but condenses the offensive effluvia in its pores where they are destroyed by a process of oxidation. Besides its use in the manufacture of gunpowder it has many applications in the arts. In medicine it is at present used chiefly to destroy fetor, for which purpose it is applied in the form of powder or poultice to gangrenous sores, phagedenic ulcers, etc.; it is also largely employed in tooth-powders, as by its mechanical action it removes incrustations, while by its chemical action it destroys fetor of the breath. In indigestion, accompanied by much flatulence, it may be given in doses of two or three teaspoonfuls suspended in water, or may be administered in the form of charcoal-biscuits. Very finely divided poplar charcoal is regarded as the best for medicinal uses. See also CHARCOAL.

WOOD CHEMISTRY AND NEW USES.—The science of chemistry as applied to wood has forged ahead by leaps and bounds. Wood technologists and chemists have discovered many phases of wood not heretofore known. Wood is a source of many chemical wonders, and there have indeed been magic processes in connection with the conversion of wood into useful products. Chemistry is involved in many different processes in the manufacture of pulp and paper products. Chemistry is the means of converting certain wood elements into many forms of medicine, extractives, and distillations, some of which are mentioned elsewhere. By chemistry, through the distillation of a resinous exudation from southern longleaf pine, many million dollars' worth of rosin and turpentine are produced yearly.

The bark of many trees has been found to develop several products. The cascara drug, black oak dyes, insulating wool, slippery elm bark, and hemlock and oak tannins are examples of bark derivatives; from sap and gum come birch beer, maple sugar and syrup, spruce gum, storax and heptane; from dissolved cellulose products in the great pulp and paper industry are developed lacquers, cellophane, photographic films, plastics and rayon, nitrated products, explosives, etc.

By-products of the sulphite process of the paper manufacture include dyes, ethyl alcohol, adhesives, fertilizers, linoleum, paint and varnish removers, vanillin and others. Some products, such as various sugars, ethyl alcohol, carbolic acid, various plastics and wood flour products, may be made by several different processes. One of the by-products of the hardwood distillation industry is wood creosote, as well as wood tar and pitch.

It would be literally impossible categorically to enumerate all of the vast array of products, including chemicals, extractives and medicines that are obtainable from wood. Although science has contributed vastly to an increased knowledge of wood, it is believed only a modest start has been made so far, and that the possibilities of the future are literally enormous.

Availability of Wood.—With all of these new developments, the question naturally arises as to whether our forests will be denuded and whether they will be able to grow sufficiently fast to supply all of these new uses in addition to normal requirements. The science of forest management has advanced rapidly, as well as the science of wood utilization. Methods of regrowing native timber stands are demonstrated to be a more effective method of regrowing our timber stands than by planting trees. Where forests have been burned or cut over so that they do not naturally reproduce, some of our forest lands must be planted with trees. But the knowledge of how to reproduce timber stands naturally has advanced to such a point that there is little likelihood of a timber scarcity. Many of the larger lumber companies are now practicing sustained yield forest management whereby their forests are growing wood, some of them even more rapidly than they are being cut.

Wood Plastics.—Plastics are made from a number of basic raw materials, but wood gives

promise of being the most important single source. There are literally thousands of tons of wood waste available in the form of sawdust, slabs, edgings, and trimmings that heretofore have been burned up or wasted that can be converted into useful materials. Plastics offer a definite field for some of this material. Plastics are those pulped or cellulose forms in which many materials are formed under heavy pressure.

Various bonding agents such as resins and glues are used in connection with them. Many architectural and structural forms, novelties, fixtures, trays, buttons, toys and handles are now being made from plastics. They have supplanted various metal and other composition forms.

Methods of manufacture involve a combination of cellulose and lignin with aldehydes to form a product that is resistant to moisture changes and has no tendency to shrink or swell. Sometimes small quantities of mineral acid are required. Wood in the form of wood flour is commonly used as a source of material. Many of the processes are still regarded as secret. Among the generally recognized processes followed are:

(1) Sawdust is first hydrolyzed with dilute acid under pressure. The solid material is freed from extraneous lignin and then is dried. (See also Wood.) Dried powder is mixed with 10 per cent furfural and air dried. This relatively dry powder is pressed together at 135° C. and 3,000 pounds per square inch.

(2) Sawdust is subjected to the action of dilute phenol at elevated temperatures of 175° C. for a period of one-half hour. The resultant powder is thoroughly washed with water to remove excess phenol and sugars to permit the recovery of the excess phenol. It is then dried and pressed under great pressure.

(3) The third process is to digest the sawdust at somewhat higher elevated temperatures with water alone. The resultant sawdust is washed free of sugars, then dried and mixed with analine and pressed at 135° C. and 3,000 pounds pressure per square inch. Other chemicals seem to give equally satisfactory results, but considerable experimentation is now being conducted to determine some unknown factors.

All of these processes produce a dense and dark colored plastic which takes a brilliant finish due to the high pressures. Some plastics have a modulus of rupture in excess of 6,000.

Zylite is an inexpensive and moisture-resistant plastic which has been developed at the United States Forest Products Laboratory, Madison, Wisconsin. Bakelite is one of the first and well known forms, but there are a great many on the market. Among some of the more important plastic products are phonograph records, telephone receivers, and mouthpieces, electrical receptacles and instruments, trays, and a myriad number of novelties, toys and materials formerly supplied by various forms of hardware made of metals.

Veneers and Plywoods.—Veneers are thin slices of wood, made by three different processes, namely, (1) sawing; (2) slicing; (3) peeling continuous sheets from a log revolved in a lathe. Most of it is made by the last process. Veneer logs, known as peeler logs, are cut into lengths of 6, 8, 10 or 12 feet, and after removing the bark, these logs are placed in a huge lathe, which turns the logs against a long razor-sharp knife. Continuous sheets of thin slices of wood are thus peeled from the log. They are passed down along conveyor tables, and are clipped into various widths and lengths as needed, eliminating such flaws as knots, splits, or other defects, and then sorted according to several grades. The sheets are then sent through automatic driers, where the moisture content is reduced. The thickness of this veneer may be from one-half inch (½") thick to as thin as 1/100 of an inch. Most commercial veneers were normally made of 1/24 to 1/28 inch thickness.

Then these sheets are laid, one upon the other, with the grain at right angles to the sheet immediately above and below it, and bonded together with glue or synthetic resins; thus 3-ply, 5-ply, 7-ply or 9-ply, or more plies, are made to suit various purposes for airplanes, furniture, partitions and hundreds of other uses.

Plywood is pressed in large hydraulic presses, where the bonding agent is set under heat and pressure; then the various panels of plywood are sanded in different thicknesses, and trimmed to specified lengths and widths. Thus sheets four feet wide and eight feet long of plywood can readily be made.

Due to the development of heat and water resistant glues, plywood has reached an enormous consumption, the total amounting to more than 1,193,000,000 board feet of logs. This amount produces more than 5,438,000,000 square feet of veneers from all species.

The principal species used in the manufacture of veneers in order of importance are: Douglas fir, red gum and tupelo. Smaller amounts are made from southern pine, cottonwood, spruce, poplar, and many other species. Douglas fir constitutes about one third of all the wood used for veneers.

The use of plywood has advanced in quantity more than that of other forest products within recent years. The mosquito bomber, built in England, is largely a plywood plane. Plywood is widely used for bombers, trainer planes and cargo planes. Many small boats are now being built of plywood, due to the development of water-resistant glues. The Second World War gave the manufacture and use of plywood a tremendous impetus.

Moisture-resistant glues are largely the protein types, which are principally casein and soybean. The moisture-proof glues are principally synthetic resin glues, and are so waterproof that the plywood can withstand repeated changes of boiling and drying without damage, and are not impaired by salt water. This represents a great advantage in the use of plywoods.

Crossbanding wood to form plywood produces a product whose strength properties are quite uniform in every direction. This is in comparison to wood which develops the greatest strength parallel to the grain. The glue joint is generally stronger than the wood itself, so that some forms of plywood and compressed plywood have replaced steel, aluminum and other metals for many uses.

Laminated Woods.—Laminated wood is made by gluing together layers of wood, either veneer or boards, with the grain of all layers running in the same general direction. This is in contrast to crossbanded layers of veneers known as plywood. Laminated wood is used where longitudinal strength is important; thus a large beam can be formed by joining together a num-

ber of small pieces. Laminated veneers are used for the manufacture of airplane propellers, gunstocks, implement and tool handles, and the larger sizes of laminated wood made from boards form beams and members used in huge structural designs. The advantage of laminated wood is that ordinarily no beam can be cut larger than the tree from which it was sawed. During the Second World War, some huge structures were partly built at least of laminated wood columns, beams and trusses, and in the case of one building, 30,000,000 board feet were used. This would be a sufficient amount of lumber to build 2,000 ordinary single-family frame dwellings.

Wood Extractives.—A large variety of wood, bark and leaf extractives assume considerable importance in chemistry, medicine, commerce and industry. These are principally tannin materials obtained from chestnut wood and from oak and hemlock barks. Domestic dyes are obtained from Osage orange wood and the leaves of sumac, but there is also a variety of logwood and other foreign materials imported for dye purposes. Besides these principal extractive products, there are mucic acid, obtained from western larch; cascara, used in many medicinal preparations, obtained from the cascara tree, on the north Pacific Coast; volatile oils from sassafras, sweet birch and Virginia red cedar; storax from sweet gum; Canadian balsam from balsam fir; Oregon balsam from Douglas fir; the bud balsam from the buds of the balsam poplar, and a large variety of leaf oils chiefly from pine and cedar. Of our total consumption of tannin materials, about one half is normally secured from foreign sources, of which quebracho wood from South America is most important. Others are wattle bark, Myrobalan nuts and mangrove.

Compressed Woods.—Compressed wood, also known as «compreg,» is a development (announced in 1944) whereby a heavy, strong and very dense wood product is made, by heavily compressing laminated resin-treated veneers in the presence of heat. The wood is soaked before pressure in an impregnating chemical called methylolurea. The wood fibers are compressed to such an extent that it greatly increases the density, strength and hardness of the wood. «Compreg» has been developed for use in gears, die castings, and the replacement of many articles and parts previously made of metals. Compressed wood can be made to resemble closely the hardness and other structural features of metals. It can be made to appear similar to lignum vitae, ebony, and quebracho, which are among the hardest known woods (quebracho is so dense and hard that it cannot be cut with an ordinary saw). The importance of this process can be appreciated when it is realized that soft woods so treated become hard as oak, and oak hard as ebony. Furthermore the product does not appreciably warp, split, swell or shrink; it can be dyed any color and, since the dye permeates the material, it requires no painting or refinishing.

Preservative Treatment.—In the 20th century the preservative treatment of wood to prolong its life in service has taken on new significance. The reasons for preservative treatment are as follows:

(1) Decay is responsible for 90 per cent of all timber and wood replacements. About eight billion board feet are annually destroyed by living organisms, known as fungi. Fungi require a certain degree of moisture, warm temperatures and oxygen for their existence. If any of these conditions are removed, wood will practically last forever. Piling driven by Caesar to cross the Tiber River about 2,000 years ago has been removed and found to be in sound condition.

(2) The supply of naturally durable woods is decreasing, and by preservative treatment, perishable woods can be made to last for several times their life in natural condition.

(3) Increasing costs of transportation.

(4) Replacement charges for crossties, piling and jetties are high. Marine borers, such as teredo and limnoria, have destroyed enormous quantities of untreated piling, wharves and other timbers used in the warmer climates.[1]

Good preservatives must be toxic, that is poisonous to fungus growth, not too soluble, must not affect the strength of timbers in service, and must be reasonably inexpensive. Some of the outstanding preservatives for widespread use are creosote and zinc chloride; other forms are mercuric chloride, and many other preparations.

There are several methods of treating wood to increase its length of life in service. They are by painting the surfaces, by dipping the material in the preservative and by pressure treatment. Most of the material is treated by the latter method. Crossties, timbers, poles, etc., are run on tram cars into long cylinders up to 150 feet or more in length. Both green and seasoned wood are used. Sometimes a vacuum is exerted, or a live-steam bath given the wood. Then the preservative, usually creosote, is put into the cylinder, and literally forced into the wood fibers by pressure. There are four good methods of pressure treatment, the Bethell system, the Rueping process, the Lowry process and the Card process. Treating plants are erected for the use of railroads, lumber companies, pole and piling yards and other concerns interested in the preservative treatment of wood, so that they will last from three to six times as long as under ordinary circumstances without treatment.

Fireproofed and Fire-Resistant Wood.—Because wood is a combustible material, there are certain building restrictions against its use where fire hazards are severe. Methods of impregnating the fibers of wood with a fire-retardant have been developed whereby interiors of structures, particularly boats and ships, office buildings and homes can be made fire-resistant. Warehouses and factories made of large wood beams enjoy a lower fire insurance rating than similar structures of steel. When treated with fire-resistant chemicals, wood can thus be made more desirable as a structural material, particularly for some interior construction. Fire-resistant doors have been in use in our larger cities for many years. Chemists and engineers are now engaged in further developing methods of fire resistance to increase rapidly the use of wood for these purposes.

Wood Distillates.—Wood is a source of many distillation products, widely in demand for war purposes as well as for normal conditions. The principal products of wood distillation are wood alcohol; charcoal; acetate of lime and vari-

[1] Between 50,000,000 and 100,000,000 crossties are used annually to keep the 450,000 miles of railroad tracks in the United States safe and sound. In building the Alaskan highway, over twelve million board feet of pressure treated timbers were used. Other important wood products treated are: paving blocks, crossarms, wooden pipes and many other specialized products.

ous wood tars and gas. About 10,000,000 gallons of wood alcohol are yearly produced in the United States, which is used as a solvent largely in the paint and varnish industry, as well as in the aniline dye factories to make colors, and for the manufacture of photographic films, the stiffening of hats and the manufacture of formaldehyde. Normally about 100,000 tons of acetate of lime are produced yearly. This is used principally for the acetic acid industry, and as a source of acetone. Acetic acid is used largely in the textile and leather industries, and in a great variety of other industries. It is of significant use in the manufacture of cordite and lyddite two important high explosives. Acetone is used as a solvent for the cutting of guncotton and in the manufacture of smokeless powder.

Charcoal is used in the manufacture of the highest grades of iron; for domestic fuel and for many chemical purposes. It is widely used in the manufacture of chemicals. The wood gas developed in the hardwood distillation process is used for illuminating and heating purposes. The most important woods used for hardwood distillation products are: beech, birch, maple, oak and hickory. Hard, heavy, well-seasoned wood, free from tarry, resinous or tannic substances are preferred. Heartwood is preferred to sapwood. Lightweight hardwoods such as basswood, cottonwood and yellow poplar are considered undesirable.

The industry has been developed principally in Pennsylvania, Michigan, New York, and Tennessee.

In the South, the softwood distillation industry is of considerable importance. There are three processes known as the (1) destructive process, (2) the steam and solvent process, and (3) the sulphate wood process. The high resin content of the southern pine trees is especially desirable, and stumpwood is commonly used. The above processes are different from the one followed in the hardwood distillation industry.

The principal products are wood turpentine, pine tar, rosin and various pine oils. The residue from the manufacture of these distillation processes is often used for the manufacture of fiberboards. One company has a daily capacity of 100,000 square feet of 1-inch fiberboard obtained from the waste products of the southern pine softwood distillation industry.

Sawdust and Its Products.—The profitable utilization of enormous quantities of sawdust products in the manufacture of lumber has for many years been a great problem. However, important advances in utilization have been made, particularly in wood flour, which by several processes is manufactured into explosives, composition flooring, matting, linoleum, fiberboards, bowling balls, wallpaper and phonograph records. Through the process of wood hydrolysis, cellulose in such wastes may be converted into various forms of sugar, chiefly glucose, and later into foods which are already used for cattle, horse and swine feed in Europe. In Europe, the well-known Bergius and Scholler processes have been developed, and this field gives wide promise for the future. Already a large plant had been installed in the United States on the West Coast to produce various forms of sugars, ethyl alcohol, animal foods and related products.

Through the various processes of wood hydrolysis and fermentation, other products are acetic acid, baking yeast, carbolic acid, ethyl alcohol, glycerine, furfural and lignin powder.

Sawdust is also an important source of plastic molding powder and sheets from which are produced dishes, battery boxes, trays, electric appliances, handles and many forms of instruments.

Sawmill Shavings.—In the manufacture of lumber, enormous quantities of wood are ordinarily lost in the planing of rough lumber to a finished board for painting or for general use purposes. The equivalent of a billion board feet of lumber is lost annually in the form of planing mill shavings.

In 1930, a large company began to make briquettes from sawmill shavings and dry sawmill refuse. Now a large volume, estimated to be several hundred thousand tons, of compressed shavings, known as briquettes, are widely used and sold on a competitive price basis with other forms of fuel, such as wood, coal, fuel oil and gas. These briquettes are about 4 inches in diameter and 12¾ inches long. Each briquette weighs about 8 pounds, which represents three times the normal weight of the wood from which the briquette is made. Briquettes are commercially known as «presto logs.» One company operating 12 machines produces about 120 tons per day. These briquettes are in wide demand for their cleanliness, convenience, freedom from ash and relatively small space for storage. They are used as fuel in kitchens of diner and lounge cars, for rolling and field kitchens of the army, automobile trailers and many ocean-going vessels. This method is very successful where there is an available supply of dry shavings, especially of pine or other resinous woods.

Timber Connectors.—The development of timber engineering techniques in the use of wooden trusses, beams and columns has vitally changed the use of wood in large structures, particularly for hangars, oil derricks, warehouses, factories and similar structures. By the development and use of certain metal rings and connectors, the strength of the various members of wooden structures is vastly increased. Some of these timber arches rise 153 feet above the floor of buildings with clear spans up to 237 feet wide. This is far beyond the height and width of spans and unsupported trusses heretofore used. Thus timbers are displacing steel in many forms of structures formerly built of steel skeletons.

Wood Fuels.—Wood has always been used as one of the most important sources of fuel, particularly before the discovery of coal, oil, natural gas, electricity and other sources of heat and fuel. Fuelwood still comprises one of the most important products of our forests. But since the 1920's, with the advancing price of gasoline, notably in Europe, charcoal, made of wood, and chunks of wood itself, have been used in hundreds of thousands of automobile trucks and other forms of engines as a source of motive power. If our petroleum resources become exhausted, as predicted by some engineers and petroleum authorities, wood may replace gasoline as a source of power.

A fire is lighted at the base of the fuel box containing charcoal or wood chunks, and as the drafts are regulated, this fuel, under partial combustion, gives off a gas, which after passing through a gas-cleaner and cooler known as a gasogene is sent directly to the carburetor, and the engine is started and continues operating in the same way the power is generated from gaso-

line vapor. In Europe, wood fuel maintains hundreds of thousands of automobiles, engines, trucks and locomotives. As wood is a renewable resource, it is widely available for use as a motor fuel, both as a source for wood gas and for alcohol which also is widely used in some countries for this purpose.

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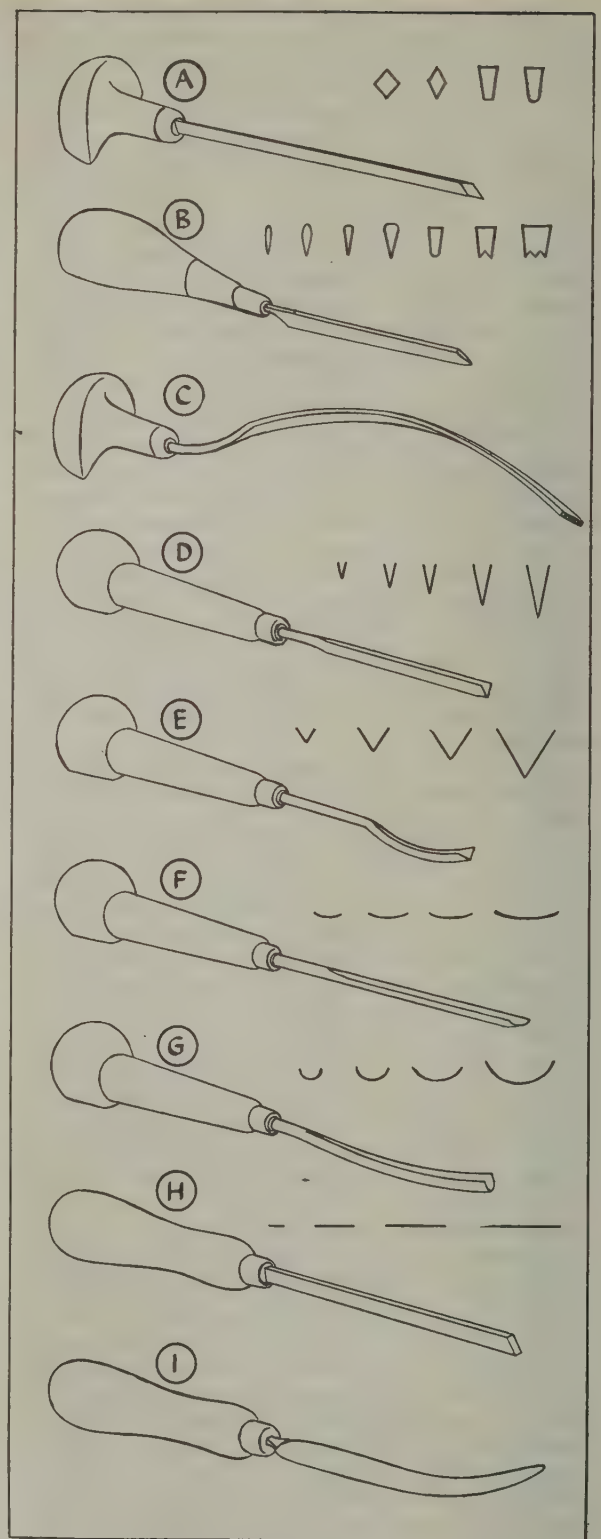
WOOD DUCK, or **SUMMER DUCK,** the most beautiful of American ducks (*Aix sponsa*). The bill is very high at the base shorter than the head; nail very large and much hooked; head crested; tail short, wedge-shaped. The head and crest are metallic green, glossed on the sides with purple; line through the eye; two bars on side of head meeting under the chin, and upper throat, white; lower neck and sides of tail purple, the former with triangular spots of white; lower parts white; sides yellowish banded with black and posteriorly with white; speculum bluish green, tipped with white; primaries silver white externally at tip; back uniform, with bronzed and green reflections; a white crescent in front of wings bordered with black; scapulae and inner tertials velvet black with violet gloss. In the female the back is more purplish, the sides of head and neck ashy, about the bill white, and lower neck brownish; the eyes are red. It is 19 inches long and 29 in alar extent. In most parts the plumage is iridescent with changing metallic reflections.

Formerly the wood duck, one of the most characteristic birds of our fauna, was abundant and widely distributed through the wooded and watered portions of the United States and southern Canada, but as a result of an unholy warfare it has become practicallv extinct over large areas. It is confined to fresh water, especially secluded ponds in woods. The flight is noiseless, very rapid, graceful and as easy among the branches of trees as that of the wild pigeon. It breeds from April to June, according to latitude, the nest being made in the hollow of a tree, or in the deserted excavations of the woodpecker or squirrel, and usually in deep swamps, though often in the vicinity of houses, for they are not shy birds. The eggs are 6 to 15, 2 by 1½ inches, pale buff and greenish, smooth and laid on dried plants and feathers. They are much attached to the breeding places. The young leap down, or are conveyed to the ground or water by their parents. The adults are excellent divers and feed on acorns, nuts, grapes, berries, rice, insects, snails, tadpoles and small fry. The chief enemies of the adults are minks, raccoons and snakes, and many of the young are destroyed by snapping turtles, alligators and predaceous fishes. It is easily domesticated and readily breeds in captivity. The only other species of the genus is the famous mandarin duck (q.v.) of China. Consult Grinnell, *American Duck Shooting* (New York 1902).

WOOD ENGRAVING. The art of wood engraving is also known as *xylography,* a distinctly modern term derived from the Greek words *xylos*—wood, and *grapho*—to write, to inscribe. It is the art of producing in relief a reverse or negative of a picture on wood which when inked and impressed on paper or other surface will make a positive of the picture.

If to the art of printing we owe an inestimable debt for bringing to us the record of the thought and history of all times, to the kindred and older art of the wood engraver we owe almost equal obligations. It gave to the com-



Tools used in wood engraving, and shapes of cuts.
A. Solid burin or graver
B. Solid tint tool
C. Stipple graver (for cutting dots or dashes)
D, E. Hollow V or parting tools
F, G. Gouges
H. Chisel
I. Burnisher

mon people the pictures by which they could be made to understand the purport of written and printed words.

Saint Christopher, the earliest wood engraving, size of original 11⅛x8⅛. Date 1423

Technique.— While the recent inventions of "process engraving," using photography, labor-saving tools, etc., make the technique of working complicated, the great works of the great masters of wood engraving were done in the very simplest manner. A block of close grained wood (boxwood only is used these days) receives on one side a perfectly smooth and polished surface. Its thickness is .918 of an inch, known as "type-high," or the height of the type along with which it may go into the "form" for the press. The smooth side is next covered with a layer of white chalk (this is known as "grounding") which is better to draw on than the smooth wood surface. On this the drawing is made in negative (the reverse of what is desired in the impression), any lettering, therefore, must read backwards. The work is now done direct on the block by photography, necessitating a sensitized surface instead of the above-mentioned grounding. From the artist or photographer the block goes to the wood engraver, who, using formerly a draw-knife but now a burin, cuts away cleanly to a certain depth all that the artist has left untouched, so that after the work is finished only the drawing remains on the upper surface, and it is in relief. If the finished woodcut be covered with printers' ink and pressed on paper or similar material it gives the imprint of the original drawing. Over and beyond manual dexterity, won by long practice, the wood engraver must also possess a certain degree of artistic temperament as well as being an expert draftsman, even when it is only a question of reproducing the drawing. But, as is the case with many illustrated sheets, there are frequently no lines but the drawing is in water colors or stumpwork. In such cases the engraver must translate the soft tones of the paintbrush either with his own technique or imitate them exactly (facsimile or tone cut). This latter art is the modern technique of American wood engravers, they being the inventors of it. So great is the difference between the old and the modern methods of producing wood engraving it is necessary to devote a few words to these differences in technique. From the 15th to the 18th centuries and even later the blocks were plank cut, that is to say the upper surface ran with the grain. Pear-tree or apple-tree wood was generally used and it was engraved with the draw-knife. The modern technique uses the cross-cut surface and boxwood exclusively, because it has the most regular texture or fibre. The knife has given way to the burin, used as on copper-plate engraving; the burins are of several forms used each for its separate purpose, whether for engraving outlines, or cross-hatching, or tone effects, etc. Again for a series of straight parallel or curved parallel lines and for the backgrounds of landscapes and portraits special machines have been invented which produce lines or stippling of more refinement and accuracy than is attainable by hand, at the same time greatly increasing the speed of execution. By changes in the process of treatment several new styles of wood engraving have come into being which will be treated of later, such as the criblé, chiaroscuro, "color" styles. An original woodcut permits the taking off of from 6,000 to 10,000 impressions, but to increase its efficiency in the number of prints possible the process of electric deposition of metals has been called into practice and *clichés* reproduce, in metallic relief, the surface engraved on the wood. As there is no limit to the number of *clichés* which can be taken from a single wood block, the number of impressions possible also becomes infinite.

The Grief of Hannah, from the Cologne Bible, about 1475

History.— The date of the actual origin of printing from engravings on wood is still in doubt; it is an involved question. In India stamps engraved on wood have been in use for printing colors on fabrics from a very distant past. Already in the 10th century the Chinese were acquainted with books printed from tablets of wood; and the illuminators of the Middle Ages used wooden embossed stamps for

impressing the outlines of colored initials on manuscripts. The earliest known examples of wood engraving date from the early part of the 15th century when in various parts of northern Europe, notably in Germany and the Netherlands, there existed various rude prints representing scenes from Scripture and the lives of the saints, evidently made from woodcuts. They were printed in a pale brown ink apparently by rubbing on the back of the paper with some blunt edged instrument and were generally colored either by hand or with the use of a stencil.

The Fall of Lucifer, from the Speculum Humanæ Salvationis

One of the most noted of these and the earliest dated print from a wood block is the famous Saint Christopher of 1423 found pasted in the cover of a manuscript discovered in the library of a convent in Buxheim, Swabia. It represents Saint Christopher wading across a stream with the infant Jesus on his shoulder. On the right bank a hermit is kneeling before his cell holding a lantern in his hand, on the left a peasant is climbing a steep hill on the way to his home. It is a rude cut without any regard for perspective, but the figure of Saint Christopher possesses a certain dignity and the pictorial effect is such as would appeal to a primitive people. Many similar cuts were produced in the 15th and 16th centuries in the cities of Augsburg, Nuremberg, Ulm, Cologne and the Flemish cities. Conventional in design and often repeating again and again the same subjects, they were yet expressive of the mediæval religious conceptions and were no doubt highly effective in giving particular and comprehensible value to the biblical lessons they were intended to convey.

It has been contended by some authorities that wood engraving really began with the invention of playing cards, but no authentic records are available of their having been printed before 1423, the date of the Saint Christopher, and they appear to have been made with a stencil. The making of sacred prints very soon developed into a large business, and by the middle of the 15th century wood engraving was an established and widely familiar art. Coming before the invention of the printing press, when books in manuscript only were the treasured possessions of the great monasteries, these prints were of inestimable value in the cause of popular religious education. From the very first wood engraving has been an art for the people. In the beginning serving religious purposes only it soon became a means of satire and comment upon the abuses of the clergy and a record of the manners and customs of the times.

In the early part of the 15th century many minds were striving toward the invention of a way to print from movable types. The idea came no doubt from the so-called block books. Many of the early prints bore the name of a saint or a short legend which was evidently cut on the block with the picture. From these legends it was a natural step to extend the text and add whole columns of text. The date and place of the earliest of these block books is a matter for conjecture, but they were known in the early part of the 15th century. One of the most widely discussed of these is the 'Biblia Pauperum,' or Poor Preacher's Bible, several editions of which are known. It is a small folio containing 40 pages printed on one side only in a pale brownish ink by means of rubbing on the back. Each page is divided into five compartments separated by pillars, suggesting the idea of church windows. The central panel shows a scene from the Gospels and on the sides are illustrations from the Old Testament bearing on the central design. There are also texts and Latin verses. Another block book that has given rise to much speculation is the 'Speculum Humanæ Salvationis,' or 'The Mirror of Human Salvation.' In this the text appears to have been printed from movable type in black ink on a press. It is, therefore, the oldest extant typographical illustrated work known. Other famous block books are the 'Apocalypsis Sancti Johannis,' Visions of Saint John; 'Ars Moriendi,' The Art of Dying; 'Canticum Canticorum,' or a History of the Virgin prefigured in the Song of Solomon. All of these are curiously and often grotesquely mediæval, full of the symbolism and mysticism of primitive humanity. Rude as they are, though, they were preparing the way for something better.

Other noted block books extant are 'Liber Regum,' Book of Kings; 'Temptationis Dæmonis,' Temptations of a Demon; 'Endcrist,' the only copy known is in the Spencer Library; 'De Generatione Christi,' of the genealogy of Christ; 'Miribilia Romæ,' The Wonder of Rome; 'Confessionale,' of the Confessional; 'Symbolum Apostolicum,' Symbols of the Apostles.

These German and Netherlands block books were issued in numerous editions and had quite a large foreign circulation. 'Ars Moriendi' was issued in Latin, German, French, Italian and English, the texts varying. Some of these block books were cut up later and pieced together in different combinations in later editions. It must be noted, however, that the engravings done in the Netherlands were, almost invariably, of a more artistic character than those emanating from German hands.

With the advent of printing the block books

were superseded and wood engraving became a handmaid of the greater art. Illustrations are to be found in many of the books of the early printers. The earliest wood engravings in a printed book with an authentic date appear in the Psalter of Faust (or Fust) and Peter Scheffer (or Schaeffer) published at Mayence in 1457. From Cologne, Mayence, Nuremberg, Ulm, Augsburg, Strassburg and Basel came many printed books illustrated with wood engravings.

The Bible was the book on which the early printers spent most of their energies. Numerous editions were published with illustrations. The most important of these was the famous Cologne Bible which appeared before 1475. Its 109 designs were, after the block books, the first illustrations of Scripture, and they showed more originality and invention than anything that had gone before. Many of the decorative borders of this Bible are in curious contrast to the sacred text.

The tendency of the early printers to trade cuts is made clear by the fact that the Nuremberg Bible, published in 1482, contains woodcuts from the Cologne Bible, published between 1470 and 1475. The Augsburg Bible, published about 1475, is a most elaborately illustrated work; Gunther Zainer is said to have been the publisher. With the exception of two, all the 73 woodcuts are placed in combination with initial letters and absorb a full column of space.

Next to the Bibles in interest in the study of wood engraving are the numerous 'Chronicles' and histories. These are records of legends and imaginery events and are illustrated with woodcuts dealing with the lives of the saints and the great happenings in local history. One of the best known of these chronicles is the one published at Nuremberg in 1493. Hartmann Schedel, a Nuremberg physician, compiled the work and it was printed by Anthony Koburger. It has over 2,000 cuts, views of cities, saints, portraits, etc., and is supposed to have been supervised by William Pleydenwurff and Michael Wohlgemuth, the latter a master of the great Dürer. The chief distinction of the Nuremberg Chronicle lies in the fact that in it for the first time woodcuts were printed in simple black and white. They were modern in this respect and in the use of cross-hatching by which grays and blacks of varying intensity were obtained by engraving lines that crossed each other at different intervals.

Another peculiar feature is the fact that the same single cut is used to represent a number of different poets, etc., or one cut suffices to depict views of several cities, etc. This economical method of multiplying the usefulness of a woodcut occurs frequently in contemporary works.

An old style of book of the 15th century also is the figure alphabet, in which the pages are devoted to forming initial letters from figures of all kinds posed in attitudes conforming to the outlines of the capital letters. All these early 15th century books were printed by a rubbing process, either some form of burnisher or roller pressed the paper over the block. The book printing press was not invented till the latter half of the century.

In France wood engraving was early identified with printing. Religious books contained many curious and often beautiful illustrations. Those known as the 'Livres d'Heures,' Books of Hours, often contained many fine examples of carefully executed blocks in imitation of miniatures. Many of these early woodcuts served simply as an outline for the colorist, who often overlaid them with an entirely different design. The first really effective artistic use of the decorative border may be seen in these 'Livres d'Heures,' and some of them are notably quaint

The Ploughman, from the Dance of Death. by Holbein

embodiments of scriptural ideas combined with others that are certainly not to be found in the sacred Book.

At Lyons several books with woodcuts were published about 1476, but the engraving is of the same coarse German grade, till, in 1493, an edition of Terence was issued with illustrations of a more artistic nature. In Paris we find among the publishers of the above-mentioned books of devotion ("Hours"), history, romance and poetry, such names as Jehan Du Pré, Guyot Marchand, Pierre Le Rouge ('La Mer des Histoires,' 1488), Pierre Le Caron, Antoine Verard, etc. Those engravings done by Jean Foucquet and Jean Perreal showed ambitious art work that needed no pigments for embellishment. The books from these publishers found a wide foreign circulation in their Flemish, English and Italian versions. Guyot Marchand's 'Danse Macabre,' Dance of Death (1485), shows most merit in its illustrations. The French brought out a new style, termed by us "criblé," in which the delineation is composed of dots; Renouvier says it was the goldsmiths' manner of engraving and may have been impressed, in some cases, from metal.

England lagged behind other countries in her art development, and wood engraving was little known there before the publication of Caxton's 'Game and Playe of the Chesse' published in 1476 and it is thought that the cuts in this were imported from Germany, and they are too crude for the English to dispute the claim. In Italy the earliest wood engravings were either importations from Germany or were suggested by German originals. The most noted example of early Italian wood engraving is the 'Hypnerotomachia Poliphili,' or Dream of Poliphilo,

written by a Venetian monk in 1467 and printed by the famous Aldus, in Venice, 1499. It contains 192 woodcuts on such subjects as mythology, ancient history, processions, etc. The Italians developed a method of engraving in chiaroscuro, in imitation of painting, by the use of several blocks, each printed in a different color. The Germans also employed the same methods, but in a much cruder form.

With the advent of Albrecht Dürer (1471–1528), of Nuremberg, wood engraving reached its highest attainment. First of all he was a great designer with a far-reaching and powerful imagination and a mind full of the new learning and spirit of the coming Reformation. He was the first fully to realize the great possi-

The Savages of Calient, from the Triumphal Procession by Burgkmair

bilities of wood engraving, and by his influence it was raised to the dignity of a fine art. He is known chiefly by four great works. The first of them the 15 large drawings illustrating the Apocalypse of Saint John (1498). Others are the 'Larger Passion of Our Lord' (1509–11), 12 cuts, 'The Life of the Virgin,' 20 cuts, and the 'Smaller Passion of Our Lord,' 36 cuts. Among Dürer's other famous works are the 'Car and Gate of Triumph' made for the Emperor Maximilian. Another great work celebrating the emperor's fame was by Hans Burgkmair (Augsburg, 1472–1531) the magnificent 'Triumphal Procession,' etc. The colossal work entitled 'The Triumph of Maximilian' was made by command of that emperor and consisted of three sets of designs: "The Triumphal Procession,' 'The Triumphal Arch,' and 'The Triumphal Car.' Its size is enormous, the "arch," composed of 92 blocks, when displayed in their correct relative position, is 10½ feet high by 9½ feet wide. While the designs were by Dürer and Burgkmair the execution of the work was by highly talented and enthusiastic wood engravers with Jerome of Nuremberg and Jost de Negker or Dienecker at the head of the list.

Dürer's masterly activity in wood engraving gave rise to a school (some of the members were pupils) of decorative designers of great talent who put their conceptions into engravings, forming them into sets, books, etc. These artists are known as the "Little Masters," and their fine work created a general renaissance in the arts of decoration; the jeweler, the potter, the cabinet-maker, all artisans incorporated in their work beautiful decoration taken from the popular designs published and widely circulated all over Europe in these engravings. The best known of these 'little masters' are Beham, Baldung, Aldegrever, Amman, Virgil Solis, etc.

Hans Holbein (1497–1543) ranks among the really great artists and wood engraving owes to him a still further advance. Holbein indeed might be well called the father of modern illustration. Among the first books he illustrated were the 'Utopia' of Sir Thomas Moore and the biblical translations of Luther. He is best known, however, for his remarkable series of designs known as the 'Dance of Death' (1538), a popular subject of mediæval times. In each of the 41 designs is a scene from common daily life expressed with a grim dramatic power and truth of drawing that are remarkable in a very high degree. Death spares neither the king nor the peasant, the praying nun nor the priest in the pulpit. Much of their success was due to the wonderfully accurate wood engraving of Hans Lützelburger, for in the hands of a less skilful engraver the originals would have lost much of their power. Holbein's 86 designs for the Old Testament, generally known as 'Holbein's Bible Cuts,' were also remarkable in many aspects, but they were more conventional in conception. After Holbein, wood engraving as an art steadily declined.

Early in the 16th century either Jost de Negker, German, or Ugo de Carpi, Italian (disputed claims) invented the so-called "chiaroscuro" process by which color effects are gained by using a series of wood blocks each impressed over the other, a separate color being produced by each successive addition. Carpi reproduced several of Raphael's designs by this method, and in Germany were reproduced sheets from the designs of J. Wechtlin, Burgkmair, Cranach, Baldung and others.

A revival, in a modern sense, began with the work of Thomas Bewick (1753–1828) in England. To him we owe the great principle of the white line which did away with much of the old drudgery and gave the engravers more freedom in handling. In the old way, where black lines crossed, the little white lozenges between had to be laboriously cut away, Bewick simply gouged out with his graver a line and by varying the width and number obtained his gradation of light and shade. He was the first also to use boxwood and the burin. Bewick is best known by the drawings and engravings in his 'British Quadrupeds' and 'History of British Birds.' He was the founder of the modern British school which held for many years a distinguished place in modern illustrative art. Bewick's pupils, Charlton Nesbit and Luke Clennell; Robert Branston, John Thompson, the Dalzels, William Harvey and W. J. Linton engraved the work of many distinguished English artists. In France and Germany wood engraving has maintained a distinct place in spite of process work and some of it has been and still is of a very high order of merit. In France a pupil of Bewick's, Charles Thompson, intro-

duced and brought together a school of wood-engravers using the refinements of the English master. In Germany, where the art of wood engraving was in an expiring condition from the middle of the 18th century, new life was developed early in the 19th century by the two Ungers and recent methods of treatment aided the reputations of Gubitz in Berlin and Blasius Höfel in Vienna. Adolf Menzel trained for the reproductions of his illustrations the engravers Unzelmann, A. and O. Vogel, H. Müller and Kretzchmar. In France the leading names of wood engravers include Leloir, Regnier, Laccate, Brevière, Porret, Count Laborde, Gérard, Bernard, Bréval, Chauchoin, Lepère, Pannemaker (son), Baude, Thiriat, Huyot, Grenier, etc.

It is to America, however, that we must look for the greatest achievement in wood engraving. Our artists have carried it to a degree of perfection unparalleled anywhere else in the world. They have taken it out of the domain of a largely mechanical handicraft and given it almost the individuality that belongs to creative art. The first American wood engraver of distinction, Dr. Alexander Anderson, was a follower of Bewick. His work appears in many early American books. Joseph Alexander Adams was another early American wood engraver whose work was even more worthy of study. The notable wood engravings made for the Harper Bible published in 1843 were done under his supervision.

To the great English and American magazines we owe the incentive and the opportunity for the development of the best wood engraving. Even before a way was discovered by which drawings might be photographed on the block, American engravers had begun to show their capacity for interpreting the lines and tones of drawings with exceptional accuracy and originality. In some instances attempts were made to copy the qualities of brush marks and the textures of different mediums such as pencil and charcoal, etc., but this was only a passing phase of an attempt at superior cleverness. W. J. Linton who spent the later years of his life in America was a leader in the effort to make wood engraving more of an individual art and although he was not always in full sympathy with the tendency toward a greater refinement of line and an effort that seemed to him to be leading away from the legitimate purposes of wood engraving, he was a very great power for good, J. G. Smithwick, long identified with the art department of *Harpers'*, and Alexander Wilson Drake, of *Scribner's Monthly* and the *Century*, did their full share in the development of the art. Frederick Juengling, J. P. Davis, Frank French, F. S. King, Wm. B. Closson, Henry Wolf, Thomas Cole, Thomas Johnson, Elbridge Kingsley, Gustav Kruell, William Muller and others are names identified with the highest attainment of American wood engraving.

In other countries we find admirable exposition of wood engraving done by such artists as A. Brown and his school at The Hague and Antwerp, with Vermorken, Pannemaker (father) and Bosquet prominent; in Italy Fabris and Ratti must be mentioned.

With the advent of process work (see PHOTO-ENGRAVING) the demand for wood engraving has greatly diminished and its employment as a reproductive art is constantly decreasing. It is a beautiful art as exemplified by the best practitioners, remarkable for its brilliancy of effect in pure black and white, requiring the most delicate skill in its manual execution and a feeling and invention with respect to the correct interpretation of values and textures of a very high order.

With the passing of the men of to-day who have given wood engraving a place among the fine arts, it is likely that it may cease to be a field for further endeavor. There are no longer incentives for its study and the time and artistic training necessary for any real accomplishment can be put to much better profit in other directions. Prints by famous wood engravers are already much sought by collectors and the future historian of the art will probably end his record with the close of the 19th century and the beginning of the 20th.

More than to any other of the graphic arts are we indebted to wood engraving. It led the way to the invention of printing and has been the means of putting before the world a record of the progress of the greater arts of drawing and painting. See also ENGRAVINGS.

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CLEMENT W. COUMBE.

WOOD-FROG. See FROG.

WOOD-IBIS, a kind of stork (q.v.).

WOOD-LARK, a European lark (*Lullula arborea*) closely allied to the sky-lark (q.v.), but distinguished by its smaller size, shorter tail, a distinct light streak over the eyes and ears and more distinct markings on the breast. It perches upon trees, and is found chiefly in fields near the borders of woods. Its flight is much less extensive and powerful than that of the sky-lark. The wood-lark often sings during the night, and on this account has been mistaken for the nightingale. "Its song" is described as "sweet and flute-like, more melancholy than that of the sky-lark, and is generally uttered from the top of some tree or else when the bird is on the wing. It rises to some height before commencing, then ascends, singing, higher and higher, throwing itself from side to side, hovers and floats in the air, and when the song is ended drops with closed wings to the ground again." It bears confinement well, singing sweetly in the cage, and even breeding easily there or in an aviary; hence it is constantly caught and kept. The nest is generally built under bushes. The eggs are five in number, of a dusky color, spotted with deep-brown spots.

WOOD-LOUSE, one of the little isopod crustaceans (see ISOPODA) of the family *Oniscidæ,* which abound underneath logs and in decaying stumps in the woods, and which, when touched, curl up for protection like armadillos. They are numerous and hardy, the sexes are distinct, and the young are hatched from the eggs in their full form, passing through no metamorphoses. The names pill bug, armadillo and sow bug are sometimes applied to the wood-louse.

WOOD-MOUSE, the red-backed mouse (q.v.). In England the long-tailed field-mouse (*Mus. sylvaticus*) is so called.

WOOD NYMPH, a minor pagan divinity supposed to live in trees and woods. This is the common name, also, of the beautiful lepidopterous insects comprising the genus *Eudryas* which are very common in the United States. It is one of the chief enemies of the grapevine. Its front wings are of a creamy white with a purple-brown border. The eggs are laid on vines in midsummer and the caterpillars develop black and orange lines and feed on the vines until September, after which they hibernate as chrysalises. Arsenate of lead sprayed on the vines is a most effective remedy against this pest of the vineyard.

WOOD OIL, the name given in commerce to a resinous juice which exudes from various trees of eastern Asia. It has a fine aromatic odor, and is used for a great variety of purposes; in medicine as a substitute for copaiba balsam; by sailors for paying the seams of a ship instead of tar; by painters as a varnish; also in the making of lithographic ink, etc. It is an excellent preservative of timber against the attacks of white-ants. It is strictly an oleo-resin, and is also known as gurjun balsam.

WOOD-PEWEE. See PEWEE.

WOOD-PULP, wood that is reduced to a mass of pulp and mixed with water — the fundamental process in making paper from wood. There are three kinds of wood pulp — ground wood, soda-process wood and sulphite-process wood; the latter two are not wood in either physical or chemical properties, but cellulose, similar to cotton fibre in appearance and nature. (See PAPER; PAPER INDUSTRY IN AMERICA). The name of wood-pulp is generally understood as designating mechanically ground pulp as distinguished from chemical pulp, or cellulose. In the manufacture of mechanical wood-pulp a block of wood is held against the surface of a rapidly revolving grindstone by hydraulic or other pressure, a stream of water pouring down upon the stone carrying away the disintegrated fibres into a stuff-chest, where they are mixed with a percentage of sulphite or other cellulose, and are then ready to go on the paper machine to be converted into paper. Spruce principally, but also poplar and other soft woods are used in the manufacture of this pulp.

Ground wood was developed in Germany in 1847 by Keller and perfected and patented by Henry Voelter, who constructed a machine which is in general use to-day. Mr. Albrecht Pagenstecher, of New York, bought and controlled the Voelter patent and introduced this industry into the United States in 1867–68, importing two machines, which were set up in Curtisville, Mass.

The introduction of this new process marked a new era in the manufacture of paper. It furnished a cheap and abundant raw material, simplified the former complicated methods of preparing stock for paper machines, and improved the quality of the paper made, besides cheapening the cost of production. Without wood-pulp it would be impossible to supply the demand for paper at the present day.

Wood-pulp was first sold at eight cents per pound, but finally dropped to less than one cent per pound, and brought the price of newspaper from 14 cents in 1868 down to less than two cents per pound in 1890 to 1900, making the one-cent newspaper possible.

The introduction of ground wood-pulp printing paper into rolls completely revolutionized modern methods of journalism. The absorbent quality of this wood-pulp paper made the modern rapid printing press practicable, eliminating the allowance for drying and limiting the printing speed only by the mechanical possibilities of the press, which were in no way dependent, as in the case of rag paper, upon the drying of each sheet. Such an improvement caused immediate changes in the making and printing of the newspaper, and as soon as the results of this new process became commercially practicable, the entire system of news gathering changed as well.

The output of wood-pulp, which in 1868 was less than one ton per day from the only mill then in existence, increased by 1900 to over 5,000 tons per day in 188 mills, requiring in its manufacture nearly 2,000,000 cords of wood annually. About this date the wood-pulp industry of Canada became important, and in 1928 the total production of pulpwood was 6,328,586 cords of

the value of $74,848,077. For other statistics, see PAPER.

The introduction of this new process was made under many difficulties, the greatest of which was to overcome the prejudice of paper-makers, who believed that rags were the only fit substance to make paper of, and considered wood-pulp as an adulteration or shoddy. At present every newspaper is composed largely of ground wood-pulp, with a small percentage of chemical fibre. Many book, wrapping and other papers also contain a large percentage of ground wood-pulp.

WOOD-QUAIL, or **ROULROUL.** See QUAIL.

WOOD-RAT, a large rat-like wild mouse of the genus *Neotoma,* of which two species dwell in the forests of the southern half of the United States. The body is eight or nine inches long, and the tail nearly as long. The form resembles that of the white-footed mouse (*Microtus*), the animal being more slender and squirrel-like than are the true or house rats, from which this may always be distinguished by his hairy tail, softer fur and much larger ears. The best known species is the Alleghany wood-rat (*N. pennsylvanica*), which is lead-colored above, sprinkled with black hairs, which lightens to yellowish on the flanks and becomes pure white on the abdomen and feet. Consult Goldman, E. A., 'Revision of the Wood Rats of the Genus Neotoma' (in United States Bureau of Biological Survey, 'North American Fauna, No. 31,' Washington, D. C., 1910), and Stone and Cram, 'American Animals' (New York 1902).

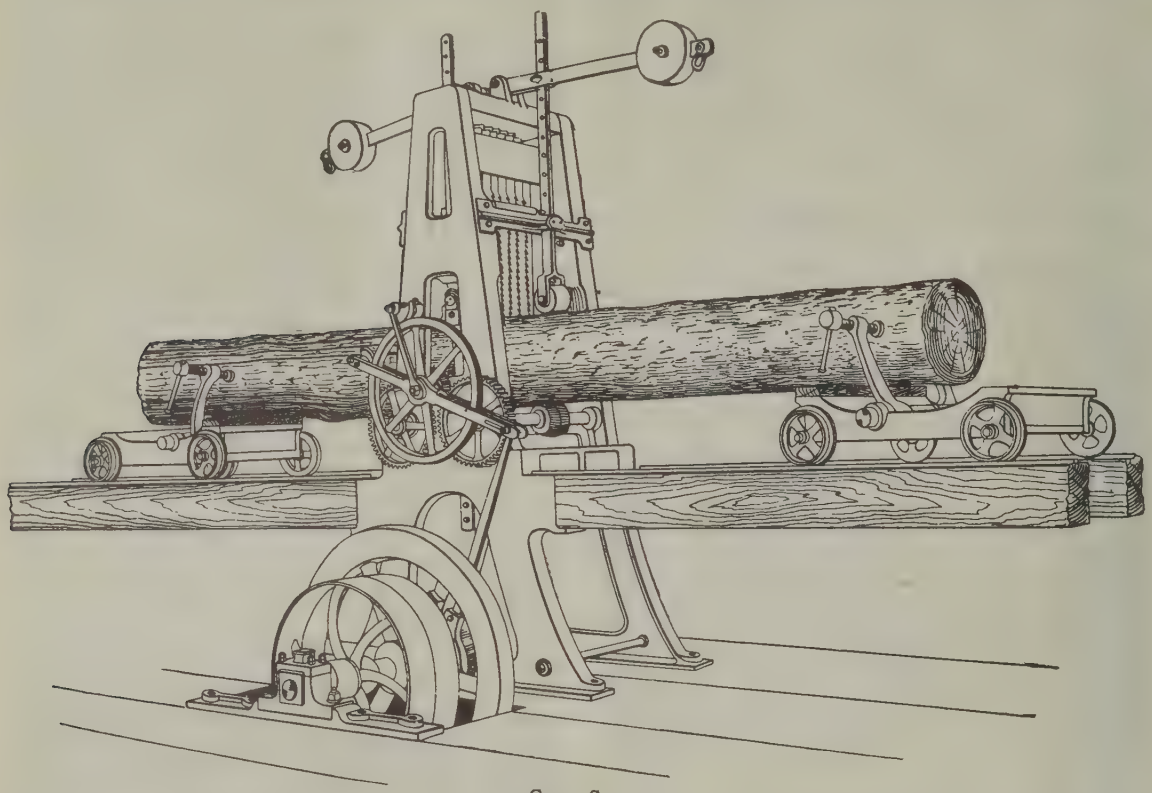
WOOD-ROBIN, the wood-thrush (q.v.).

WOOD-THRUSH, or **WOOD-ROBIN,** the most familiar of North American spotted thrushes (*Hylochichla mustelina*), famous for the rich four-parted melody of its spring song. It is numerous in warm weather throughout the Eastern States and Canada, inhabiting the wild spaces as well as confidently approaching the house and roadside. Its nest is often built in a village shade-tree, or even in a garden bush, but more frequently among the forking twigs of an apple tree; and it is to be distinguished from that of the robin by the absence of mud and the presence of many dead leaves, which always form the principal part of its foundation. The eggs are deep blue, smaller and less greenish than those of the robin. It soon becomes unsuspicious of the persons whom it is accustomed to see about the place and who do not disturb it, but is jealous of the attention of other birds, and defends its home with admirable vigor and success. The song, which is heard most frequently and pleasingly toward sunset, is excelled by that of none of the more familiar Eastern birds either in musical quality or in sentiment. It is low, sweet, evenly modulated and flute-like, yet has far-carrying power, and when heard at twilight across the fields, or from unseen recesses of the orchard, it brings to the mind a hymn chanted in praise of the serenity of the summer evening. This thrush is bright cinnamon above, brightest on the head; below white, with large rounded black spots forming lines down in front.

WOOD-WARBLER, a book-name for the small and beautiful American birds of the family *Mniotiltidæ* (see WARBLER); but the name is without special significance, as these birds are not more characteristic of woodland than of other places; nor than other warblers.

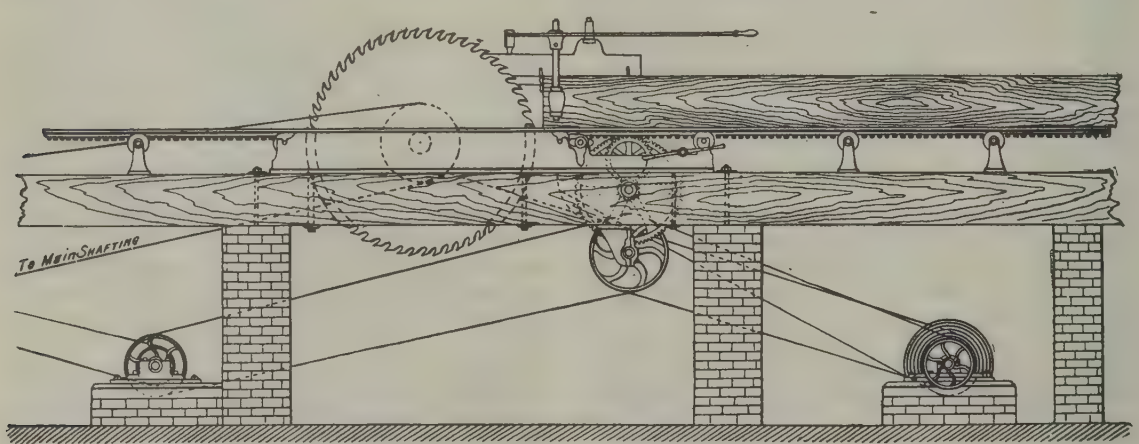
WOOD-WORKING MACHINERY embraces the various machines employed to reduce the timber as cut in the forests into lumber, shingles, doors, sashes, moldings, veneers, barrels, buckets and the endless variety of wooden objects and contrivances used for industrial purposes. As the woods upon which they are used vary in many qualities from the docile white pine to the difficult elm and the almost metallic hardness of the ebony and toughness of the lignum vitæ, their variety and adjustments must be almost numberless. They may be conveniently divided into four general classes — saws, which operate by rending or scission; planers, by which the work is accomplished by a paring action; lathes, in which the wood is turned or pared while being revolved; and grinders or abrading machines, which are generally employed as finishers and accomplish the work through the medium of sand or emery. Saws are blades of steel with toothed edges and though also used to divide metal and stone, they are employed principally to divide wood. (See SAWS AND SAWING; SAW-MILL). For saws used in metal-working see METAL WORKING MACHINERY. The use of saws is of very ancient origin, and it is practically impossible to enumerate in detail their adaptations to various mechanical processes. Among uncivilized peoples, saws were made of flakes of flint imbedded in wooden blades and held in place by means of bitumen. Later, among the ancients, bronze saws were used, but all modern saws are made of steel of the finest quality. Band saws were invented about the beginning of the 19th century, and although their particular merits were known long before the circular saws came into general use, they were not adopted until the latter part of the century, owing to the difficulty of making blades capable of withstanding the severe service. But, with the manufacture of the finer grades of steel of greater tensile strength and elasticity, since 1885, they have been adopted in addition to the circular saws in many of the larger mills. They are made in sizes ranging from one-half inch in width, used for ordinary shop-work, to from six to eight inches in width, for the use of the larger lumber mills. In mode of operation, which is as that of a belt over two pulleys, they cut with a continuous downward motion, with the toothed edge always in the kerf. The pulleys or guide-wheels, one of which is the driver, range from 54 to 72 inches in diameter. The saw blades are in a continuous band, from 45 to 60 feet in length, and the saw is run at a speed of 4,000 feet per minute. Being made extremely thin, they are used for continuous and rapid cutting in planing mills and other wood-working plants, where some cuts have to be made in scrolls and curves, and require a very flexible blade. The thinness of the blade insures a much smaller kerf-waste than that resulting from the circular saw, and as installed in their larger forms in the lumber

mills are capable of sawing an average of 40,000 feet of lumber per day. The table of band saws used in shop-work is often made to tilt, for beveled work; or the saw blade and its pulleys may be tipped backward, for the same purpose. The saws commonly known as scroll saws and jig saws are very narrow straight blades of steel, often as fine as 1/32 of an inch in width, which are operated with a reciprocating movement, and are employed to cut various ornamental designs as for brackets, corner-pieces, clock-cases, etc., and in making furniture.



Gang Saw.

Another form of veneer-cutting saw is a single-bladed reciprocating saw doing its work in a horizontal position in a carriage which rises and falls in vertical guides. Another form of veneer cutter is a vertical knife against which the log of wood is revolved so as to take off a continuous shaving. Planers are used to smooth lumber and to reduce it to exact dimensions by removing the rough surfaces of the product of the sawmills. In the surface planer this is accomplished by a rank of overlapping revolving cutters which pare off shavings and leave the surface of the timber quite smooth.

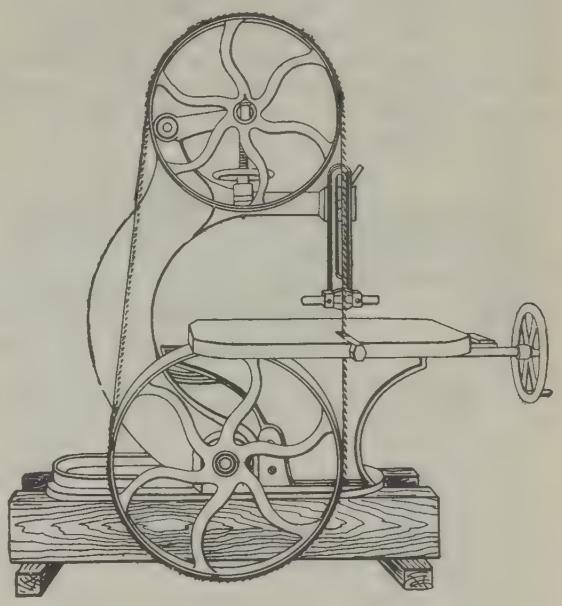


Circular Saw, with Rack-feed.

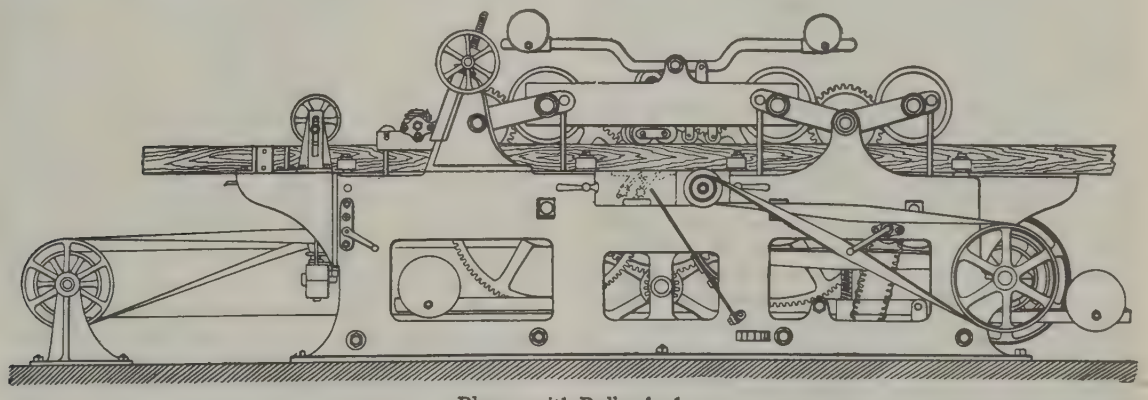
Of saws used for special purposes, the segment saw used for cutting veneers should receive mention. The segment saw is circular in shape and is formed by bolting the blade segments, which are extremely thin, upon the outer edge of a strong cast-iron centre, which gives the required rigidity. The larger sizes range up to six feet in diameter and possess cutting edges so light that they are capable of cutting veneers almost as thin as a sheet of paper.

The cutters are very ingeniously arranged, and in many cases all four sides of the board are planed down, and the tongue and groove cut in the edges at one operation. The cutters may be so arranged as to produce curved surfaces by following a pattern or model which controls the depth of the cut, and are extensively used in the manufacture of moldings, panels, etc. These machines also cut rebates and grooves and do a limited amount of shaping. They can be run at several different speeds, whichever may be best adapted for the kind of wood being worked. Moldings are, however, usually cut on special machines with upright spindles, the cutter-head only being above the table. Some have two spindles and two cutters, so that both sides of a strip may be modeled at once. They are run at a speed of 5,000 feet per minute.

Mortising machines are of two classes: (1) in which the cutter is chisel-shaped and works with a reciprocating motion; and (2) in which a revolving cutter is used. Large machines of this type, as used in shipbuilding, usually carry a rank of chisels on a single frame, so that several mortises may be cutting at the same time. The blocks to be mortised are adjusted on the feed table so that each chisel cuts its proper chip, and scores for the next chip; each succeeding chisel cutting deeper into the wood. A machine for the ordinary shop, carrying a single chisel, is actuated by a link motion so that each successive blow is deeper than the previous one. Or the depth may be arbitrarily controlled by the foot of the operator on a treadle. Tilting tables enable the mortise to be cut on the bevel if desired. These machines operate at the speed of about 400 strokes per minute. To this class also belong the dovetailing machines in which the cutters are arranged in gangs, similar to a gang of chisels, or revolve upon a vertical spindle. They cut out the tongues and spaces automatically. Wood-working lathes are similar in principle to those employed in metal-working. The piece of wood is held between the stocks of the machine and revolved rapidly, while a chisel or other tool is pressed against it and removes a shaving by a combined paring and severing action. By the use of various automatic duplicating attachments in conjunction with patterns, as in the case of the Blanchard lathe, in which patterns and blanks are revolved together, exact facsimiles are readily obtained, and the output of the machines greatly increased. By these machines such irregular shapes as axe handles, gun stocks and shoe lasts are produced. Other machines involving the lathe principle are the various kinds of borers for drilling holes; tenoning machines and mortising machines for making tenon joints and the mortises to receive the tenons; and gaining machines for cutting grooves. Abrading machines are of two kinds — those in which an endless belt coated with sand or emery is brought in contact with the work, generally of small dimensions; and those in which a drum similarly coated is employed to work down large surfaces. Or they may take the form of simple disks of sandpaper or emery paper glued to a face plate.



Band Saw.

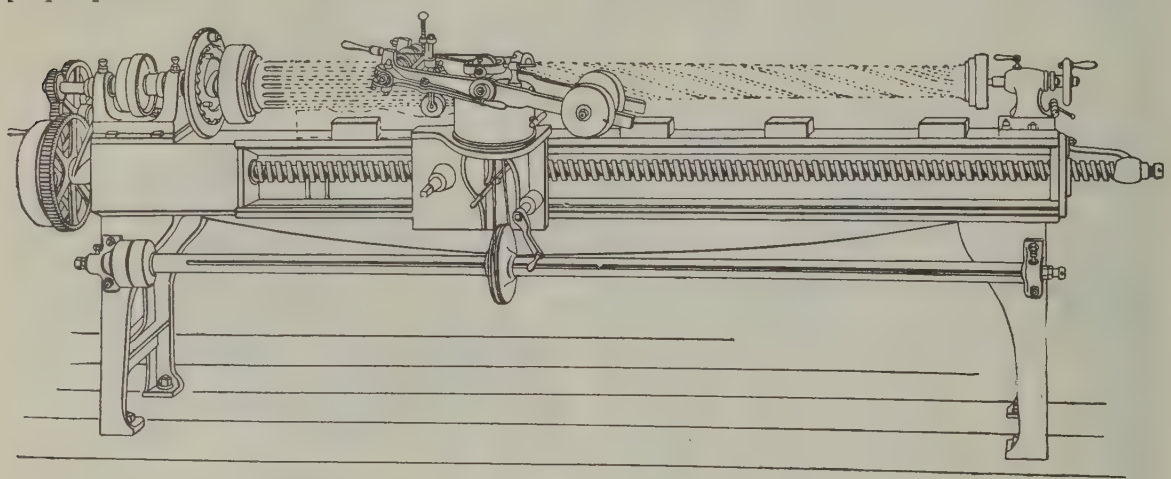


Planer, with Roller-feed.

Practical Suggestions.—The very important place occupied by the circular and band saws among the various classes of wood-working machines demands a few practical suggestions and rules relative to their use, care and management. The principal points to be observed in this connection are as follows:

Hanging the Saw.— Circular saws should always be hung upon the mandrel with the side marked "log side" next to the log on the mill, and should be perfectly plumb when the flanges have been screwed up. Thin saws and saws

driven at high speed should be put up very open in order to allow the centre to pull through. These saws when hung on the mandrel may be concave or convex on the log side when at rest, but when running at the speed for which they are hammered they should straighten up and be flat on the log side. The difficulties resulting from too much crowning or dishing on the log side may be overcome by the use of suitable paper rings placed between the saw and the collars, so that when the saw is clamped between the flanges it will be brought to the proper position.



Copying Lathe.

Lining the Saw with the Track.— The track should be solid, level and straight, and should be put down by careful measurement so as to be from one-eighth to one-quarter of an inch farther from the saw at its centre than at a distance of 20 feet from it. Some saws require more inclination toward the track than others in order to hold them to their work on the log, and if the track is properly adjusted any small variations from the required inclination may be effected by means of the set screws on the box.

The *lead* or the holding of the saw to its work may be adjusted by its position to the track as already described, or by beveling on the back of the teeth. Assuming that the teeth are properly filed perfectly square in front, then bevel filing on the back of the teeth on the board side will lead the saw into the log, and bevel filing on the log side will lead it out of the log. A "snaky" or in-and-out lead indicates that the rim of the saw is too large for the centre and, therefore, requires to be opened out at the centre. This may be effected by running the saw warm at the centre by creating friction, by reducing the set or spread of the teeth, or by hammering between the centre and the rim.

Motion.—The motion of circular saws is one of the conditions which requires the most careful attention. The saw should always be run at a speed approximating as nearly as practicable to a periphery speed of 9,000 feet per minute (in soft woods), and it should be run at a uniform speed both in and out of the cut. Excessively high speeds generate heat in the saw and make it so touchy and limber that it will do good work only on light feed and while the teeth are in the best of condition; but, when the teeth have lost their sharp edge, the saw will dodge whenever it runs against the slightest obstacle. Speeds too low are also objectionable, but they do not produce such ruinous effects upon the saw. These difficulties may be partially remedied by the hammering of the saw, but it is impossible to overcome them completely by such means. The accompanying table gives the proper speed of circular saws of varying diameter. It is calculated on the basis of a periphery speed of 9,000 feet per minute. As a general rule, however, saws for portable mills are usually run at a speed of 450 revolutions per minute, and those for steam feed mills from 600 to 900 revolutions per minute.

TABLE OF SPEED OF CIRCULAR SAWS.

Diameter, inches	Revolutions per minute	Diameter inches	Revolutions per minute
8	4,500	42	870
10	3,600	44	840
12	3,000	46	800
14	2,585	48	750
16	2,222	50	725
18	2,000	52	700
20	1,800	54	675
22	1,636	56	650
24	1,500	58	625
26	1,384	60	600
28	1,285	62	575
30	1,200	64	550
32	1,120	66	545
34	1,050	68	529
36	1,000	70	514
38	950	72	500
40	900		

The three following rules may be readily employed for calculating the speed of saws, pulleys or drums.

1. To find the number of revolutions of the driven when its diameter is known.

Multiply the diameter of the driver by its number of revolutions and divide the product by the diameter of the driven; the quotient will be the number of revolutions of the driven.

2. The diameter and revolution of the driver being given, to find the diameter of the driven, that shall make any given number of revolutions in the same time.

Multiply the diameter of the driver by its number of revolutions and divide the product by the number of revolutions of the driven; the quotient will be the diameter of the driven.

3. To find the size of the driver.

Multiply the diameter of the driven by the number of revolutions it is required to make, and divide the product by the number of revolutions of the driver; the quotient will be the size of the driver.

In the case of band saws the most important point requiring careful attention is the tension or the opening up or expanding of the centre of the blade so as to place the strain on the edges of the band. The tensioning of saws may be accomplished by the use of rolls, or by hammering, the last-named method being preferable as the saws are liable to hold their shape much longer. The accompanying table shows the circles of tension for band saws of different widths and gauges. These figures give the saw as much tension as it will take and lie flat on the running-board, a condition which accords with the best practice.

CIRCLES OF TENSION FOR BAND SAWS.

Width, inches	Gauge	Circle, feet	Width, inches	Gauge	Circle, feet
6	16	26	10	15	35
6	17	26	10	16	40
6	18	26	11	14	40
6	19	30	11	15	45
6	20	30	12	13	40
7	15	30	12	14	40
7	16	30	12	15	45
7	17	30	13	12	50
7	18	30	13	13	50
7	19	35	13	14	50
8	14	30	14	12	50
8	15	30	14	13	50
8	16	30	14	14	50
8	17	35	15	12	55
8	18	35	15	13	55
9	14	30	15	14	55
9	15	30	16	12	66
9	16	30	16	13	66
9	17	35	16	14	66
10	14	30			

It is often desirable that the toothed edge should be strained a little tighter than any other portion of the saw. This may be accomplished, and an uniform tension preserved by rolling or hammering the back of the saw to a curve showing about one-sixty-fourth of an inch rounding in five feet, and then tilting the upper wheel so that the saw has an uniform pressure across the blade. The strains usually put upon saws range from 5,000 to 12,000 pounds, and should be only sufficient to prevent slipping on the wheels. A rubber tire three-fourths of an inch in thickness on the upper pulley adds much to the endurance of the blade. This upper pulley should also be provided with a tension link. The following table gives the strains for band saws of different sizes and gauges.

TABLE OF STRAINS FOR BAND SAWS.

Width, inches	Gauge	Pounds	Width, inches	Gauge	Pounds
6	16	4,212	10	15	7,770
6	17	3,756	11	13	11,286
6	18	3,174	11	14	9,856
6	19	2,718	11	15	8,547
6	20	2,268	12	13	12,312
7	15	5,439	12	14	10,752
7	16	4,914	12	15	9,324
7	17	4,382	13	13	13,338
8	14	7,168	13	14	11,648
8	15	6,216	14	13	14,364
8	16	5,616	14	14	12,544
9	14	8,064	15	13	15,390
9	15	6,699	15	14	13,440
9	16	6,318	16	13	16,416
10	13	10,260	16	14	14,336
10	14	8,960			

Gauges.— In selecting a saw, the nature of the work for which it is required, and the power available to drive it, should always be taken into account. In this connection the first important point is the proper gauge. Generally speaking, a thin-gauge saw blade lasts much longer than a thick one. For mills of ordinary capacity and operating on a general line of work the most suitable saws are those measuring seven gauge at the centre and eight on the rim. If the timber is valuable, and the sawyer skillful, saws as light as eight or 10 gauge may be used, but saws lighter than that are impracticable for use in ordinary mills. In large mills where the saving of time is more desirable than the saving of lumber, and consequently greater speed and feed are used, the most suitable saws are those of six and seven gauge, which are sufficiently heavy to stand up to the more severe service. In the case of these heavier saws it is imperative that the pulleys be of large diameter.

The second important point in the selection of a saw is the number of teeth. With high speed and the accompanying high feed, more work is required of a saw in a given time, and, therefore, it should have more teeth with which to do that work and to distribute the strain evenly. The speed, however, should not exceed 3,500 feet per minute with 36-inch pulleys. The number of teeth should depend not only on the thickness of the saw, but also on the character of the timber to be sawed and the speed and feed of the mill. Gullet teeth are preferable for all except very hard woods, and they should not be too close together. See Ball, A. A., 'Woodworking Machinery' (1923); Hunt, De Witt, 'A Manual for Machine Woodworking' (1925); U. S. Vocational Education Board, 'Factory Woodworking Trades'; Tautz and Fruits, 'Modern Motor Driven Woodworking Shop' (1930).

WOODBERRY, wŭd'bĕr-ĭ, **George Edward,** American critic and poet: b. Beverly, Mass, 12 May 1855; d. 2 Jan. 1930. He was graduated from Harvard in 1877, became professor of English in the University of Nebraska in 1878–79, was on the *Nation* staff in 1879–80, was again at Nebraska, and until 1891 was in active literary work, holding the literary editorship of the Boston *Post*, and contributing to the *Atlantic*. From 1891 until his resignation in 1904 he was successively professor of literature and of comparative literature (from 1899) in Columbia University. He became known as an authoritative critic, and a poet of much distinction, and must be ranked among the most scholarly and important of the more recent American littérateurs. The titles of his works include 'A History of Wood-Engraving' (1883); a very valuable 'Life' of Poe (1885; 'American Men of Letters'); 'The North Shore Watch, and Other Poems' (1890); 'Studies in Letters and Life' (1890); 'The Heart of Man' (1899); 'Makers of Literature' (1900); 'Nathaniel Hawthorne' (1902; 'American Men of Letters'); 'Collected Poems' (1903); 'America in Literature' (1903); 'North Africa and The Desert' (1914); 'The Flight, and Other Poems' (1914); 'Ideal Passion' (1917); 'Literary Essays' (1920); 'The Roamer and Other Poems' (1920); 'Literary Memoirs of the 19th Century' (1921). He also edited the poetical works of Shelley

4 vols. (1892); *Essays of Elia by Lamb* (1892); Aubrey de Vere's *Select Poems* (1894); *Columbia University Studies in Comparative Literature,* 9 vols. (1899–1903); *Sidney's Defense of Poesie* (1908); *European Years; Letters of an Idle Man* (1911); *New Letters of an Idle Man* (1913).

WOODBINE, wo͝od'bīn, borough, New Jersey, in Cape May County; altitude 43 feet; on the Pennsylvania-Reading Seashore Lines. It is located 22 miles west-southwest of Atlantic City. Its industrial products are clothing, hats, and rubber goods. It is the seat of a state hospital for feebleminded men. Pop. (1950) 2,417.

WOODBRIDGE, wo͝od'brĭj, **Frederick James Eugene,** American educator and philosophical scholar: b. Windsor, Ontario, Canada, March 26, 1867; d. June 1, 1940. He was graduated from Amherst College in 1889, at the Union Theological Seminary, New York, in 1892, and studied at the University of Berlin in 1892–1894. He became a member of the faculty at the University of Minnesota in 1894, and held the chair of philosophy there in 1895–1902. He was appointed professor of philosophy at Columbia University in 1902, became Johnsonian professor of philosophy there in 1904, and from 1912–1929 was also dean of the faculties of political science, philosophy, pure science, and fine arts. He was prominently connected with the neorealism movement in philosophy.

He edited the *Journal of Philosophy* and the *Archives of Philosophy;* contributed to scientific periodicals, and wrote *Nature and Mind* (1937).

WOODBRIDGE, William, American politician: b. Norwich, Conn., Aug. 20, 1780; d. Detroit, Mich., Oct. 20, 1861. He removed with his father to Marietta, Ohio, in 1791, but studied law at Litchfield in his native state, and in 1806 was admitted to the Ohio bar, becoming a member of the Ohio Assembly the next year. A state senator 1808–1814, as well as county attorney, he was appointed secretary of Michigan Territory in 1814, was territorial delegate to Congress 1819–1820, and judge of the Supreme Court of the Territory 1828–1832. In 1837 he became a state senator, was governor of Michigan 1839–1841, and a United States senator 1841–1847.

WOODBRIDGE, wo͝od'brĭj, town, Connecticut, in New Haven County, chiefly residential, adjacent and suburban to the city of New Haven. Pop. (1940) 2,262; (1950) 2,822.

WOODBRIDGE, township, New Jersey, in Middlesex County; altitude 30 feet; on the Pennsylvania, and the Central of New Jersey railroads. Located 4 miles north of Perth Amboy, in an industrial section. Its industries are terra cotta, tile, and brick. Nearby are deposits of clay. To the east of the township is Arthur Kill, separating New Jersey from Staten Island. Many persons employed in nearby oil refineries and plants engaged in the heavy industries live in Woodbridge. Pop. (1940) 27,191; (1950) 35,758.

WOODBURN, wo͝od'bĕrn, **James Albert,** American educator and historian: b. Bloomington, Ind., Nov. 30, 1856; d. Madison, Wis., Dec. 12, 1943. He was graduated at the Indiana State University in 1876; taught in the preparatory department of that university from 1878 to 1886; was fellow in history at Johns Hopkins University in 1889–1890; professor of American history in Indiana University, 1890–1924, and professor emeritus thereafter. He wrote *Causes of the American Revolution* in *Johns Hopkins University Studies* (1891); *The Historical Significance of the Missouri Compromise,* in Reports of the American Historical Association (1893); *The American Republic and Its Government* (1903); *Political Parties and Party Problems in the United States* (1903; rev. ed., 1922). He also edited (with Prof. C. W. Hodgin) *Select Orations of Burke and Webster* (1892); Lecky's *American Revolution* (from Lecky's *England in the Eighteenth Century*), with bibliography and notes; *American Political History* from Prof. Alexander Johnston's articles in Lalor's *Cyclopedia of Political Science and United States History* (4 vols.).

WOODBURY, wo͝od'bĕr-ĭ, **Charles Herbert,** American artist: b. Lynn, Mass., July 14, 1864; d. Jan. 21, 1940. He was graduated at the Massachusetts Institute of Technology in 1886, and studied art in Paris at the Académie Jullian under Gustave Boulanger and Jules Joseph Lefebvre. He later established himself in Boston, where he became well known as a marine painter. He was elected to the National Academy of Design in 1907; was awarded medals at the expositions held at Paris, Buffalo, St. Louis, and Buenos Aires; received a gold medal at Atlanta in 1905, and a gold medal and medal of honor at San Francisco in 1915. Among his works are *The North Atlantic* (Worcester Museum); *The Sea* (Indianapolis Art Association); *The Cliff* (Carnegie Institute). He was awarded the Noyes Prize of the Society of American Etchers in 1933.

WOODBURY, Daniel Phineas, American soldier and military engineer: b. New London, N. H., Dec. 16, 1812; d. Key West, Fla., Aug. 15, 1864. He was graduated from West Point in 1836 and was appointed second lieutenant of artillery. Not long afterward he was transferred to the engineers and became first lieutenant in July 1838. After service to 1840 in constructing the Cumberland Road in Ohio, he took charge until 1847 of repairing works on the Atlantic coast. He was in charge of construction at Forts Kearny and Laramie till 1850 and on the North Carolina coast till 1856. He became captain of engineers 1860, major Aug. 6, 1861, lieutenant colonel September, and brigadier general of volunteers March 19, 1862. At the opening of the Civil War he was assigned for engineer duty in the Army of the Potomac and was active in planning the defenses of Washington. He controlled all the engineering operations in the siege of Yorktown and those before Richmond, and his prompt action at the Battle of Fredericksburg in bridging the Rappahannock, won for him the brevet of brigadier general in the regular army. While in command of the Key West District he died of yellow fever. He published *Sustaining Walls* (1845); *Elements of Stability in the Well-Proportioned Arch* (1858).

WOODBURY, Levi, American jurist: b. Francestown, N. H., Dec. 22, 1789; d. Portsmouth, N. H., Sept. 4, 1851. He was graduated at Dartmouth in 1809, studied law, was admitted to the bar in 1812, and practiced his profession at Francestown till 1816, when he was elected clerk

of the state Senate, Woodbury was active in state politics, and from 1817 to 1825 served variously as associate justice of the superior court, as governor (1823–1824), and speaker of the House. From 1825 to 1831 he was a member of the United States Senate and in 1831 became secretary of the Navy. A staunch supporter of President Andrew Jackson, he was named secretary of the Treasury in 1834. In this capacity he achieved his most notable public service, carrying out the independent treasury project of the president, in the face of determined opposition from adherents of the Bank of the United States. Woodbury remained with the Treasury until 1841 and then was re-elected to the national Senate. In 1845 President James K. Polk appointed him associate justice of the United States Supreme Court, which office he held until his death. Woodbury was a prominent and influential Democrat and at the time of his death was a strong presidential candidate.

Consult Woodbury, Levi, *Writings of Levi Woodbury, Political, Judicial and Literary,* ed. by Nahum Capen, 3 vols. (Boston 1852).

WOODBURY, wo͝od'bĕr-ĭ, town, Connecticut, located in Litchfield County, on the Pomperaug River, eight miles west of Waterbury; altitude 264 feet. Considered a residential center, Woodbury is noted for its dairy products and also manufactures machinery. The town, settled in 1672 and chartered in 1674, contains some fine 18th century houses and several old churches. Pop. (1950) 2,564.

WOODBURY, city, New Jersey, seat of Gloucester County, eight miles southwest of Camden, on Woodbury Creek, a navigable arm of Delaware Bay; altitude 35 feet; served by the Pennsylvania-Reading Seashore Lines. Located in a thriving agricultural region, the city is a trade center for surrounding truck gardens and poultry and dairy farms. Local industries include manufacture of luggage, clothing, and cement blocks. Woodbury is rich in American historical tradition, particularly during Revolutionary times. There are several notable 18th century buildings and a county historical museum.

Woodbury was settled in 1683, incoporated as a borough in 1854, and as a city in 1870. The government is of the mayor-council type. Pop. (1950) 10,931.

WOODBURYTYPE PRINTING, wo͝od'-bĕr-ĭ-tīp, one of the early photomechanical methods of reproduction, a photogelatin process which provided excellent printed copies of photographs, primarily of historic interest today. Developed by Walter Bentley Woodbury (1834–1885) and first shown by him in 1866 in the *Photographic News,* the process relies on the change of the solubility of bichromated gelatin when exposed to light.

To make the woodburytype printing plate, an image of the object to be reproduced must first be obtained in a photographic negative, as is done in other processes of photomechanical reproduction. Next a relief image or mold must be made: to do this, a layer of bichromated gelatin is exposed to light through the photographic image or film. Where unobstructed light reaches the gelatin, it is rendered highly insoluble; where no light comes through, it remains soluble; and, as the light varies between these extremes, so is the solubility effected. Placed in warm water, a relief image is produced through washing away the soluble gelatin. Hardened in a solution of chrome alum, the completed mold is achieved, a hardened, washed-out gelatin relief, which, when impressed in type metal under great pressure, results in an intaglio (q.v.) metal plate. Since the gelatin mold is considerably harder than type metal, many printing plates can be made from a single mold.

The metal plate must be lightly oiled before printing. It is then filled with pigmented gelatin. Smooth paper, specially treated with varnish, is held under firm impression a few minutes until the gelatin sets; upon removal of the paper, the film of gelatin adheres to it. An excellent, crisp reproduction results. Actually the reproduction achieved is a replica of the original gelatin mold in a very thin film of pigmented gelatin. The dark areas are thickest and the highlights are thinnest. In normal production the long wait for the gelatin to set under impression was offset by having one pressman attend several presses in rotation. The process was greatly limited as to size, the maximum being about a foot square. The presses were thus small and of the type used for simple copying.

Woodburytypes, as such reproductions came to be known, were produced in the United States, England, France, and Germany. In his annotated catalogue (1892) of the Boston Museum of Fine Arts' Exhibition Illustrating the Technical Methods of the Rreproductive Arts, Sylvester R. Koehler described the process as one that "gives very beautiful results, but unfortunately the prints are apt to become brittle, from drying out, and to chip off." This brittleness is noticeable in surviving prints.

It is notable that collotype, which was developed at about the same time as Woodbury's process, also used bichromated gelatin. But in making use of the degree of solubility of the treated gelatin, collotype applies this characteristic to the principle that oil and water do not readily mix and, as in lithography (q.v.), moistens such a gelatin film before inking. According to degree of solubility, the gelatin collotype plate then accepts or rejects ink, re-creating the image desired. Collotype today, of all reproduction methods, produces the greatest range of tone in the gray scale and is widely used.

Slowness of production, fragility of prints, and improvement of quality in other cheaper, faster processes have led to virtual disuse of woodburytype printing.

Bruce Gentry,
Graphic Arts Consultant.

WOODCHAT, wo͝od'chăt, name common both to an Asiatic bird of the thrush family (Turdidae) and to a European bird of the shrike family (Laniidae). (1) The Asiatic woodchat is represented in the genera *Ianthia* and *Larvivora,* whose habitat is western Asia. The males are mostly bright blue, but have red or rufous markings on the under parts. (2) The European woodchat (sometimes called the woodchat shrike) belongs to the species *Lanius rutilus* (sometimes designated *Lanius senator*), whose habitat is southern Europe, where it appears in dry and open country, bushy commons, orchards, and olive groves. The woodchat is about seven inches long, its bill is hook tipped, its behavior is hawklike, its song is musical, though interspersed with

harsh notes. Though a rich chestnut-red color appears on the crown of the head and on the nape of the neck, both sexes are mostly black on the upper parts and white on the under parts and have some white on wings and tail.

DEAN AMADON.

WOODCHUCK, wo͝od'chŭk, or **GROUND HOG,** an American marmot (*Marmota monax*), 20 to 27 inches long, grizzled brown above and lighter below, the feet and tail blackish. It is found in the United States from the Atlantic coast to the Mississippi Valley (except in the Gulf states) and in Canada across the continent and as far north as Alaska, several distinct subspecies occurring in this wide range. Other related species of marmots are found west of the Rocky Mountains in North America, Europe, and Asia.

Woodchucks dig their holes in the fields, on sides of hills, or under rocks in the woods, in a slanting direction, at first upward to keep out the water, with several compartments, and usually with more than one entrance. Winter is passed in this burrow, in a dormant state. The digging is effected by the powerful forefeet, assisted by the front teeth, the dirt being thrown backward under the belly and then kicked out by the outspread hindfeet. The food consists of various plants, fruits, and vegetables, clover being particularly favored. As a result, the animal sometimes does considerable damage to both crops and gardens.

Woodchucks feed chiefly during early morning and late afternoon, and spend most of the remaining time lying in the sun or sleeping in the nests at the bottom of their burrows. They become extremely fat (weighing up to 14 pounds in the autumn), retire to hibernate on the first intimation of winter (usually two to four marmots cohibernate in one den), and reappear after the snow has gone in the spring, when they soon reduce to their normal weight of eight or nine pounds. The brood of young, numbering from two to eight, is born in the spring or early summer; they are forced to leave the burrow and to shift for themselves when a few months old. The woodchuck, generally a bold and unsuspecting creature, has alert senses and, where much persecuted, may become extremely vigilant. When driven to bay, it can fight with considerable courage and effectiveness. Its chief natural enemies are foxes and bobcats, but the animal remains generally abundant in both cultivated regions and woodlands throughout its range. See also MARMOT.

Consult Seton, Ernest T., *Lives of Game Animals...*, vol. 4 (New York 1928); Hamilton, William J., *The Mammals of Eastern United States* (Ithaca 1943); Drimmer, Frederick, ed., *The Animal Kingdom,* vol. 1, pp. 267–72 (New York 1954).

KARL F. KOOPMAN.

WOODCOCK, wo͝od'kŏk, a well known American game bird (*Philohela minor*), belonging to the sandpiper family (Scolopacidae). The body is full and robust; the wings, short and rounded; the head and eyes, very large; and the bill, straight, tapering from the stout base, grooved for nearly the entire length, and exceedingly sensitive at the end. The legs are very short for a snipe. The woodcock is 10 or 12 inches long and weighs from seven to nine ounces, the female being the larger bird. The colors are a soft harmonious blend of various shades of brown and gray, with black mottling above, nearly uniform pale brown below.

Habits.—The woodcock seldom ventures beyond the limits of the eastern half of the United States at any season, except to invade Ontario and other southern provinces of Canada. In winter it migrates to the South Atlantic and Gulf states, but mostly it breeds in the Central and Northern states. Migration northward begins very early, and many of the more hardy individuals reach the Middle and New England states in early March before the frost has left the ground. At such times, and also in the late fall, they secure their food, consisting of insects and their larvae and snails, by turning over fallen leaves; but during summer and whenever the ground is sufficiently soft, they probe it with their long sensitive bills and extract with great skill the earthworms which constitute their chief food. Even when the bill is plunged deeply into the earth, the large eyes, placed very high on the head, permit unobstructed vision in all directions.

Woodcocks frequent bogs and swampy places along alder-grown streams and hillside springs during summer; but in autum they forsake these coverts for cornfields and undergrowth of low woods, the surest indication of their presence being their perforations in the soft earth. As the large size of the eye suggests, the woodcock is crepuscular and nocturnal. The period of its greatest activity is in the hours immediately succeeding sunset and preceding dawn, although, when the moon is full, it may be abroad throughout the night. During the day it remains hidden in deep bogs and thickets, rising only when frightened; then springing perpendicularly above the bushes, it flies in an irregular course for a short distance and drops as suddenly to the ground.

In April or even earlier it builds a simple nest of leaves and grass in a dry, well-concealed spot in a bog and lays four buffy eggs spotted with dark brown and lilac. After incubation the fluffy brownish white chicks leave the nest at once, led away by the parent. The parent is very solicitous in the care of its young and not only feigns injury to entice an intruder from their vicinity, but has been said to carry them, one by one, between its thighs to a place of safety.

Courtship.—The courtship flight of the male is curious and interesting. After a series of nasal *peents,* delivered with much apparent effort, he springs from the ground and mounts high in the air on whistling wings in a long circular flight. He then zigzags slowly earthward, each phase of the descent being accompanied by a series of clear and musical notes. This music is partly vocal in origin, but in part is produced by the vibration of the air through the outer wing quills, which are stiff and narrow. The male bird then drops like a plummet to the exact spot from which he took wing. He is quite fearless when engaged in his courtship flights, which are repeated at short intervals, and may be observed, even with the aid of a flashlight without disturbing him. With the coming of hard frosts, most of the woodcocks leave for the South, and become concentrated in favorite bottoms along the lower Mississippi River area and other sections of the Gulf States.

As Game.—Next to the quail the woodcock is perhaps the most popular game bird of the eastern United States, and deservedly so. Its numbers, however, have greatly decreased. Only by strict regulation of the hunting season and by providing suitable brushy cleared areas in the woods can the woodcock remain an important game bird. Because of its peculiar appearance

and big head, sportsmen have several amusing vernacular names for this bird, such as "timberdoodle."

The European woodcock (*Scolopax rusticola*) is similar to the American species, but is larger and is prominently barred below. Three additional, but little known, species of woodcocks are resident in the East Indies. The most remarkable of them is known only from the little island of Obi in the Moluccas.

Consult Bent, Arthur C., *Life Histories of North American Shore Birds,* Part I (Washington 1927); Pettingill, Olin S., *The American Woodcock, Philohela Minor* (Boston 1936); Knight, John A., *Woodcock* (New York 1944).

DEAN AMADON,
Curator, Department of Birds, The American Museum of Natural History.

WOODCUTS. See WOOD ENGRAVING.

WOODEN WALL, the side of a ship; hence the ship itself. When Athens was in imminent danger from the Persians in 481 B.C., prior to the invasion of Xerxes, the oracle at Delphi was consulted, and, intimating that the city and country were doomed to ruin, added that when all was lost, a wooden wall should still shelter her citizens. The Athenians interpreted "a wooden wall" to signify ships; Themistocles, who probably had influenced the oracle to utter this prediction or counsel, was of the same opinion; faith was put in the navy, and the result was the great Greek victory of Salamis (479 B.C.). It was from this incident that the expression, "The wooden walls of England," arose.

WOODFALL, wo͝od'fôl, **Henry Sampson,** English printer and journalist: b. London, England, June 21, 1739; d. there, Dec. 12, 1805. About 1758, he became editor and publisher of the *Public Advertiser,* of which his father was the printer. Among its contributors was Sir Philip Francis (q.v.), reputedly the author, during 1768–1772, of the famous *Letters of Junius* (q.v.) attacking public characters of the day. Woodfall, however, is on record as stating that he definitely knew that Francis "never wrote a line of Junius" and that he had no personal acquaintance with the author of the letters. After the Junius letter to George III had appeared in the *Advertiser,* Woodfall was prosecuted by the crown for libel in 1770, but the verdict was practically one of acquittal. He published the *Letters* in book form in 1772 and profited largely by their sale. He sold the *Advertiser* in 1793, and two years later it ceased publication. In 1797 he served as master of the Stationers' Company.

WOODFORD, wo͝od'fẽrd, **Stewart Lyndon,** American lawyer, army officer, and diplomat: b. New York, N.Y., Sept. 3, 1835; d. there, Feb. 14, 1913. He graduated at Columbia University, 1854, was admitted to the New York bar, 1857, and became assistant federal district attorney for the southern district of the state, 1861–1862. During the Civil War he served as chief of staff to Gen. Quincy Adams Gilmore in the Department of the South, became military commandant of Charleston, and reached the brevet rank of brigadier general of volunteers. He was lieutenant governor of New York during 1867–1869, but met defeat as Republican candidate for the governorship of the state, 1870. During 1873–1874 he was in the House of Representatives and from 1877 to 1883 he served as federal attorney for the southern district of New York. Appointed United States minister to Spain in 1897, he relinquished the post after the outbreak of the Spanish-American War in 1898 and resumed law practice in New York, N.Y.

WOODFORD, former urban district, England, in Essex, 10 miles northeast of London. It lies in the picturesque Epping Forest district and is a residential suburb of London, now part of Wanstead and Woodford municipal borough. Pop. of borough (1951) 61,620.

WOODHOUSELEE, LORD. See TYTLER, ALEXANDER FRASER.

WOODHULL, wo͝od'hŭl **Alfred Alexander,** United States army surgeon: b. Princeton, N. J., April 13, 1837; d. there, Oct. 18, 1921. After graduating at Princeton in 1859, he studied medicine at the University of Pennsylvania. Commissioned a medical officer in the United States Army in 1861, he served throughout the Civil War. During 1864–1865 he was medical inspector of the Army of the James. He continued his military career and in 1899 served as chief surgeon in the Philippines. In 1900 he was promoted colonel and was appointed assistant surgeon general. In 1901 he was retired but in 1904 was advanced to the rank of brigadier general, retired. From 1902 until 1907 he lectured on hygiene and sanitation at Princeton. He was an industrious contributor to medical literature.

WOODHULL, Victoria. See CLAFLIN, VICTORIA AND TENNESSEE CELESTE.

WOODIN, wo͝od"n, **William Hartman,** American industrialist and statesman: b. Berwick, Pa., May 27, 1868; d. New York, N.Y., May 3, 1934. He attended the School of Mines of Columbia University, and in 1892 joined the railroad equipment firm of Jackson and Woodin, Berwick, of which his grandfather had been one of the founders. Although president of the company in 1899, in that year he left it for the American Car and Foundry Company, which he served as president from 1916 to 1922. He was also a director of associated and other companies. Although a Republican in politics, he became secretary of the treasury under President Franklin D. Roosevelt in 1933, at a period when the country was in the throes of a severe banking and financial crisis. The successful efforts he made to restore public confidence led to a breakdown in his health and compelled him to resign office at the years' end. Music was his avocation. In 1930 he published *Raggedy Ann's Sunny Songs,* pieces for children, and he also composed the *Franklin Delano Roosevelt March;* a group of his compositions was played in 1930 by the Manhattan Symphony Orchestra of New York.

WOODLAND, wo͝od'lănd, city, California, seat of Yolo County, situated 18 miles northwest of Sacramento at an altitude of 63 feet; it is served by the Southern Pacific Railroad. The center of a rich agricultural region, the city contains beet sugar refiineries, stockyards, and feed mills. At Davis, south of Woodland, are the University of California's College of Agriculture, founded in 1908, and the California State Nursery. First named Yolo City, the city was called Woodland because of the grove

of oaks in which it stood, when its postoffice was opened in 1859. Natural gas and hydro-electric power are available. It has a mayor-council form of government. Pop. (1950) 9,386.

WOODLYNNE, wŏŏd'lĭn, borough, New Jersey, in Camden County, two miles south-southeast of Camden of which it is a suburb, on state highways and a tidal branch of Newton Creek. It is situated at an elevation of 25 feet close to the business and industrial centers of Philadelphia and Camden, and it is chiefly an industrial community.

The region was originally settled around 1681 and some of the buildings of the town date from the 18th and early 19th centuries. In the late 19th century the site of the town was the property of Charles M. Cooper, an amateur horticulturist, who collected rare trees and shrubs on his plantation, which after his death in 1890 was named Woodlynne Park. Two years later the town was laid out and in 1901 was chartered under its present name. It is governed by mayor and council. Pop. (1950) 2,776.

WOODMAN, Richard, Protestant martyr: b. Buxted, Sussex, about 1524; d. Lewes, June 22, 1557. An ironmaker by trade, he offended the clergy in Warbleton, East Sussex, in 1554, and was several times arrested and imprisoned for heretical utterances as an itinerant preacher, until 1557, when he was entrapped into a declaration upon the nature of the sacrament and excommunicated. In the same year he was put to death in company with nine other heretics.

WOODMEN OF THE WORLD, a fraternal life insurance society in the western United States, founded June 5, 1890 by Fred A. Falkenburg. It is a nonpolitical, nonsectarian organization, having approximately 400 lodges in nine states: California, Colorado, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming. Its home office is in Denver, Colo. Membership is open to men, women, and children to whom all regular forms of life insurance certificates are issued. In 1947 the membership totaled 33,416 adults and 4,574 juniors, and the society's assets were valued at $21,493,679.

WOODPECKER, a bird of the family Picidae, one of the most sharply defined families of birds which, with the related Picumnidae and lyngidae form the natural order *Pici.* These birds have a unique type of bony palate (saurognathous) especially characterized by the separation of the vomer into a pair of splint-bones; the fourth toe is reversed permanently so that it forms a pair with the hallux, which, however, is occasionally absent. The *Picidae* are distinguished by the acute, rigid and bristly character of the tips of the five well-developed pairs of tail quills, the outer or sixth pair being rudimentary. In typical woodpeckers the head is large, the neck slender but very powerful, the bill stout, straight, chisel pointed, and often strengthened by longitudinal ridges, the nostrils protected by a thick screen of bristly feathers, and the feet very powerful, with short stout tarsi, strongly hooked claws and rough scales. The tongue is slender and flexible, with a barbed, hard tip in most cases, and the posterior hyoid "horns" curving up over the rear of the skull into sheaths of muscle. This tongue is provided with muscles for projecting it far beyond the tip of the bill. This arrangement enables these birds to explore deep recesses for insects, and even to drag larvae from their burrows by means of the barbed tip and the adhesive secretion which the tongue receives from the greatly developed salivary glands.

The woodpeckers are a large group, 45 genera and 350 species having been enumerated in 1890. Except Australian, Madagascar and certain groups of the Polynesian Islands they inhabit the forest-clad regions of the entire globe. Their food, which consists to a great extent of the long-lived wood-boring larvae, makes them largely independent of seasons, and they are, with some exceptions, little migratory and are equally at home in far northern and tropical forests. A few woodpeckers, like *Colaptes* (see FLICKER), robin-like, search for worms and insects on the ground, and these have weaker, slightly curved rounded bills and smaller heads. Some, as the sapsuckers (*Sphyrapicus*), drill the outer bark of rosaceous trees and lap the flowing sap with their bristle-brushed tongues or, like the redhead woodpecker, peck the ripest apples, green corn and other sweet and succulent vegetables. But the great majority are strictly insectivorous and perform an invaluable service to human kind by their enormous destruction of a class of pernicious insects largely beyond artificial attack.

In searching for insects woodpeckers usually begin at the very base of a tree trunk, move spirally upward supported by their strong feet and bracket-like tail, peering into every crevice, pausing occasionally to tap the bark, then remain in an attitude of apparent intense listening and move on. From time to time they peck the bark with hammer-like blows delivered with intense energy, which make the chips fly rapidly and soon expose the larva whose presence within had apparently been detected by the bird's keen sense of hearing. As soon as one tree is sufficiently explored they go to another, but often spend a long time searching and drilling a decayed limb or stump much infested with insects.

Woodpeckers have a very characteristic undulating or galloping flight which is seldom much protracted. Their nests are in holes drilled by themselves first horizontally then vertically downward and chambered in the usually partially decayed limb or bole of a tree or some suitable substitute. The eggs are always white with a highly polished porcelain-like surface, are usually numerous, and are deposited on a few wood chips at the bottom of the excavation. Woodpeckers are unmusical, their nuptial song being a loud harsh rattling cry or laugh, combined with a loud drumming on resonant branches. Except during the nesting season they are usually silent and solitary birds. In Great Britain, the cry of the green woodpecker (*Picus viridis*) is said to prognosticate rain.

About one half of the known woodpeckers are American and eight genera and 30 species and subspecies enter the United States, a number of racial forms being confined to the extreme Southwest. As their habits conform pretty closely to the account just given, only a few representative forms need be mentioned.

The primate is the magnificent ivory-billed woodpecker (*Campephilus principalis*), the embodiment of all the attributes of woodpecker life and structure. (See IVORY-BILL). A smaller, duller colored, but generally close counterpart of the ivory-bill is the pileated woodpecker (*Ceophlœus pileatus*), of similar habits and only less quickly affected by the destructive agencies of man. Its original range, however, was much wider, but it is now a generally very rare and wary inhabitant of the deep woods. It is about 17 inches long, the bill is black and the fourth toe is peculiar in being much shorter than the hallux. *Dryobates* includes numerous species of small and moderate size with the plumage variously striped and spotted with black and white, the males with a red head-patch which the females lack. Very familiar nearly resident species of the wood lot and orchard are the little downy and the larger hairy woodpeckers (*D. pubescens* and *D. villosus*). A more southern and woodland species is *D. borealis,* the red-cockaded woodpecker, while the West has *D. scalaris, D. nuttallii* and *D. arizonæ. Xenopicus* contains the noteworthy *X. albolarvatus,* which has a completely white head; while *Picoides* is still more noteworthy in the entire absence of the hallux. Two or three species of the three-toed woodpeckers (*P. arcticus, P. americanus,* etc.), inhabit the northern parts and western mountains of North America, and others occur in Eurasia. Besides the much divided black and white the plumage shows some yellow and brown. The remaining North American species are less typical in structure and habits. First of them is the handsome and well-known red-headed woodpecker (*Melanerpes erythrocephalus*), locally a common bird among old timber everywhere east of the Rocky Mountains, except in New England. Southward it is resident, northward migratory and more a vegetarian than most woodpeckers, eating, besides insects, which it sometimes catches flying, nuts, berries, green corn and fruits in search of which it haunts the orchard. The California woodpecker (*M. formicivorus*), as its name indicates, finds ants a favorite article of diet, but also eats fruits, nuts and acorns, and has a remarkable habit of storing vast quantities of the latter in chinks and holes, often completely studding the boles of tall trees with acorns wedged in singly and sometimes using the space behind the cornices of houses for storage. Much speculation has been indulged in concerning this habit, but the fact is that these birds are migratory and but few of the acorns or the contained grubs thus stored are ever utilized for food. The eastern red-head stores up acorns less regularly. This genus also includes three other western species and the red-bellied woodpecker (*M. carolinus*) chiefly of the southeastern United States.

The sap-sucking habit and the peculiar structure of the tongue of *Sphyrapicus* have been alluded to above. The eastern species, the yellow-bellied woodpecker (*S. varius*), is the well-known sap-sucker, whose rows of holes completely encircling the trunks of orchard trees are so familiar. In the West are *S. nuchalis, S. ruber* and *S. thyroideus.* Finally, the genus *Colaptes* contains the handsome ground-woodpeckers or flickers (q.v.), which, while retaining much that is picine in structure and habit, in other respects depart widely.

The Old World woodpeckers for the most part belong to the typical groups of genera, but three-toed woodpeckers are found in Europe and Asia and in the Malayan Islands, the latter being a peculiar crested genus (*Gauropicoïdes*) A ground woodpecker (*Geocolaptes olivaceus*) of South Africa is gregarious and remarkable from its habit of nesting, kingfisher-like, in holes in banks. The related wrynecks (*Iyngidæ*), confined to the Old World, have the general aspects of larks, with soft broadly webbed tail feathers, but their feet and other anatomical parts and their habits, as well, are those of the woodpeckers. However, they nest in natural holes in trees or banks and often seek their food on the ground. The *Picuminidæ* have short tails with feathers of the ordinary structure. They are mostly diminutive insectivorous birds, chiefly confined to tropical America.

Consult Malherbe, 'Monographie des Picidées' (Metz 1862); Evans. 'Birds' (London 1900); Eckstorm, 'The Woodpecker' (Boston 1901); Coues, 'Key to North American Birds' (Boston 1903); Beal, 'Food of Woodpeckers,' Bulletin 37, United States Department of Agriculture (Washington 1911).

WOODROW, wud'rō, **James,** American Presbyterian clergyman and college president; b. Carlisle, England, 30 May 1828; d. Columbia, S. C., 17 Jan. 1907. He was graduated from Jefferson College, Canonsburg, Pa., in 1849, subsequently studied at the Lawrence Scientific School at Harvard, and at the University of Heidelberg. He was professor of natural science in Oglethorpe College, Ga., 1853–61, entered the Presbyterian ministry in 1860 and was Perkins professor in the Presbyterian Theological Seminary, Columbia, S. C., 1861–84. From 1891 to 1897 he was president of South Carolina College.

WOODRUFF, Charles Edward, American army surgeon and ethnologist: b. Philadelphia, Pa., 2 Oct. 1860; d. 13 June 1915. He was graduated at the General High School of Philadelphia in 1879, studied at the United States Naval Academy in 1879–83, and was graduate at Jefferson Medical College in 1886. He became an assistant surgeon in the navy in 1886, but in 1887 was transferred to the army. He was on duty in the Philippine Islands in 1898, 1902–04, and in 1909–10, and attained the rank of lieutenant-colonel. In 1913 he was retired. He was subsequently chief health officer at New Rochelle, N. Y. He was author of about 75 monographs and of 'The Effects of Tropical Light on the White Man' (1905); 'Expansion of Races' (1909); 'Medical Ethnology' (1915).

WOODRUFF, Clinton Rogers, American municipal reformer: b. Philadelphia, Pa., 17 Dec. 1868. He was graduated at the University of Pennsylvania in 1889 and received the degree of LL.D. there in 1892. He was counsel of the Philadelphia Municipal League in 1891-1903, and in 1903–04 he was special Indian commissioner for the investigation of alleged frauds. He served in the Pennsylvania legislature

two terms and fathered the «personal registration» amendment to the Pennsylvania Constitution. In 1906 he was appointed president of the board of personal registration commissioners for Philadelphia; in 1920–24 he was president of the Civil Service Commission there; and afterwards the director of public welfare. He served also as honorary secretary of the National Municipal League. He edited the *Proceedings* of the National Conference for Good City Government in 1894–1911, and is editor of the *National Municipal Review*. He published 'City Government by Commission' (1911).

WOODRUFF, Wilford, American Mormon leader: b. Northington (now Avon), Conn., 1 March 1807; d. Salt Lake City, Utah, 3 Sept. 1898. He adopted the Mormon faith in 1833 and in subsequent years made missionary tours to England, and in the eastern States. He was one of the Mormon emigrants to Salt Lake City; became one of the 12 apostles in 1839; and in 1887 was elected president of the Mormon Church. For 22 years he held a seat in the Utah legislature.

WOODRUFF, wûd'rŭf, or **WOODROOF,** plant of the genus *Asperula* and natural order *Rubicaceæ,* with whorled leaves, native of northern parts of the old world, and distinguished by a funnel-shaped or bell-shaped corolla, a bifid style, capitate stigma, and dry didymous fruit. The sweet woodruff (*A. odorata*) is common in shady woods in all parts of Europe. It has a creeping root, a stem five to 10 inches long, weak and sub-erect, four or five whorls of lanceolate leaves, six to eight in the whorl rough at the edge and keel, and small white flowers. The plant when dried has a very agreeable fragrance, similar to that of *Anthoxanthum odoratum* under similar circumstances. It forms an agreeable herb-tea, and enters into the composition of the popular *Maydrink* of the Germans. Dyer's Woodruff (*A. tinctoria*) is a native of the continent of Europe and of Siberia, a perennial, with reclining stems about 12 inches long, whorls of six or four linear leaves, upper leaves opposite, flowers whitish. The root is used in Dalmatia and elsewhere instead of madder; but the crop obtained from a field is inferior in quantity to that of madder. For flavoring, the Germans in this country use the sweet-scented bedstraw (*Galium triflorum*), of the same family, and with odor much like that of woodruff; it is procumbent, the fruit bur-like, with hooked bristles, the flowers in threes, greenish; it is common in woods that have a rich soil.

WOODS, Charles Robert, American soldier: b. Newark, Ohio, 19 Feb. 1827; d there, 26 Feb. 1885. He was graduated at the United States Military Academy in 1852 and was engaged in garrison and frontier service until 1861. He commanded the troops on the steamer *Star of the West,* in the attempt to relieve Fort Sumter in April 1861, and was appointed colonel of the 76th Ohio volunteers 13 Oct. 1861. He saw service at Fort Donaldson, at Shiloh, the siege of Corinth and in the Vicksburg campaign, and was promoted brigadier-general of volunteers 4 Aug. 1863. He commanded a brigade at Lookout Mountain and Mission Ridge and a division in the Georgia and Carolina campaigns. He was mustered out of the volunteer service 1 Sept. 1866, with brevet rank of major-general in the regular army and was transferred to the regular army. He was later engaged in the Indian warfare of the western plains. He was appointed colonel of the Second infantry 23 March 1874 and was retired from service in December 1874.

WOODS, Frederick Adams, American biologist: b. Boston, Mass., 29 Jan. 1873. He studied at the Massachusetts Institute of Technology in 1890–94 and took the degree of M.D. at Harvard University in 1898. He was connected with the faculty of the Harvard Medical School in 1898–1903, and from 1903 to 1923 lecturer on biology at the Massachusetts Institute of Technology. He published many papers on heredity and the volumes 'Mental and Moral Heredity of Royalty' (1906); 'The Influence of Monarchs' (1913), and is joint author of 'Is War Diminishing?' (1915). Died Rome, Italy, 5 Nov. 1939.

WOODS, Katherine Pearson, American novelist: b. Wheeling, W. Va., 28 Jan. 1853; d. Baltimore, Md., 19 Feb. 1923. She was educated in private schools in Baltimore. During 1893–94 she held a fellowship under the College Settlement Association and published the report of investigations during that period in the *American Journal of Statistics* (December 1895). She engaged in missionary work among the whites of North Carolina from 1903–06. Her published works include 'Metzerott Shoemaker'; Mark of the Beast'; 'A Web of Gold'; 'From Dusk to Dawn'; 'A Tale of King Messiah'; 'The Son of Ingar'; 'The True Story of Captain John Smith'; and many magazine articles.

WOODS, Leonard, American Congregational clergyman: b. Princeton, Mass., 19 June 1774; d. Andover, Mass., 24 Aug. 1854. Graduated at Harvard in 1796, he studied theology at Somers, Conn., as a pupil of Dr. Charles Backus, in 1798 was ordained pastor of the church at Newbury, Mass., and upon the establishment of the Andover Theological Seminary in 1808 was made professor of Christian theology there. In 1846 he retired from the active duties of the chair. He was a strict Calvinist, well-versed in metaphysical studies, a clear and vigorous writer and a champion of the New England theology against Ware, Buckminster, Channing and other Unitarians. «He is emphatically,» says H. P. Smith, «the 'judicious' divine of the later New England theology.» He was prominent in the founding of the Temperance Society, the American Tract Society, and the Board of Commissioners of Foreign Missions. Among his works are 'Life of Mrs. Harriet Newell' (1814); 'Letters to Unitarians' (1820); 'Lectures on the Inspiration of the Scriptures' (1829); 'Letters to the Rev. N. W. Taylor' (1830); 'Memoirs of American Missionaries' (1833); 'Examination of the Doctrine of Perfection' (1841) and 'Lectures on Church Government' (1843); 'Theology of the Puritans' (1851). Consult Foster, F. H., 'A Genetic History of New England Theology' (Chicago 1907), and Walker, Williston, 'Ten New England Leaders' (New York 1901).

WOODS, Leonard, American theologian and college president, son of Leonard Woods,

1774–1854: b. Newbury, Mass., Nov. 24, 1807; d. Boston, Mass., Dec. 24, 1878. He was graduated at Union College in 1827 and at the Andover Theological Seminary in 1830. He was professor of sacred literature at Bangor Seminary in 1836–1839, and in 1839–1866 he was president of Bowdoin College. He edited the *Literary and Theological Review,* New York, in 1834–1837; translated G. C. Knapp's *Christian Theology,* 2 vols. (1831–1833), and was author of many valuable papers on the early history of Maine, contributed to the *Proceedings* of the Maine Historical Society.

WOODS, Robert Archey, American university settlement worker: b. Pittsburgh, Pa., Dec. 9, 1865; d. Boston, Mass., Feb. 18, 1925. He was graduated at Amherst and at Andover Theological Seminary in 1890. He studied European social problems, spending six months at Toynbee Hall, London. He was head of the South End House, Boston, after 1891, and of the National Federation of Settlements from 1923 until his death. He lectured on social economics at Andover Theological Seminary (1890–1895), and on social ethics at the Episcopal Theological School, Cambridge (1896–1914). In 1911 he was secretary of the National Federation of Settlements, and he was president of the National Conference of Social Work (1917–1918).

He is the author of *English Social Movements* (1891); *The Settlement Horizon* (1922); *The Neighborhood in Nation-Building* (1923); *Preparation of Calvin Coolidge* (1924).

WOODS, William Burnham, American jurist: b. Newark, Ohio, Aug. 3, 1824; d. Washington, D.C., May 14, 1887. He was graduated at Yale in 1845, was admitted to the Ohio bar in 1847, and was mayor of his native city in 1856–1857. In the last-named year he was elected to the Ohio legislature and chosen speaker. At the outbreak of the Civil War he entered the Union Army as lieutenant colonel of the 76th Ohio Regiment, and was promoted brevet major general, serving under Grant and Sherman. From 1880 to 1887 he was associate justice of the United States Supreme Court.

WOODS HOLE, village, Mass., in the town of Falmouth (q.v.), in Barnstable County, on Buzzards Bay, and on the New York, New Haven and Hartford Railroad. It has a large, deep harbor, and is widely known as the location of the Woods Hole Oceanographic Institution, founded in 1930. Pop. (1950) 549.

WOODSTOCK, town, Connecticut, in Windham County; altitude 600 feet; 6 miles northwest of Putnam. There are several small villages within the town. It lies in a farming section, near the boundary lines separating Connecticut from Massachusetts on the north, and Rhode Island on the east. Incorporated in 1690, when the three states were engaged in territorial disputes, it belonged first to Massachusetts, but in 1749 was taken over by Connecticut. Pop. (1950) 2,271.

WOODSTOCK, city, Illinois, McHenry County seat; altitude 943 feet. It is situated 33 miles west of Waukegan, on the Chicago and North Western Railroad. Woodstock is the county's merchandising center; its industries are die casting and the manufacture of metal goods and typewriters. The city has junior and senior high schools, and is the seat of the Todd School for Boys, founded in 1848, and designed to encourage exercise of the creative faculties. The old city hall and opera house building is used as a summer Little Theater, attracting guests from outside the city. The city also has a winter stock theater. Settled in 1844, Woodstock was incorporated as a village in 1852 and as a city in 1873. It has mayor and council. Pop. (1950) 7,192.

WOODSTOCK, town, New Brunswick, Canada; seat of Carleton County. It is situated on the St. John River, near the Maine border, 48 miles west-northwest of Fredericton, and is served by the Canadian National and the Canadian Pacific railways. There are copper, zinc, and lead mines in the surrounding country, which also engages in dairying, fruit growing, and lumbering. The town manufactures furniture, agricultural machinery, and dairy products. It is the seat of a provincial agricultural college. Pop. (1951) 3,996.

WOODSTOCK, city, Ontario, Canada, Oxford County seat; located on the Thames River, 26 miles east-northeast of London. It is served by both Canadian Pacific and Canadian National transcontinental railways. There are seven public schools including the new and modernly equipped Collegiate Institute; also the Redemptorist Fathers' College. There are 12 churches and a centrally located public library. The courthouse, occupying a commanding position, is noted for its architectural beauty. The city's chief industries are furniture and other woodworking plants; stoves, garden implements, wire fences, pianos, organs, and textile plants are also among its varied industries. An abundance of parks and public playgrounds and a golf course immediately adjoining the city add to its many attractions as a place of residence. Pop. (1951) 15,544.

WOODSTOCK, town, Vermont, including Woodstock village, and Windsor County seat; altitude 705 feet; 13 miles west of White River Junction; on the Boston and Maine Railroad. The Woodstock Railroad, formerly connecting the two points, has been discontinued. Once a publishing center, its principal industry is woodworking. Woodstock is a summer and winter resort, with skiing facilities. It has a high school and a public library. Settled in the 1750's, incorporated in 1761, it has a board of selectmen. Pop. (1950) 2,613.

WOODSTOCK, a novel by Sir Walter Scott, published in 1826. It is an English tale of the time of Cromwell; the events occurring in the year 1652, immediately after the Battle of Worcester. The scene is laid chiefly in the Royal Park and Manor of Woodstock.

WOODWARD, Calvin Milton, American educator: b. Fitchburg, Mass., Aug. 25, 1837; d. St. Louis, Mo., Jan. 12, 1914. He was graduated at Harvard University in 1860 and was principal of Brown High School, Newburyport, Mass. (1860–1865). During one year of the Civil War he was captain of Company A, 48th Massachusetts Volunteers, serving in Louisiana. In 1865 he was called to Washington University, St. Louis; elected professor of mathematics and

applied sciences (1870); dean of the school of engineering (1871–1896); and was founder and director of the St. Louis Manual Training School from its organization in 1879.

Dr. Woodward's service to the cause of education was marked by success along practical lines. He served as a member of the St. Louis School Board (1877–1879) and again after 1897; regent of the Missouri State University (1891–1897) and in 1906 president of the American Association for the Advancement of Science.

In the summer of 1910 he retired from the deanship and the last four years of his life were devoted to works of philanthropy and to the authorship and publication of his book on *Rational and Applied Mechanics.* He contributed many valuable articles to educational and scientific journals and wrote *History of the St. Louis Bridge* (1881); *The Manual Training School* (1887); *Manual Training in Education* (1890).

WOODWARD, Robert Simpson, American astronomer, physician and mathematician: b. Rochester, Mich., July 21, 1849; d. June 29, 1924. He received the degree of C.E. at the University of Michigan 1872 and was appointed assistant engineer, United States Lake Survey. During 1882–1884 he served as assistant astronomer to the United States Transit of Venus Commission; from 1884–1890 he was astronomer, geographer and chief geographer to the United States Geological Survey; became assistant in the United States Coast and Geodetic Survey in 1890, and served for three years. From 1893 to 1905 he was professor of mechanics and mathematical physics at Columbia University, and from 1895 to 1904 was dean of the faculty of pure science. In 1904 he became president of Carnegie Institution, Washington, D.C.

He wrote *Smithsonian Geographical Tables* (1894); *Higher Mathematics—a Text Book for Classical and Engineering Colleges* (1896, with Mansfield Merriman).

WOODWARD, city, Oklahoma, Woodward County seat, altitude 2,002 feet. It is situated on the North Canadian River, and the Atchison, Topeka and Santa Fe, and Missouri, Kansas and Texas railroads, 124 miles northwest of Oklahoma City. A United States field station and dairy experiment station is on the city's western edge, where every crop and tree adapted to this section is cultivated. Leather goods are manufactured. Woodward was settled in 1893, and has commission government. Pop. (1950) 5,915.

WOODWAXEN, wo͝od'wăk-sĕn (also called Dyer's-Broom, Dyeweed, Greenweed, Greenwood, Whin, and Woadwaxen), a low shrub, *Genista tinctoria,* of the family Fabaceae. The genus comprises about 80 species, natives of Europe, northern Asia and Africa. The woodwaxen is a low-branching shrubby plant, with a few yellow nearly sessile flowers. It was originally cultivated in New England gardens because of the yellow dye it produced and is now found from Maine to eastern New York.

WOODWORTH, wo͝od'wûrth, **Robert Sessions,** American psychologist and physiologist: b. Belchertown, Mass., Oct. 17, 1869. He was graduated at Amherst College in 1891, received the degree of A.M. at Harvard University in 1897, and that of Ph.D. at Columbia University in 1899, and later studied at the universities of Edinburgh, Liverpool and Bonn. He was demonstrator in physiology at the University of Liverpool in 1902–1903, and was subsequently connected with the faculty of Columbia University, where from 1909 to 1942 he was professor of psychology. He was president of the American Psychological Association in 1914.

He was joint author of *The Elements of Physiological Psychology* (1911); and author of *The Accuracy of Voluntary Movement* (1899); *The Care of the Body* (1912); *Dynamic Psychology* (1917); *Adjustment and Mastery* (1933); and *Experimental Psychology* (1938).

WOODWORTH, Samuel, American author and editor: b. Scituate, Mass., Jan. 13, 1785; d. New York, Dec. 9, 1842. He received a limited education in his native town, and was apprenticed in Boston to Benjamin Russell, editor and publisher of the *Columbian Sentinel.* After the expiration of his indentures he published for a brief period at New Haven, Conn., the weekly *Belles Lettres Repository,* and engaged in other literary pursuits, in which he continued with more or less success until the close of his life. He was one of the founders in 1823, in conjunction with George P. Morris, of the *New York Mirror,* from which he withdrew within a year. Among his writings were a number of dramatic pieces, and *Champions of Freedom,* a romance of the War of 1812 (1816), but his reputation rests principally upon his songs and miscellaneous poems, one of which, *The Old Oaken Bucket,* obtained a wide popularity. His collected poems were published by his son, with a memoir by George P. Morris, 2 vols. (1861).

WOOF. See Weaving.

WOOL, wo͝ol, **John Ellis,** American general: b. Newburgh, N. Y., Feb. 20, 1784; d. Troy, N. Y., Nov. 10, 1869. He was in early life proprietor of a bookstore in Troy, and his property being consumed by fire, he turned to the law, but his studies were interrupted by the war with Great Britain in 1812, when he became captain in the 13th Infantry. He distinguished himself at Queenstown Heights, Plattsburgh, and Beekmantown, and in 1816 was appointed inspector general of the northern division; in 1818 lieutenant colonel; in 1821 inspector general of the whole army; and in 1826 brevet brigadier general for 10 years' faithful service. In 1832 the government sent him to Europe to examine the military systems of some of the principal nations. In 1836 he was charged with removing the Cherokee Indians to Arkansas; and in 1838, during the Canadian difficulties, made a reconnoissance through the wilds of northern Maine, with a view to the defense of the frontier. He was appointed brigadier general, June 25, 1841, and at the beginning of the Mexican War was ordered to the West to organize the volunteers, May 30, 1846, and in less than six weeks dispatched to the seat of war with 12,000 troops fully armed and equipped. He selected the ground on which was fought the Battle of Buena Vista Feb. 23, 1847, commanded in the early part of the action, and for his conduct on this occasion was brevetted a major general in 1848. After his return home in July 1848, he commanded the

WOOL

Australian Merino ram, producer of world's finest wool.

International Wool Secretariat

Crossbred sheep on a ranch in New Mexico.

International Wool Secretariat

Half-blood sheep ready for shearing on a western United States range.

U.S. Forest Service Photo

Sheep camp on a range in the western United States.

Library of Congress

Crossbred sheep on a ranch in New Mexico.

WOOL

British Combine

Shearing a sheep with power clippers.

Acme

Wool shearer holding fleece as it appears immediately after shearing.

Ranch hand holding rolled wool fleeces as they appear after shearing.

British Combine

Girl holding raw wool as it appears after scouring.

Eastern Military Division, with headquarters at Troy, N. Y., until 1853, when he was placed in command of the Department of the East, with headquarters at Baltimore, Md. From 1854 to 1857 he was in command of the Department of the Pacific, and from then until 1861 again of the Department of the East.

After the outbreak of the Civil War, he was given command of Fortress Monroe, Va., which he preserved for the Union with timely reinforcements. Promoted to the rank of major general in the Regular Army in May 1862, he was retired in the following year because of age and disability.

WOOL, the animal fiber forming the protective covering of the sheep. The outside of the fiber is made up of flat, irregular scales that overlap like shingles on a roof, presenting an imbrecated appearance. The fiber grows with a crimp, a wavy form which gives it excellent properties of elasticity and resilience. Some wool fibers are short; others, long. Some are fine; others, coarse. Basically, length and fineness determine the purpose for which the fibers can best be used.

Chemically, wool is a protein called keratin, and is made up of about 18 different amino acids. The amino acids are linked to one another to form long, coiled molecular chains, shaped somewhat like a coiled spring. Individual chains are linked to each other by chemical (disulphide) cross-links. Branching off the chains are reactive chemical sites (side groups of some amino acids). The molecular chains uncoil when wool fibers are stretched or distorted, but tend to assume their original shape when the stretching force is removed. Thus wool fabrics shed wrinkles easily and are long wearing because of the unique elasticity of the wool protein. The reactive side groups are easily modified by chemicals to give new wool properties and also readily attract dyestuffs. They account for wool's excellent dyeability.

Wool is usually white, though the degree of whiteness may vary considerably. It may also be creamy yellow, gray, brown, or black, but there is no noticeable difference in structure or properties between wool of these colors and white wool.

History.—The story of wool dates back to man's earliest history. The sheep was one of the first animals to be domesticated, and through the ages it has provided man with two of the basic necessities of life—food and clothing.

No one knows when wool was first spun and made into cloth, but wool fabrics have been unearthed in ruined villages that were inhabited in the Neolithic age by Swiss lake dwellers. Garments made of wool fabrics were worn by the Babylonians as early as 4000 B.C., and by 3000 B.C. all the Asiatic tribes were raisers and breeders of sheep. Joseph's "coat of many colours," mentioned in Genesis 37, is said to have been made of wool. Wool clothmakers and tailors traveled with Julius Caesar's legions, and in the early Christian era fine woolen cloth was made in Baghdad, Damascus, and other cities of the Middle East.

In the Middle Ages the wool industry flourished in Flanders and in the Italian cities of Venice and Florence. As the weaving industry expanded, a demand for better sheep and finer wools was stimulated. The development in Spain of native Merino sheep between 1400 and 1700 gave the world the finest of all wool-producing sheep. For many years, Merinos were jealously guarded by the Spanish government, their exportation being punishable by death. In the 17th century, France began importing Spanish Merinos, and in the 18th century they were imported also into Norway, Denmark, Germany, Hungary, and England, as well as into Australia, South Africa, and South America.

The development of the wool textile industry in England expanded as the result of a policy of inviting craftsmen from other lands to settle in Britain. By the early part of the 18th century, England had become the leading wool textile producer.

Domesticated sheep were not known to the original Indian inhabitants of the Americas. They were first brought to the New World in 1540 by the Spanish explorer Francisco Vásquez de Coronado. In 1609 a few were shipped to Jamestown, Va. Although the spinning wheel was a familiar household appliance in the colonial American home, few sheep were raised in the early years, woolgrowing was slow to develop, and the colonies relied mainly on England for their supplies of wool and cloth. The necessity for wool clothing as a protection against the severe weather in the New England colonies did bring about an early establishment of the wool textile industry there, but the first real expansion of the industry was stimulated by the need to produce clothing made from domestic wools during the Revolutionary War, when foreign sources of supply were either curtailed or cut off.

Beginning in 1801, Merino sheep were imported into the United States to aid in the improvement of the breeds of domestic sheep, and by 1810 approximately 24 woolen mills were operating in New England and the nearby Eastern section of the country. The manufacture of wool carpets and rugs also began about this time. After 1830 improvements in machinery, the spread of transportation facilities across the United States, and the growth of cities stimulated a further development of the industry and started the transfer of woolgrowing to the West. Then, during the Civil War, the great need for service uniforms brought about further expansion of the wool textile industry. The industry continued to develop after the war, keeping pace with the country's general industrial expansion, and by 1897 it was providing more than 90 per cent of the domestic requirements for wool fabrics.

Woolgrowing.—The domesticated sheep is raised in every country of the world, and in several hundred varieties differing in appearance and in the type of wool produced. These variations result from differences in soil, climate, pasturage, and breed. No two fleeces, even from the same type of sheep and the same geographic area, are exactly alike. There are, however, three major types of sheep, which can be classified as follows: (1) mutton types, raised primarily for meat; (2) wool types, raised principally for wool; and (3) dual types, raised for both meat and wool.

Most sheep are raised either on large ranches, where they constitute the principal profit-making product, or on small farms with diversified crops and livestock. The first type of enterprise prevails in Australia, New Zealand, and South America, and the western United States, and the second in the midwestern United States, England, and continental Europe. In addition, large num-

bers of sheep are raised under primitive conditions in remote mountain districts, such as the Highlands of Scotland, the Pyrenees of Spain, and the plateau of central Asia.

Sheep raising does not require extensive equipment or heavy labor, but it does necessitate constant attention. Most sheep farms are located in hilly or rough areas on land unsuited to other agricultural enterprises. To distinguish the sheep in each flock, raisers generally mark the animals with paint or a stamping compound.

Sheep flocks in Australia may number more than 100,000 head, but flocks ranging from 2,000 to 5,000 are the most numerous. Most flocks in the United States run about 1,000 head, but there are herds as large as 50,000.

Sheep are generally shorn once a year, and within a year's time their wool may grow to lengths varying from 1 inch to 15 or more inches. The shearer works with a power machine, resembling a barber's electric clippers, which removes the whole fleece in one piece, and an expert can clip between 100 and 200 sheep in a day. Wool obtained this way is called shorn wool, whereas the fleece taken from the pelts of lambs or sheep slaughtered for meat is known as pulled wool. Shorn wool is the predominant of the two classes, produced in by far the greater quantities.

Before wool reaches the ultimate consumer it passes through a great many processes. The raw wool comes to the manufacturer or mill in the form of fleeces, which are packed or shipped in bags or bales. The weight of the bags or bales varies in the different wool-producing areas. Australian and New Zealand bales, for example, weight about 300 pounds; South African bales, about 370 lbs; South American bales, 1,000 pounds; and United States bags, from 225 to 350 pounds.

Types of Wool.—There are two broad classifications of raw wool based on ultimate use: apparel-class wools and carpet-class wools. Carpet wools are coarser and usually longer than apparel wools. Comparative quality is designated in the wool trade by either the numerical or the blood system, both of which assign market grades to the various types of wool. The blood system, peculiar to the United States, is compared with the numerical or English system in Table 1. Fiber diameter, length, and general fiber soundness are primary considerations in the evaluation of each of these grades for use and marketing purposes. Among other important properties are contour, crimp, color, and the felting property.

Table 1—APPAREL WOOL GRADES

Blood system	Count or numerical system
Fine	64's, 70's, 80's
Half blood (½ blood)	60's, 62's
Three-eighths blood (⅜ blood)	56's, 58's
Quarter blood (¼ blood)	48's, 50's
Low-quarter blood	46's
Common	44's
Braid	36's, 40's

Source: Hermie, Albert M., *Prices of Apparel Wool,* Technical Bulletin No. 1041, U.S. Dept. of Agriculture, p. 5 (Washington 1951).

Fine wool has a length of 2½ to 5 inches, up to 2,400 "surface" scales to the inch, and a diameter of about 1/2000 of an inch. Only pure Merino sheep or breeds with predominantly Merino blood produce fleeces classified as fine wools. These sheep are found principally in Australia, South Africa, and the United States. About 60 per cent of the world's apparel wool is produced by crossbred and medium-wool sheep, such as the Corriedale, Southdown, Shropshire, Hampshire Down, and Dorset Down. This type of wool is grown principally in the United States, the United Kingdom, Australia, New Zealand, and South America.

Carpet wools are produced in all parts of the world by sheep which usually live under primitive conditions. A large proportion of these sheep are raised in Asiatic countries, among them the Somali, Hirrik or Iraqi, Sikkim Bera, and Tatarian breeds. Their wool consists of a long outer coat of hair protecting an undercoat of true wool.

Table 2—WORLD SHEEP POPULATION AND WOOL PRODUCTION

	Sheep population (millions)	Wool Production, greasy basis (millions of pounds)		
	1956	Average 1946–1950	1957[1]	Type of Wool
Major exporting countries				
Australia	139	1,060	1,603	Largely apparel
Argentina	47	450	441	75 percent apparel, 25 percent carpet
New Zealand	40	375	490	Largely apparel
South Africa	38	216	311	Apparel
Uruguay	23	163	176	Apparel
Total above	287	2,264	3,021	
Other important countries				
USSR	125	312	598	Apparel and carpet
United States	31	318	295	Apparel
China	17[2]	75	110	Largely carpet
United Kingdom	24	81	105	Largely apparel
Total above	197	786	1,108	
All other countries	415	860	966	
Grand total	899[3]	3,910	5,095	

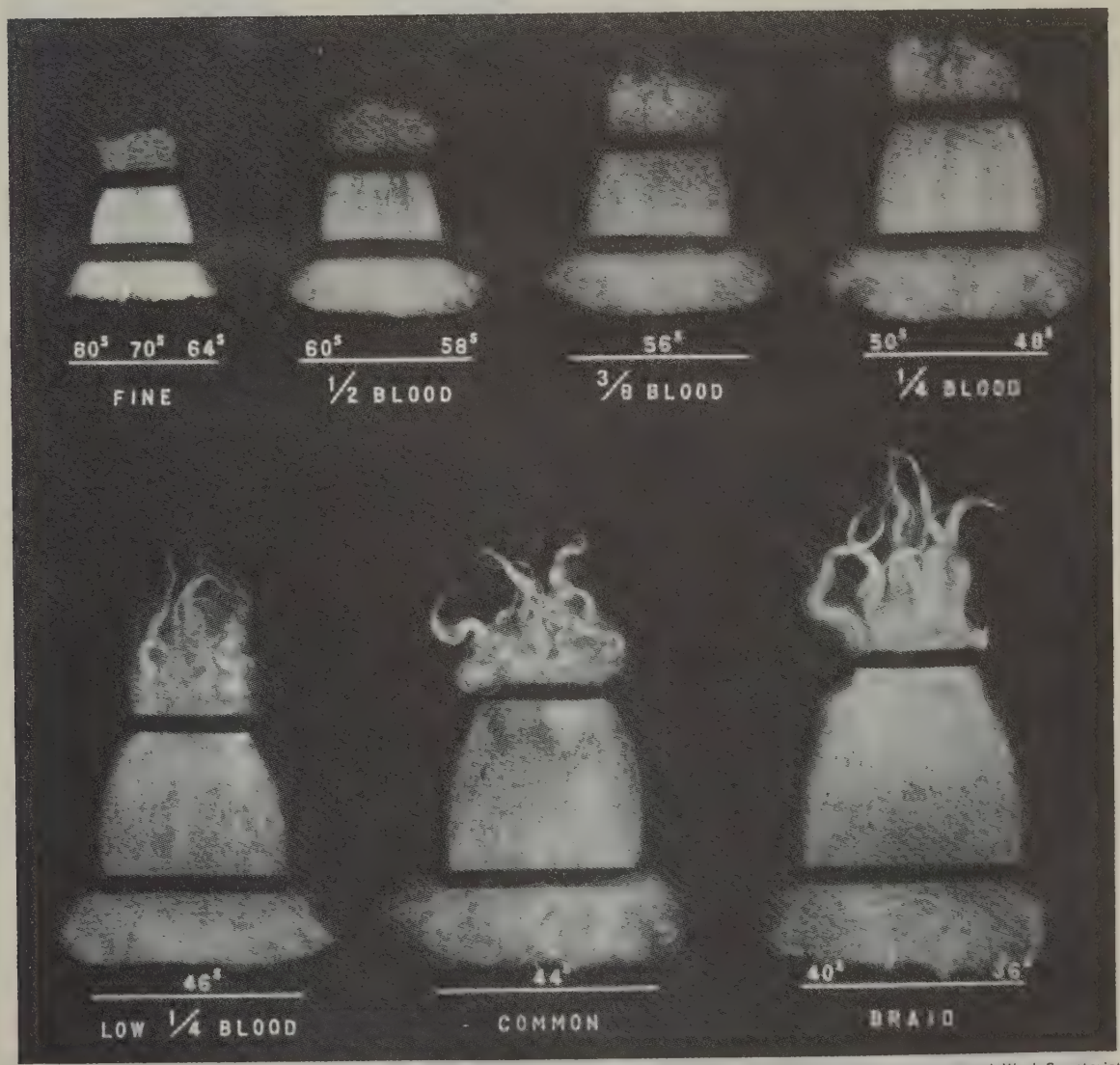
[1]Preliminary. [2]1953 figure. [3]Preliminary total for 1957 is 919 millions.
Source: United States Department of Agriculture

Wool Supply.—The annual world production of wool has been increasing steadily. Since 1956, it has exceeded 5 billion pounds (greasy basis), of which about 80 per cent is classified as apparel wool and 20 per cent as carpet wool. On the whole, despite occasional sharp changes in wool production by individual countries, short-term variations in the wool supply by groups of countries are relatively small. Table 2 shows world wool production and sheep population by major countries.

Australia is the largest producer of wools in the world and the leading supplier of fine wools. Five countries of the Southern Hemisphere (Aus-

Ewing Galloway, N.Y.

Sorting wool before it is washed.

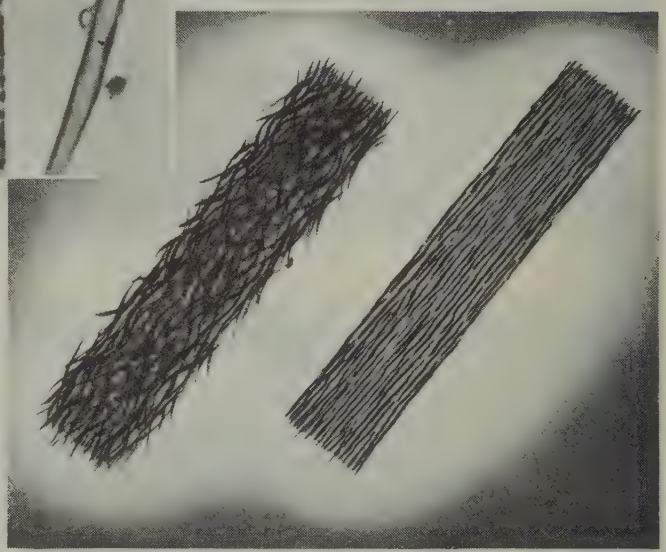


International Wool Secretariat

Grades of wool, as represented in the practical forms of the official standards for grades of wool, are designated by the blood terms as well as by the corresponding numerical terms.

WOOL

Microphoto showing scales on the wool fiber.



Enlarged diagram of (left) woolen and (right) worsted yarns.

International Wool Secretariat

The surface appearance of (left) a woolen fabric and (right) o worsted fabric.

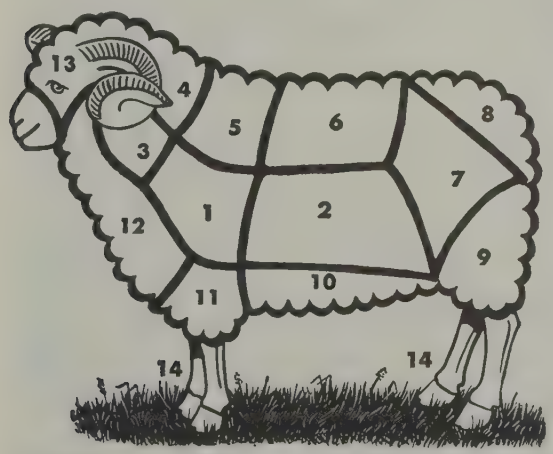
tralia, New Zealand, South Africa, Argentina, and Uruguay) produce almost three fifths of the world supply and about three fourths of that of apparel-class wool. Most of this wool is shipped thousands of miles across the world to countries, such as the United States, which have large populations and insufficient wool supplies. The United States and the United Kingdom, which are the chief apparel wool consumers, also produce important quantities of this type of wool. The principal sources of carpet wools are the USSR, Argentina, Turkey, India, and China, which account for 45 per cent of the total output of this class. The Balkan countries, New Zealand, Iran, Pakistan, Iraq, and French North Africa produce the bulk of the remaining 55 per cent.

Marketing.—The world's annual wool supply is marketed by two principal methods: (1) private or cooperative trading among growers, dealers, and manufacturers; and (2) auction selling by open, competitive bidding. Practically the entire domestic production of the United States is marketed by the first method, while a number of other countries, including Australia, New Zealand, and South Africa, favor the auction method. Important wool marketing centers are located in Sydney, Australia; London, England; Boston, Mass.; and Buenos Aires, Argentina.

Another phase of wool trading is the wool futures market, where standard wool contracts, for either raw wool or wool top, are bought and sold by growers, merchants, and consumers. These contracts specify certain quantities and qualities of wool for future delivery. They are traded to obtain price insurance (hedging), to minimize losses on cash transactions or inventories of wool and processed wool goods, or to speculate for profit. Because of the difficulty in establishing standards for wool quality, however, raw wool futures have not developed as widely as similar markets for other commodities.

Since 1890 the growth of wool consumption has been slightly more rapid than the growth of world population. Wool textile industries of varying importance are now carried on in virtually every country of the world, and the annual world consumption of wool approximates world production.

Uses and Manufacture.—Wool is used chiefly to make clothing, but there are many other important wool products, including blankets, carpets, rugs, upholstery, draperies, industrial cloths, felt, and knit goods.



Wool quality breakdown. Low numbers indicate best qualities.

The first step in preparing wool for manufacture into fabrics is sorting. The fleeces are divided into sections based on the average diameter of the wool fibers in the various parts. The best wool is found on the shoulders and sides. The lower part of the back, though less choice, is also of good quality, but the wool from the tail, lower part of the legs, and head is stiff, straight, and coarse. The sorted wool is then scoured by either a soap-alkali or a solvent method in order to wash grease, suint (dried sweat), and other impurities from the raw stock. These impurities include vegetable matter, such as burrs, seeds, twigs, leaves, or straw, that is contained in all raw wool. During this cleaning process the wool loses from 20 to 80 per cent of its original (greasy) weight. Thereafter, it is referred to as clean or scoured wool.

Fabrics made from wool for clothing and other purposes are woven or knit from woolen or worsted yarns or made by felting the unspun fiber. Preparatory to making the yarn, wool fibers of similar characteristics are carefully blended. They are then put through a process known as carding in order to disentangle the locks and bunches of fibers and to remove very short fibers and any remaining bits of burrs and vegetable matter. The carding operation can be compared to the combing and brushing of one's hair. This process produces rove or roving, a rope of wool adaptable for spinning into yarn. From this point on processing differs, depending on whether woolen or worsted yarn is desired.

Wool clothing fabrics comprise two classes—woolens and worsteds. The manufacture of woolens utilizes a wider range of raw material, and there is more variety in the finished product. Woolen yarns require less processing, being spun directly after carding. They are also more open, hairy, and irregular than worsted yarns.

Before wool is made into worsted yarn, it must go through a combing process in order to separate the short from the long fibers. The shorter fibers, called noils, are collected and used in making woolen yarns or pressed felts. In contrast to the roving made up of small strands of fiber that is produced by carding for the woolen system, worsted cards produce a web of fibers that is condensed into a thick strand adaptable for feeding into the worsted comb. The comb then removes the short fibers and forms the long fibers into a thick, uniform strand known as wool top. This strand is reduced in size to a roving by being drawn through rollers for mixing and parallelization. When the roving is of a predetermined thickness and weight, it is ready for spinning into yarn.

Most wool products are woven on looms. In weaving, two sets of yarns are interlaced at right angles to each other, one, termed the warp, running lengthwise in the loom, and the other, termed the filling or weft, running crosswise. Since the warp runs lengthwise and the filling is inserted horizontally and at right angles to the warp, there are only two possibilities of interlacing: the individual warp thread can only lie over the filling thread or under it. Woolen and worsted fabrics generally vary in width between 54 and 60 inches. The length of a piece or cut is usually 50 to 70 yards, but in a few cases it may run from 120 to 140 yards. Woolen and worsted yarns are often combined to make certain fabrics.

Woolen and worsted cloths go through a series

of finishing processes after they leave the loom. The primary object in finishing is to enhance the quality of the cloth by giving it a specific appearance and handle. There are three main groups of finishes for wool fabrics: (1) clear finish; (2) face finish; and (3) modifications of either one. Clear-finished fabrics, which include most worsted fabrics, have an even, unnapped surface, the weave and the colors being prominently developed. Face-finished fabrics, on the other hand, have a distinct nap or pile of fibers on the surface, an indistinct weave, and usually subdued and softened colors.

Wool may be dyed in any stage of manufacture. Sometimes the raw material is dyed immediately after scouring; in other cases the wool is dyed in the top, at the yarn stage, or in the finished fabric. In addition, wool fabrics are sometimes printed for use as neckwear, blouses, dresses, or beachwear.

Both woolen and worsted yarns are knit by machine into such products as hosiery, sweaters, and cloth and made into coats, dresses, and other products. In addition, woolen and worsted yarns are prepared and marketed for hand knitting. Woolen and worsted yarns used in carpet and rug manufacturing are usually heavier than those used in making apparel.

Wool felt is manufactured by a separate division of the wool textile industry, using a method handed down from antiquity. The felting property, which causes the fibers to adhere closely, is a predominant characteristic of wool. Felts are made from masses of unspun fibers by firmly enmeshing them through a combined mechanical-chemical action that includes treatment by moisture and heat. Unwoven felts are used widely in the hatmaking trades and for covering metallic and other surfaces in industry. Woven felt is used extensively in the piano industry, in printing, and in the chemical and optical trades. (See also FELT.)

Specialty Hair Fibers.—Most of the wool we use comes from the sheep, but certain other animal fibers, which are closely related to wool and are basically termed wool, are used alone or in conjunction with sheep's wool to make clothing and other types of fabrics. These fibers come from the covering of goats, camels, llamas, alpacas, vicuñas, and certain fur-bearing animals. The specialty hair fibers, as they are called, are employed to add special effects of beauty, color, softness, or luster to fabrics.

Reclaimed Wool, Secondary Raw Materials, and Byproducts.—Because of wool's durability and relatively high cost among textile fibers, wool textile manufacturers use mill waste as well as reprocessed and reclaimed wool to make inexpensive fabrics for certain markets. In addition, other fibers are sometimes blended with wool in order to lower the manufacturing costs and retail prices of fabrics, to add strength, or to produce special effects.

Wool grease, known in its purified form as lanolin (q.v.), is an important byproduct of the wool industry. It enjoys a wide industrial use in the production of pharmaceuticals, cosmetics, cutting oils, printing inks, lubricating greases, rust preventives, and varnishes.

Wool Products Labeling.—In the United States wool producers, manufacturers, distributors, and consumers are protected against misrepresentation of wool products by the Wool Products Labeling Act, enacted by Congress in 1940. This law requires the labeling of all products containing wool except upholstery and floor coverings, and stipulates that the label show the percentage of total fiber weight represented by each kind of wool or other fiber present in a wool product.

The term "wool" is defined in the act to mean the fiber from the fleece of the sheep or lamb or the hair of the Angora or Cashmere goat (it may include the specialty fibers from the hair of the camel, alpaca, llama, and vicuña), which has never been reclaimed from any woven or felted wool product. Reprocessed wool is defined as wool fiber which has been reclaimed from woven or felted materials which have never been utilized in any way by the ultimate consumer. Re-used wool is defined as wool fiber reclaimed from used or worn wool products. Virgin or new wool, as defined in the regulations under the act, is wool fiber which has never been in any way used, reclaimed, reworked, reprocessed, or re-used from any spun, woven, knitted, felted, or manufactured product.

See also SHEEP; TEXTILE FABRICS; TEXTILE MACHINERY—*Woolen and Worsted Machinery.*

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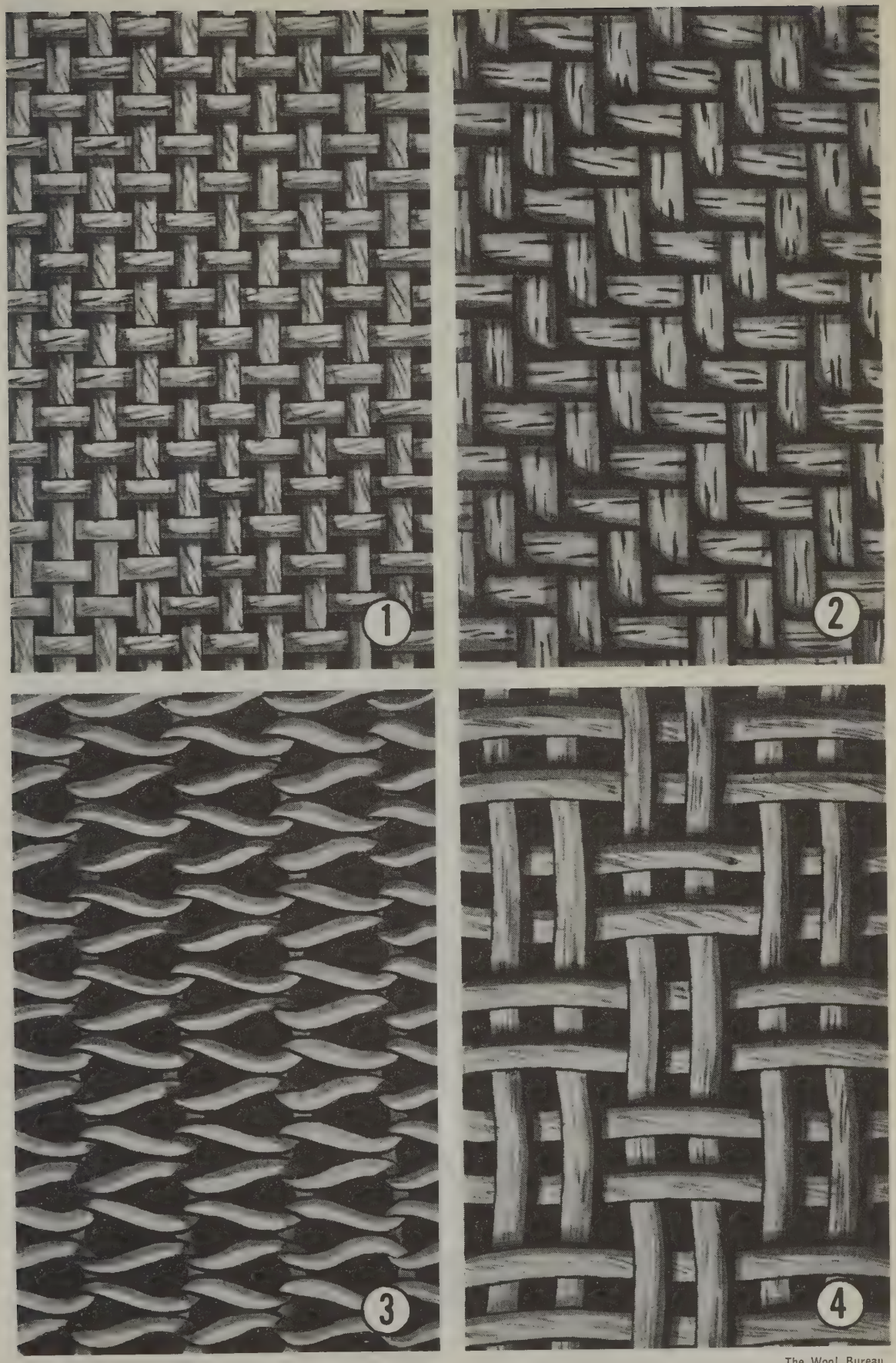
THE WOOL BUREAU INCORPORATED.

WOOLBERT, Charles Henry, American educator: b. Ottawa, Ill., June 26, 1877; d. Iowa City, Ia., June 9, 1929. After graduating A.B. at Northwestern University in 1900 he was an instructor for two years at the high school at West Aurora, Ill., then taught for a year at Olivet College, Mich., his field being English and public speaking. From 1903 he taught for a decade at Albion College, Mich., during which period he obtained his M.A. degree at the University of Michigan. After three years as an associate in public speaking at the University of Illinois he joined the Harvard faculty as an assistant in psychology and aesthetics. Harvard awarded him the Ph.D. degree in 1918, after which he held professorships at the universities of Illinois and Iowa. He was for five years a speaker for the Michigan Anti-Saloon League. From 1920 to 1923 he edited the *Quarterly Journal of Speech Education.* He was author of *Fundamentals of Speech* (1920).

WOOLDRIDGE, wo͝ol'drĭj, **Harry Ellis,** English painter and musicologist: b. Winchester, England, March 28, 1845; d. London, Feb. 13, 1917. After a brief experience of commercial life he bagan his studies in painting at the Royal Academy School in 1865. Through his friendship with Sir Edward Coley Burne-Jones, he became attracted to the pre-Raphaelites, under whose in-



The Wool Bureau

Typical weaves and knit patterns used in making wool fabrics. (1) Plain weave; (2) twill weave; (3) plain knit; (4) basket weave.

WOOL

Above: Lacey off-the-shoulder cloudlight wool blouse worn with a jet black mushroom-pleated wool skirt.
Above right: The resilience of wool helps this herringbone topcoat shed wrinkles overnight and keep its trim lines through long wear.

The Wool Bureau, Inc.

Left: A lightweight worsted suit in blue and black miniature checks on a light gray background. *Right:* Wool is also used in fabrics for dressy occasions as in this attractive white wool jersey gown.

fluence he executed a number of wall paintings and designed stained glass. In his youth he had been a talented singer, and during his career as a painter he pursued his studies in musical history. Chosen to re-edit William Chappell's *Popular Music of the Olden Time,* he published his revision in 1893. Appointed Slade professor of fine art at Oxford University in 1895, he held this position until 1904. While at the university he contributed the first volume of *The Oxford History of Music* (1901), his second volume being published in 1905. With his friend the poet laureate Robert Bridges, he edited the *Yattendon Hymnal* (1895–1899), for which he harmonized 43 old melodies and composed 6 chorales. In his Oxford lectures, Woodridge emphasized the importance of new methods and materials, rather than the influence of contemporary events, in the development of art.

WOOLF, Albert Edward, American chemist and inventer: b. New York, N.Y., Sept. 26, 1846; d. there, April 19, 1920. One of the four sons of Benjamin Edward Woolf (q.v.), he was educated at the College of the City of New York where he majored in chemistry. He introduced the use of peroxide of hydrogen as a bleacher for ostrich feathers and as an antiseptic and was the discoverer of the electrical decomposition of sea water used for sanitation. He also made practical demonstration of the value of hypochlorites, subsequently used in the armed services of Britain, France and the United States. An amateur artist, he modeled a bronze medallion of Gen. U. S. Grant, placed in the room at Mt. McGregor where Grant died.

WOOLF, Arthur, English engineer and inventor: bap. Camborne, England, Nov. 4, 1766; d. The Strand, Guernsey, Channel Islands, Oct. 26, 1837. After serving his apprenticeship as a carpenter in Cornwall, he went to London, where he became a master engineer in 1795, and in the following year engineer for a brewery, a post he held until 1806. Meanwhile, he patented a new boiler (1803) and improvements in the steam engine (1804, 1805). He went into partnership with Humphrey Edwards in 1806, and four years later took out a patent on his best-known invention, the first practical compound engine. Returning to Cornwall in 1812, he applied it to mining operations.

WOOLF, Benjamin Edward, American composer and critic: b. London, England, Feb. 16, 1836; d. Boston, Mass., Feb. 7, 1901. The son of Edward Woolf, a musician and painter, he was taken in 1839 to New York, where his father trained him in music. Eventually he became the conductor of orchestras in Boston, Philadelphia, and New Orleans, but it was as a critic that he was best known. Settling in Boston, he served as dramatic and music critic of the *Saturday Evening Gazette* from 1871 to 1893, when he became music critic of the Boston *Herald.* In this capacity he was recognized as a man of exacting standards, but one who gave encouragement to young musicians. Meanwhile, Woolf himself had become a prolific composer of overtures, quintets, trios, and operettas. He was the author of more than 60 plays and operettas, many of which were extremely popular in their day. Among the most successful of these were *The Doctor of Alcantara,* for which he wrote the libretto; *The Mighty Dollar,* a comedy; *Westward Ho!,* a comic opera; and *Pounce & Co., or Capital vs. Labor,* an operetta.

WOOLF, Leonard Sidney, English writer: b. London, England, Nov. 25, 1880. The son of a barrister, he was educated at St. Paul's School and at Trinity College, Cambridge, where he remained five years. He then entered the Ceylon Civil Service and spent the period from 1904 to 1911 in Ceylon, for the last two and one-half years being in charge of the Hambantota District, where the only other Europeans were half a dozen government officials. After returning to England on extended leave, he resigned from the service in the hope of making his living by writing. His first book, *The Village in the Jungle,* published in 1913, was a novel based largely on his experience in Ceylon. In 1912 he was married to Virginia Stephen, better known by her married name of Virginia Woolf (q.v.). Joining the Fabian Society and the Labour Party, he studied the cooperative movement and wrote about it. From this time began his close association with Sidney and Beatrice Webb, through whose influence he became a regular contributor to the *New Statesman.* In 1916 he published *International Government,* which was followed by *The Future of Constantinople* (1917), *Co-operation and the Future of Industry* (1918), *Empire and Commerce in Africa* (1920), and *Socialism and Co-operation* (1921). Meanwhile, in 1917, he and his wife had founded as a hobby the Hogarth Press, which eventually developed into a highly successful publishing house. Toward the end of World War I he became an editorial writer on the *Nation,* and from 1923 to 1930 was its literary editor. Editor of the *International Review* in 1919, for the following two years he was on the staff of the *Contemporary Review.* From 1931 on he served as joint editor of the *Political Quarterly.*

Among Woolf's other published works are the novel *The Wise Virgins* (1914); *Hunting the Highbrows* (1926); *Essays* (1927); *Imperialism and Civilization* (1928); *Quack, Quack!* (1935); *After the Deluge* (2 vols., 1931–1939); *The Hotel* (1939); *Barbarians at the Gates* (1939); *The War for Peace* (1940); *Foreign Policy* (1947); and *Principia Politica* (1953). In addition, he edited posthumous works of his wife and volumes of her correspondence.

WOOLF, Samuel Johnson, American artist and writer: b. New York, N. Y., Feb. 12, 1880; d. there, Dec. 3, 1948. The nephew of Benjamin Edward Woolf (q.v.), he was named for the great lexicographer. He received his B.A. degree at the College of the City of New York in 1899. After studying at the National Academy of Design and the Art Students League of New York, he became a portrait painter. Subsequently he engaged in lithography, and his lithographs of such celebrities as Mark Twain and President Theodore Roosevelt brought him to wide public notice. The course of his later career as an artist-journalist was foreshadowed by his drawings and paintings of troops and battle scenes of World War I, which were based on sketches he had made at the front in France in 1918 for *Collier's,* and by his series of portraits of the leading American generals of the war. Beginning in 1923 he contributed drawings to illustrate feature articles in Sunday sections of the New York *Times.* When that newspaper sent him

to Europe in 1927 to draw European notabilities, his sketch of George Bernard Shaw with an accompanying article giving his personal impressions of the sitter was so admired that thereafter he continued to combine a text with his portrait sketches. During World War II he served as a war correspondent in England and France in 1944. From 1941 to 1947 he was a member of New York City's Board of Higher Education. His art work is represented in the Brook Club, Catholic Club, College of the City of New York, Metropolitan Museum of Art and the New York Public Library. He is author of *Short History of Art* (1909), *Drawn from Life* (1931) and *Here Am I* (1941).

WOOLF, Virginia, English novelist, critic and essayist: b. London, Eng., Jan. 25, 1882; d. Lewes, Sussex, Mar. 28, 1941. A daughter of Sir Leslie Stephen (q.v.), on the occasion of her birth James Russell Lowell, then American ambassador at the Court of Saint James, penned verses for her as his "dear little goddaughter," praying that she would be "a sample of Heredity." In 1912 she married Sidney Woolf (q.v.), and their home in Bloomsbury near the British Museum soon became a center for younger writers and artists. Her first novel, *The Voyage Out* (1915), influenced by E. M. Forster, attracted favorable attention, but the second, *Night and Day* (1919), was generally considered a failure. However, the short stories collected as *Monday or Tuesday,* illustrated with woodcuts by her sister Vanessa Bell and published by the Hogarth Press in 1921, brought Mrs. Woolf high critical commendation. Her rank as one of the most distinguished novelists of her day was assured with the publication of *Jacob's Room* (1922), *Mrs. Dalloway* (1925), and *To the Lighthouse* (1927). However, some of her later novels, as *The Waves* (1931) and *The Years* (1937), were criticized as over-elaborate psychological studies. She was strongly influenced by the theories of William James, Bergson and Freud, and vigorously championed women's rights, notably in *A Room of One's Own* (1929) and *Three Guineas* (1938). An admirer has described her as "a metaphysical poet who has chosen prose-fiction for her medium." Fearing a mental breakdown, she ended her life by drowning.

WOOLLCOTT, wo͝ol'kŭt, **Alexander Humphreys,** American journalist and writer: b. Phalanx, N. J., Jan. 19, 1887; d. New York, N. Y., Jan. 23, 1943. After a boyhood spent in Kansas City, Mo., he was graduated from Hamilton College in 1909. From 1914 until 1922 he served on the staff of the New York *Times,* except for a period during World War I when he was a sergeant on the army newspaper *Stars and Stripes.* On the *Times* he began as a cub reporter and subsequently became dramatic critic. In 1922 he moved to the New York *Herald* and in 1925, to the New York *World.* Later he starred in a popular radio program, in which he was known as the Town Crier, and for many years contributed a column, "Shouts and Murmurs," to *The New Yorker* magazine.

Woollcott was a man of excitable enthusiasms who popularized books that he liked and famous literary and theatrical people whose friendship he enjoyed. With George S. Kaufman, he was co-author of two rather poor plays, *Channel Road* (1929), and *The Dark Tower* (1934). For short periods he appeared on the stage as actor, in *Brief Moment, Wine of Choice,* and *The Man Who Came to Dinner.* The last play, an outstanding success, was written by Kaufman and Moss Hart and admittedly based on the personality of Woollcott. He achieved great success as an anthologist, three of his best collections being *The Woollcott Reader* (1935), *Woollcott's Second Reader* (1937), and *As You Were* (1943). His own published writing included collections of dramatic criticisms, such as *Shouts and Murmurs* (1923) and *Enchanted Aisles* (1924), and more varied pieces, *While Rome Burns* (1935) and *Long, Long Ago* (1943). Consult also Kaufman, Beatrice, and Hennessey, Joseph, *The Letters of Alexander Woollcott* (New York 1944); Adams, Samuel Hopkins, *A. Woollcott, His Life and His Times* (New York 1945).

WOOLLETT, wo͝ol'ĕt, **William,** English engraver: b. Maidstone, Kent, Aug. 15, 1735; d. London, May 23, 1785. His family originally came from Holland, and he was instructed in his art by an engraver named John Tinney. He engraved historical subjects and portraits, but was most successful in landscapes, in which he exhibited such varied excellences, as in the opinion of Longhi, to entitle him to be considered the marvel and the example for all contemporary engravers and for those of the present time. His foregrounds are vigorous and solid, and his aerial perspective wonderfully clear and true, while he treats water, the crux of the engraver, with supreme success. His masterpieces are his *Niobe* and other plates after pictures by Richard Wilson, and the *Death of Wolfe* and the *Battle of La Hogue* after West. He was the first who conceived and embodied in practice the idea of uniting in one plate the three methods of engraving, by aqua fortis, the burin, and the dry needle. His genuine plates are estimated at 123, but impressions are exceedingly rare and valuable, as he permitted no imperfect prints to be struck off. Consult Fagan, Louis, *Catalogue Raisonné of the Engraved Works of William Woollett* (1885).

WOOLLEY, wo͝ol'ĭ, **Celia Parker,** American Unitarian minister: b. Toledo, Ohio, June 14, 1848; d. March 9, 1918. Graduated from Coldwater Female Seminary, in 1868 she was married to J. H. Woolley and in 1876 removed to Chicago. She was pastor of the Unitarian Church, Geneva, Ill., for three years, and of the Independent Liberal Church, Chicago (1896–1898), after which she was active as a lecturer and in the work of women's clubs. She is the author of the novels *Love and Theology* (1887), republished as *Rachel Armstrong, or, Love and Theology; A Girl Graduate* (1889); *Roger Hunt* (1893).

WOOLLEY, John Granville, American prohibitionist: b. Collinsville, Ohio, Feb. 15, 1850; d. Granada, Spain, Aug. 13, 1922. Graduated from the Ohio Wesleyan University in 1871, he was admitted to the bar of the Illinois Supreme Court in 1873, became attorney of Paris, Ill., in 1875, prosecuting attorney in Minneapolis in 1881, and practiced at New York, 1896. At one period, addicted to intemperance, he began lecturing against

it in 1888, and lectured to many audiences at home and abroad. He became editor of *The New Voice*, a prohibition organ in 1899, and was the Presidential candidate of the Prohibition party in 1900, receiving a vote of 208.914. He published 'Seed'; 'The Sower'; 'Civilization by Faith'; 'The Christian Citizen' (1897–98); 'The Lion Hunter' (1900); 'Temperance Progress in the 19th Century' (1902); 'South Sea Letters' (1905).

WOOLLEY, Mary Emma, American educator: b. South Norwalk, Conn., 13 July 1863. She qualified as a teacher and was an instructor in Wheaton Seminary, Norton, Mass. (1886–91); in 1894 she was graduated at Brown University. She was teacher of biblical history at Wellesley College, 1895–1900, the last two years being professor and head of the department of biblical history and literature. In 1900 she became president of Mount Holyoke College and the growth and development of that institution have largely been due to her efforts. She has received honorary degrees from Brown, Amherst, Smith and Yale. Miss Woolley is closely identified with many and varied movements, having served as member of the board of electors of the Hall of Fame, National board of the Y. W. C. A., executive committee of the American School Peace League, council of the National Institute for Moral Instruction, Commission on Peace and Arbitration; senator of United Chapters Phi Beta Kappa; honorary chairman Institute of Public Relations at Honolulu, etc. She has written 'Early History of the Colonial Post Office'; 'Development of the Love of Romantic Scenery in America'; also many educational articles. D. Sept. 5, 1947.

WOOLMAN, John, American Quaker preacher: b. Northampton, Burlington County, N. J., August 1720; d. York, England, 7 Oct. 1772. In 1741 he became a speaker in the meetings of the Society of Friends. He was at this time a bookkeeper in a mercantile house, but subsequently learned the tailor's trade. In 1746, in company with Isaac Andrews, he made his first itinerant tour in some of the back settlements of Virginia, and from that time continued at intervals to visit the societies of Friends in the different portions of the colonies. In 1763 he visited the Indians on the Susquehanna. He both spoke and wrote much against slavery. His best-known work is the posthumons 'Journal of John Woolman's Life and Travels in the Service of the Gospel' (1775), which Whittier edited, with an introduction in 1871. Woolman's simple and candid style has been highly praised by Charles Lamb, Crabb Robinson, and others. Among his other writings are 'Some Considerations on the Keeping of Negroes' (1753; Part II, 1762); 'Considerations' on various topics (1768), and 'Serious Considerations' (1773). In 1774–75 a collective edition of his works appeared. Consult Whittier's sketch in the above-mentioned edition of the 'Journal'; also Shore, W. T., 'John Woolman: His Life and Our Times' (New York 1914).

WOOLNER, Thomas, English sculptor and poet: b. Hadleigh, Suffolk, 17 Dec. 1825; d. London, 7 Oct. 1892. At 12 he was placed in the studio of William Behnes, in 1842 entered the schools of the Royal Academy, and in the following year his first work, 'Eleanor Sucking the Poison from the Arm of Prince Edward,' was exhibited. His first work to attract attention was 'The Death of Boadicea' (1844), and this success was followed by 'Alastor' (1846); 'Puck' (1847); 'Titania and Her Indian Boy' (1848), and 'Eros and Euphrosyne' (1848). About 1850 he was associated with Rossetti and the other artists who formed the "Pre-Raphaelite Brotherhood," in founding the short-lived but famous periodical called *The Germ*. His contributions, which were in verse, were collected and published, with additions, under the name 'My Beautiful Lady' (1863). Woolner visited Australia in 1852, and one of his first works on his return was a life-size statue of Lord Bacon for the Oxford Museum. Among his more important works are 'Elaine with the Shield of Sir Lancelot'; 'In Memoriam' (1870); 'Guinevere' (1872); 'Lady Godiva' (1876); portrait busts of Carlyle, Tennyson, Darwin, Newman, Gladstone, Kingsley and Dickens, and statues of Lord Macaulay for Trinity College, Cambridge (1866), Sir Bartle Frere for Bombay (1872), Dr. Whewell for Trinity College, Cambridge (1873), Lord Lawrence for Calcutta (1875), J. S. Mill for the Thames Embankment (1878), Captain Cook for Sydney (1879), Sir Stamford Raffles for Singapore (1887) and Lord Palmerston for Palace Yard, Westminster. He became a Royal Academician in 1874, and for a time was professor of sculpture in the Academy. His fame as a sculptor has overshadowed his reputation as a poet, but 'Pygmalion' (1881), 'Silenus' (1884), 'Tiresias' (1886) and 'Poems' (1887) give him honorable rank among the minor poets of his time. Consult Garnett, in 'Dictionary of National Biography.'

WOOLSACK, a sack filled with wool; hence, the seat of the lord chancellor in the House of Lords, a square cushion of wool, covered with red cloth. It is said to have been first placed in the House of Lords in the 14th century to symbolize an act prohibiting the exportation of wool from England.

WOOLSEY, wůl'sĭ, **Sarah Chauncey** ("Susan Coolidge"), American author, niece of T. D. Woolsey (q.v.): b. Cleveland, Ohio, 1835; d. Newport, R. I., 9 April 1905. As "Susan Coolidge" she was a popular writer for children, but also wrote for their elders 'Verses' (1880); 'A Short History of Philadelphia' (1887). Among her books for young people were 'The New Year's Bargain' (1871); 'What Katy Did' (1872); 'A Guernsey Lily' (1881); 'A Little Country Girl' (1885); 'Clover' (1888); 'Curly Locks' (1899); 'Short History of the City of Philadelphia' (1887). She also edited 'The Diary and Letters of Mrs. Delaney' (1878); 'The Diary and Letters of Frances Burney, Madame D'Arblay' (1880).

WOOLSEY, Theodore Dwight, American college president and scholar, nephew of Timothy Dwight (q.v.): b. New York, 31 Oct. 1801; d. New Haven, Conn., 1 July 1889. He was graduated at Yale College in 1820; studied law in Philadelphia, and theology at

Princeton, was tutor at Yale, 1823–25, and was licensed to preach in 1825. After studying abroad (1827–30) he was professor of Greek at Yale 1831–46, and president of the college 1846–71. In 1871–81 he was chairman of the American company of revisers of the New Testament. Besides editions of Greek plays — the 'Alcestis' of Euripides (1833), the 'Antigone' (1835) and 'Electra' (1837) of Sophocles, the 'Prometheus' of Plato (1837), as well as the 'Georgias' of Plato (1842) — his works include an 'Introduction to the Study of International Law' (1860; 5th ed. 1879); 'Essays on Divorce and Divorce Legislation' (1869); 'Political Science; or the State Theoretically and Practically Considered' (1877); 'Religion of the Past and of the Future' (1871); 'Communism and Socialism' (1880); 'Helpful Thoughts for Young Men' (1882). He also edited Lieber's 'Civil Liberty and Self-Government' (1871), and his 'Manual of Political Ethics' (1871). He was one of the founders of the *New Englander,* to which he often contributed, one of the regents of the Smithsonian Institution, and at one period president of the American Oriental Association. Woolsey Hall of Yale University was named in his memory.

WOOLSEY, Theodore Salisbury, American professor of international law, son of T. D. Woolsey (q.v.): b. New Haven, Conn., 22 Oct. 1852. He was graduated from Yale in 1872, became instructor in international law at Yale in 1877, and from 1878 to 1911 was full professor there. He published 'America's Foreign Policy,' and edited Pomeroy's 'International Law' (1886); and the 6th edition of Woolsey's 'International Law' (1891). He was also associate editor of Johnson's 'Universal Cyclopedia' (1892–95); and editor of the *American Journal of International Law.* He received the degree of LL.D. from Brown University in 1903. He died 24 April 1929.

WOOLSON, Constance Fenimore, American author: b. Claremont, N. H., 5 March 1848; d. Venice, Italy, 24 Jan. 1894. Educated in Cleveland, Ohio, and New York, she resided in Ohio, then in Florida and other Southern States, and finally abroad, chiefly in Italy. Her first story published in a secular magazine — contributions to Episcopalian periodicals had preceded it — was 'The Happy Valley' in *Harper's Monthly* (1870). In this much of her subsequent work appeared. Many poems were printed from time to time, but these were never collected. Her reputation was based on works of fiction, the volumes being 'The Old Stone House' (1873); 'Castle Nowhere: Lake Country Sketches' (1875); 'Rodman the Keeper' (1880); 'Anne' (1882); 'For the Major' (1883); 'East Angels' (1886); 'Jupiter Lights' (1889); 'Horace Chase' (1894), and 'The Front Yard, and Other Italian Stories' (1895). Their background is generally American, preferably the Lake region or the South; and when it shifts to Europe is less skilfully treated. They were highly praised by Stedman and other critics for equal freedom in presenting diverse types and conformity to high literary standards.

WOOLSTON, wůl'stŏn, **Thomas,** English deist: b. Northampton, 1669; d. London, 21 Jan. 1731. He was educated at Sidney Sussex College, Cambridge, became a Fellow, and took orders in the English Church. He made a careful study of Origen, and in 1705 published the 'Old Apology for the Truth of the Christian Religion against the Jews and Gentiles Revived.' He maintained in this work that Moses was an allegorical personage, and his history typical of that of Christ. In 1721 he published 'The Moderator between an Infidel and an Apostate,' dialogues tending to show that the Gospel miracles by themselves could not prove Christ to be the Messiah. This work occasioned great scandal, and it was only through the intervention of Whiston that the author escaped a prosecution. In 1721 his college deprived him of his fellowship. The views set forth in his last work Woolston developed more fully in 'The Moderator between an Infidel and an Apostate' (1725). His famous series of six 'Discourses on the Miracles of Christ' appeared 1727–29, with two 'Defences' in 1729 and 1730. He was indicted for blasphemy in consequence of the publication of this work and was imprisoned 28 Nov. 1729. His collected works with 'Life' appeared in five volumes (1833). See DEISM, and consult Cairns, J., 'Unbelief in the Eighteenth Century' (1880), and Sayons, 'Les Déistes anglais' (1882).

WOOLWICH, wůl'ĭch, England, a municipal and parliamentary borough of London, in Kent, eight miles below London Bridge. Area, 8,277 acres. It has many ancient, together with a number of handsome modern houses, an old church (restored 1894), other places of worship, a town hall and several charitable endowments. It owes its importance to the royal arsenal, which occupies an area of above 350 acres, and is one of the most complete and magnificent establishments of the kind in the world, with extensive forges, foundries and workshops of various kinds in which the newest types of machinery are employed for the manufacture of immense quantities of warlike stores which are kept in suitable magazines and storehouses. Woolwich Dockyard, for centuries the most important in the kingdom, having become unsuitable for modern requirements, was made over to the War Office in 1872. In the Rotunda there is a fine historical collection of arms and other interesting objects. A large garrison is stationed at Woolwich, which is the headquarters of the royal artillery; and there are various barracks, a military and a naval hospital, etc. On the edge of Woolwich Common, a fine large open area, are the handsome buildings of the Royal Military Academy (see MILITARY SCHOOLS); and the Royal Ordnance College is also at Woolwich. At North Woolwich, on the opposite side of the river, to which runs a free steam ferry, many houses and extensive factories, especially of telegraph cables, have recently sprung up. The borough returns one member to Parliament. Pop. 140,389. Consult Larking, 'The Domesday Book of Kent' (1869); Vincent, 'Records of Woolwich' (1890).

WOOLWORTH, Frank W., American merchant: b. Rodman, N. Y., 13 April 1852; d. Glen Cove, L. I., 9 April 1919. He received

a public and commercial school education, and in 1879 established a "five cent store" at Utica, N. Y., removing the business to Lancaster, Pa., later in that year. Out of the business grew a great chain of about 1,000 "five and ten cent stores" in the United States and Canada, and about 75 in England. The business was organized in 1911 under the firm name of Frank W. Woolworth and Company, of which Woolworth was president. He amassed a great fortune, and was a director in various banks and trust companies. He also built in New York (1913) the famous tower "skyscraper" known as the Woolworth Building, 57 stories high and of beautiful design.

WOONSOCKET, city, Rhode Island, in Providence County; alt. 122 feet; on the Blackstone River; 13 miles northwest of Providence; on the New York, New Haven and Hartford Railroad. This industrial city has mills and factories turning out a well diversified list of products, out textiles predominate, principally woolen and worsted goods. Other leading products are rubber rolls and rubber footwear, machine tools and textile machinery. The home of the Harris Institute, founded in 1856, was taken over by the city for use as a city hall, and the Harris Institute Library was housed in it, along with the municipal administrative offices.

Of the numerous churches in the city a large proportion are Catholic; the French-Canadian element in the population is numerically predominant. Woonsocket has several parks; Barry Memorial Field provides accommodations for various athletic sports. A local organization presents a French opera each year.

History.—The first family to settle on the site of the present city was that of John Arnold, in 1695; Richard Arnold had built a sawmill beside the river in 1666. In 1720 a forge was established, which for several decades produced farm tools for local sale. The textile industry began about 1810 with cotton mills operated by water power. From 1840 on, the milling of wool gradually superseded that of cotton. Woonsocket was originally comprised within the towns of Cumberland and North Smithfield. It was separated from them in 1867 and 1871. Incorporation as a city was effected in 1888. The city has a bicameral legislature. Pop. (1950) 50,211.

WOORARI or **WOORARA.** See CURARE.

WOOSTER, wo͝os'tẽr, **David,** American Revolutionary general: b. Stratford, Conn., March 2, 1711; d. Danbury, Conn., May 2, 1777. He was graduated at Yale College in 1738, and in 1739, when the war broke out between England and Spain, entered the provincial army as lieutenant, and was subsequently made captain of a vessel built and equipped by the colony for defense of its coasts. In 1745 he participated in the expedition against the French fortress of Louisburg, and then was sent in command of a cartel ship to England, where he was made a captain in the regular service under Sir William Pepperell.

In the French and Indian War, which ended in 1763, he was commissioned by the governor of Connecticut as colonel, and subsequently as brigadier general, and served during the whole war. In April 1775 he was one of the members of the Assembly of Connecticut, who promoted the plan for the seizure of Ticonderoga; and when the Continental Army was organized he was appointed one of the eight brigadier generals.

Wooster was engaged in the expedition into Canada, where after the death of General Richard Montgomery he for a time held the chief command. He resigned and returned to Connecticut, and was major general of the militia when William Tryon invaded that province for the purpose of destroying the military stores at Danbury. He attacked Tryon's rear guard April 27, 1777, and while rallying his men was mortally wounded. On June 17 Congress voted that a monument should be erected to his memory, but no steps were taken to have the resolution carried into effect, and his neglected grave was not identified until 1854, when the cornerstone of a monument to his memory was laid, by act of the Connecticut legislature. The town of Wooster, Ohio, was named in his honor.

WOOSTER, city, Ohio, county seat of Wayne County; altitude 910 feet; 30 miles southwest of Akron; on the Pennsylvania, and on the Baltimore and Ohio railroads, and on five state and federal highways. Wayne County ranks first in Ohio's agricultural counties and the annual Wayne County Fair and the Ohio Agricultural Experiment Station near by are widely and favorably known. It is the seat of the College of Wooster.

In addition to its importance as a trade center Wooster is the home of thriving industries. The products include fire-fighting equipment, ladders, truck bodies, paint, brick, roller bearings, steel pipe and fabricated parts, paint brushes, food products and animal feeds. Gas and oil wells in the vicinity provide heat and power fuel.

The public library building houses the Wooster Museum, with its collection of natural history specimens and relics of pioneer days. Settled in 1807 and incorporated in 1817, it was named for Gen. David Wooster. It has a mayor and a council. Pop. (1950) 14,005.

WOOSTER, College of, located at Wooster, Ohio, was founded under the auspices of the Presbyterian Church, chartered in 1866 and first opened in 1870. In 1899 the charter was revised and the power of electing the members of the board of trustees delegated to the Presbyterian Synod of Ohio. In 1914 the name of the institution was changed from "The University of Wooster" to "The College of Wooster." It is a coeducational nonsectarian institution.

The organization of the college now consists of the collegiate department, the Bible and missionary training school and the conservatory of music. The college offers two baccalaureate degrees, bachelor of arts and bachelor of science. It is a member of the North Central Association of Colleges. It is on a beautiful campus of 130 acres on a hilltop overlooking the city of Wooster. Splendid athletic facilities are furnished by the large gymnasium and a 14-acre stadium given to the college by the late L. H. Severance of New York. Chapel attendance is required of all students daily. Enrollment averages about 1,200.

WORCESTER, wo͝os'tẽr, **Dean Conant,** American zoologist and educator: b. Thetford, Vt., Oct. 1, 1866; d. Manila, P.I., May 2, 1924. He was graduated at the University of Michigan in 1889, having previously accompanied the

Steere scientific expedition to the Philippine Islands in 1887–89. He was instructor in animal morphology at the University of Michigan 1893–96, becoming assistant professor in the last-named year. In 1890–92 he again traveled in the Philippines, with F. S. Bourns, in a tour known as 'The Menage Scientific Expedition,' and in January 1899 was appointed one of the United States commissioners to the islands to investigate and report on conditions there. He was the only member of this commission to be appointed on the second or Taft commission, which returned to the Philippines in 1900, and established civil government there. He was Secretary of the Interior of the Philippines (1901–13). He published 'Preliminary Notes on Birds and Mammals collected by the Menage Scientific Expedition to the Philippine Islands' (1894); 'Contributions to Philippine Ornithology' (1898); 'The Philippine Islands and Their People' (1898); 'The Philippines, Past and Present' (1914); and numerous articles on the 'Wild Tribes of the Islands,' which were under his executive control for 12 years. He died, Manila, P. I., 2 May 1924.

WORCESTER, Edward Somerset, 2D MARQUIS OF, English inventor: b. Raglan Castle, Monmouthshire, 1601; d. 3 April 1667. He engaged in the service of Charles I during the Civil War, and was employed by the king to act for him in Ireland; but when his errand was discovered he was treated with duplicity by Charles, and retired to France in 1648. Returning to England in 1652 he was imprisoned in the Tower 1652–54, and his estates were seized, but after the Restoration he recovered most of these. He afterward spent his time in retirement, and in the cultivation of natural philosophy and mechanics. In 1663 he published a book entitled 'Century of the Names and Scantlings of Inventions as I can call to mind to have been Tried and Perfected,' in which he first gave a description of the uses and effects of an engine for "driving up water by fire"; and afterward published a small pamphlet, called 'An Exact and True Definition of the most Stupendous Water-commanding Engine, invented by the Marquess of Worcester.' In neither of these does he give any statement of the mode of constructing his engine; but, from his description and account of its effects, it may be inferred that its action depended on the condensation as well as the elastic force of the steam. (See STEAM-ENGINE). Consult Dircks, Henry, 'Life, Times, and Scientific Labors of the Second Marquis of Worcester,' London (1865); Dircks, 'Worcesteriana' (1865).

WORCESTER, Edwin Dean, American railway official: b. Albany, N. Y., 19 Nov. 1828; d. New York, 13 June 1904. He studied law, and followed various pursuits, but entered railroading in 1853, when he became a member of the accounting department of the New York Central Railway. He laid out, opened and managed the books of this company when there were no precedents in the United States for the organization of large railways, and the present accounting system of railways in this country is largely the development of his work. Subsequently he became successively treasurer and secretary of the company; in 1873 secretary and treasurer of the Lake Shore and Michigan Southern; in 1883 its vice-president; and in 1878 secretary of the Michigan Central, in 1883 its vice-president. After 1883 he was also connected with numerous other companies.

WORCESTER, Elwood, American Protestant Episcopal clergyman, author, and philosopher: b. Massillon, Ohio, 16 May 1863; d. Kennebunkport, Me., 19 July 1940. He was graduated from Columbia University in 1886, and received the degree of Ph.D. at the University of Leipzig in 1889. He was professor of philosophy and psychology at Lehigh University in 1890–96, also serving as chaplain; was acting rector at Saint John's, Dresden, Germany, in 1894–95; rector of Saint Stephen's, Philadelphia, in 1896–1904, and 1904–29 had charge of Emmanuel Church, Boston. He originated the Emmanuel Movement, which gives moral treatment for nervous and, rarely, for organic disorders, with the aid of medical practitioners in such cases as require medical assistance. His works include 'Religious Opinions of John Locke' (1889); 'The Book of Genesis in the Light of Modern Knowledge' (1901); 'Religion and Medicine' (1907); 'The Living Word' (1908); 'The Christian Religion as a Healing Power' (1909); 'Was Jesus a Historical Person' (1927); 'The Allies of Religion' (1929).

WORCESTER, Joseph Emerson, American lexicographer and philologist; b. Bedford, N. H., 24 Aug. 1784; d. Cambridge, Mass., 27 Oct. 1865. He was graduated from Yale in 1811, and from 1819 resided in Cambridge, Mass., busily preparing and publishing books. Among his earlier works, compiled with much accuracy and excellent considerations, were 'A Geographical Dictionary' (1817), of which an enlarged edition appeared in 1823; a 'Gazetteer of the United States' (1818); and 'Outlines of Scripture Geography' (1828). His first effort in English lexicography was an edition of 'Johnson's English Dictionary, as Improved by Todd and Abridged by Chalmers, with Walker's Pronouncing Dictionary Combined' (1828). In 1829 he prepared an abridgment of Webster's 'American Dictionary'; and in 1830 published his 'Comprehensive Pronouncing and Explanatory Dictionary.' After collecting philological works in Europe in 1830–31, he edited the 'American Almanac' in 1831–43, and in 1846 published the 'Universal and Critical Dictionary of the English Language.' His chief work, 'A Dictionary of the English Language,' appeared in 1860, being the first work of the sort to employ illustrations. For this many collaborators were employed, particularly for the definition of technical terms.

WORCESTER, Noah, American theologian: b. Hollis, N. H., 25 Nov. 1758; d. Brighton, Mass., 31 Oct. 1837. He was a fifer in the Continental army in 1775, and entered the service again for a short time as fife-major in 1777. In 1786 he was licensed to preach by a Congregational association, and in 1787 ordained pastor of the church in Thornton, N. H., where he had held local offices and been elected representative to the General Court. In 1802 he was employed as the first missionary of the New Hampshire Missionary Society, and in that capacity traveled and preached widely in the northern portion of the State. In 1810 he removed to Salisbury and took charge of the

congregation, and in 1813 settled at Brighton, Mass. His work on the doctrine of the Trinity, entitled 'Bible News of the Father, Son, and Holy Ghost' (1810), soon became the subject of severe criticism, the Hopkinton association, of which he was a member, passing a formal sentence of condemnation against the book. From 1813 to 1818 he edited *The Christian Disciple,* a periodical published in Boston, and in 1814 published his tract, 'A Solemn Review of the Custom of War,' once well known, and translated into several languages. Shortly after this the Massachusetts peace society was formed, and in 1819 he began *The Friend of Peace,* which continued in quarterly numbers for 10 years, nearly the whole of it being written by himself. In 1829 he published 'The Atoning Sacrifice, a Display of Love, not of Wrath'; in 1831, 'The Causes and Evils of Contention among Christians'; and in 1833, 'Last Thoughts on Important Subjects.' Among his further writings is a 'Respectful Address to the Trinitarian Clergy' (1812). Consult Ware, Henry, 'Memoirs of Noah Webster, D.D.' (Boston 1844).

WORCESTER, Samuel Austin, American missionary and translator: b. Worcester, Mass., 19 Jan. 1798; d. Park Hill, Indian Territory, 20 April 1868. His father was a Congregational minister and also a printer. His parents moved to Vermont during his childhood. He was educated in the University of Vermont (of which his uncle, Rev. Samuel Austin, was president), where he was graduated in 1819. He was graduated from Andover Theological Seminary in 1823 and in 1825 was ordained to the ministry and shortly afterward entered the service of the American Board of Commissioners for Foreign Missions, being assigned to duty at Brainerd Mission in East Tennessee. In 1827 he was transferred to New Echota, Ga., which was the Cherokee capital. He aided in the establishment of the *Cherokee Phœnix,* which was the first paper to be printed in the Cherokee language and alphabet. In March 1829 he was arrested by the Georgia authorities because of his refusal to take a special oath of allegiance to that State — an obligation which had been devised and prescribed for the avowed purpose of discouraging missionary work among the Indians. He was released but was rearrested, tried, convicted and sentenced to the State penitentiary for the term of four years. Clad in the garb of a felon, he was confined at hard labor until January 1833, though the Supreme Court of the United States had decided nearly a year before that his imprisonment was illegal. He then returned to Brainerd where he was beyond the jurisdiction of Georgia. In 1835 he moved to the Indian Territory, whither the Western Cherokees had removed from Arkansas in 1829. After visiting the Dwight Mission he tarried for a season at Union Mission, where he set up the first printing establishment in the Indian Territory. In December 1836 he settled at Park Hill, five miles south of the present town of Tahlequah, where his mission was established and where he labored during the remainder of his life. In addition to his work as a preacher and teacher Mr. Worcester devoted himself to the task of translating various works into the Cherokee language, to be printed and published at his Park Hill Mission. The mission press also printed many books and pamphlets for the missionaries laboring among the Creek, Seminole, Choctaw and Chickasaw nations. His own translations included large portions of the Bible, tracts, hymn-books, school books and the Cherokee Almanac, printed in English and Cherokee, with astronomical calculations for the meridian of Fort Gibson. In translating the Bible he rendered the text from the original Hebrew directly into Cherokee without the medium of either the Greek, Latin or English versions. Prior to his removal to the West he had laboriously prepared manuscripts for a grammar and a dictionary of the Cherokee language, both of which were unfortunately lost when the steamboat transporting his personal effects was sunk while ascending the Arkansas River. He was greatly revered among the Cherokees by whom he was known as "The Messenger." Consult Mooney, James, 'Myths of the Cherokee' (in 19th Annual Report of the Bureau of American Ethnology); Lumpkin, Wilson, 'Removal of the Cherokee Indians from Georgia'; Benson, Henry C., 'Life Among the Choctaws'; and Drake, Samuel G., 'The Aboriginal Races of North America.'

WORCESTER, England, (1) a city, the capital of Worcestershire, situated in a beautiful vale on the eastern bank of the Severn, 120 miles west-northwest of London. The cathedral is a noble specimen of Gothic simplicity. It was first erected by Ethelred, king of Mercia, in 680, and a later edifice was burned down and rebuilt in the beginning of the 13th century. It was restored in 1857–74. It is 394 feet long, 78 feet wide and 68 feet high, and the tower, which rises from the intersection of the nave and aisles to the altitude of 170 feet, is ornamented at the corners by lofty pinnacles. It contains many handsome monuments and sculptures, including the tombs of King John, of Bishop Gauden and of Arthur, Prince of Wales and son of Henry VII. There are about 20 other handsome places of worship, such as Holy Trinity, Saint Nicholas, Saint Andrew's, Saint Helen's etc. Among other buildings are the shire-hall, guildhall, Victoria Institute (library, museum, etc.), corn-exchange, the hop and fruit market, museum of natural history, two grammar-schools, several charitable institutions, etc. Worcester is the chief seat of the English leather glove trade, has celebrated porcelain-works, "Worcester sauce" works, vinegar-works, chemical and manure works, foundries, railway signal works, locomotive works, horse-hair weaving, agricultural implements, carriage factories and other works. Its trade in hops is extensive. There are municipal electric lighting works and a service of electric trams. The most remarkable event here was the victory of the English army, under Cromwell, over the Scotch in the cause of Charles II, in 1651. There are traces of Roman occupation, but its history dates from the establishment of the Episcopal see in the 7th century. The first charter was obtained from Philip and Mary in 1554; James I granted another in 1622 and its government was again altered by the Municipal Reform Act of 1835. Pop. about 50,000. (2) An inland county bounded on the north by Shrop and Stafford, on the west by Hereford, on the south by Gloucester and on the east by

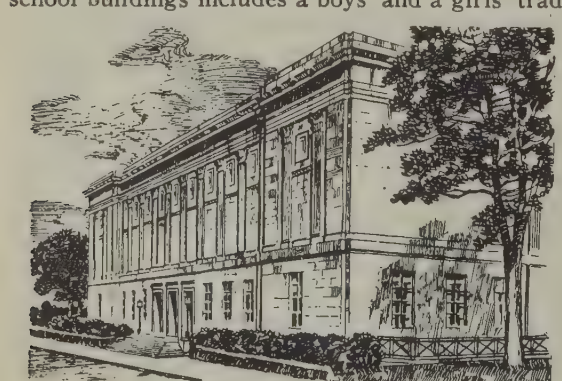
Warwick; with some separated portions, enclosed by the counties of Gloucester and Warwick. The area is 699½ square miles. The surface, generally level or gently undulating, has some extensive and beautiful vales, the principal of which, that of the Severn, is 30 miles long and one quarter to a mile broad. On the southwest are the fine Malvern Hills, the loftiest of which is 1,444 feet above sea level. The soil, composed chiefly of clay and loam, is of great fertility. The principal crops are wheat, barley, oats, beans, peas, turnips and hops. The orchards are celebrated for their apples and cider. The vales consist of meadows and rich pastures. The sheep are of the Leicester breed. Coal is found in the north and northwest; the brine springs at Droitwich and Stoke Prior supply immense quantities of salt; iron is found with the coal, and the manufacture of iron and steel, and of hardware, is extensive; carpets and rugs are made at Kidderminster; and porcelain, gloves and other articles at Worcester. Pop. (1951) 522,974.

WORCESTER, city, Massachusetts, county seat of Worcester County, is located on the Blackstone River, at an altitude of 481 feet, 44 miles west of Boston in the heart of New England. It is served by the New York, New Haven and Hartford, the Boston and Maine, and the Boston and Albany railroads, and by state and federal highways. The city started in a valley, spread to the surrounding hills and now covers an area of 38.41 square miles. It is the largest manufacturing city in the United States not on a navigable waterway, and although inland, is a port of entry.

Industries.—Worcester is a railroad and industrial center and is noted for the wide variety of products produced by its more than 1,000 manufacturing plants. It produces steel, wire and wire products, abrasives and grinding wheels, textile machinery, machine tools and machine-shop products, printing, carpets, textiles, shoes, clothing, paper products, steam and electric cars and airplane parts.

Educational Facilities.—Its institutions of higher education include the College of the Holy Cross (1843), Worcester Polytechnic Institute (1868), Massachusetts State Teachers College (1874), Clark University (1887), Academy of the Sacred Heart, Assumption College, Becker Junior College, Venerini Academy, Worcester Junior College, Worcester School of Business Science, Worcester Young Men's Christian Association Institute, Worcester Academy (1832), the Bancroft School, Salter Secretarial School and the Worcester Art Museum School.

The public school system with nearly 100 school buildings includes a boys' and a girls' trade school. Six of the parochial schools have high school departments. The public library, established in 1859, was one of the first in the United States to remain open on Sunday. The library and museum of the American Antiquarian Society, which dates from 1812, contains many rare portraits, books and pamphlets of early Americana. The Worcester Art Museum, founded in 1896 by Stephen Salisbury, is considered one of the finest and contains the Bancroft collection of Japanese art. The Worcester Natural History Society (1829), and the Worcester Historical Society (1875), maintain museums that are open to the public.



Worcester Art Museum.

Churches and Charitable Institutions.—The city contains more than 100 churches. The denominations rank, according to the number of their buildings, as follows: Roman Catholic, Congregational, Baptist, Lutheran, Methodist Episcopal, Protestant Episcopal, and others one or two each. The hospitals are the City Hospital, Belmont Hospital, Fairlawn Hospital, Hahnemann Hospital, Saint Vincent's Hospital, and the Washburn Memorial Hospital. Other institutions are the State Insane Hospital, the State Odd Fellows' Home, Home for Aged Men, Home for Aged Women, Home for Aged Colored People, Jewish Home for Aged and Orphans, Memorial Home for the Blind, a home for the friendless, and a number of private hospitals and sanitariums.

History.—A settlement made on the site of Worcester in 1673 was called Quinsigamond Plantation. It was situated on the shore of Quinsigamond Lake which borders the city on the east. Indian hostility culminating in the outbreak of King Philip's War in 1675 caused its abandonment. Resettled in 1684, it was named after the English home of some of the new settlers. In 1702 it was again abandoned under Indian attacks. Then in 1713 a tavern and a mill were built and a turnpike was constructed to Boston. In 1722 it was incorporated as a town and in 1848 was chartered as a city.

The canalization of the Blackstone to Providence (1828) marked the beginning of Worcester's rapid industrial development. It was then manufacturing hats, clocks, chairs, carpets, corduroy and textile machinery. The first railroad to Boston was completed in 1835. The population held strong antislavery sentiments and an attempt to enforce the Fugitive Slave Law in 1854 led to a serious riot.

Buildings and Municipal Improvements.—The principal public buildings are the Municipal Memorial Auditorium, the Federal Building, county courthouse, city hall, State Armory, Mechanics Hall, Horticultural Hall, the Young Men's Christian Association, the Young Women's Christian Association, buildings of the women's clubs and of several fraternal organizations, the State Mutual Life Assurance Company, Masonic Temple, two boys' clubs, the religious and educa-

Worcester Memorial Auditorium.

tional institutions, several charitable institutions, and the Union Station.

There are 18 public parks, having a combined area of 1,134 acres; Lake Park has 110 acres and Elm Park, the oldest municipally owned park in the United States, 88 acres. Playgrounds occupy 118.2 acres.

Worcester Musical Festival.—In the Art Memorial Auditorium is held the annual music festival, consisting of four concerts, including one or more large oratorios or choral works, given under the auspices of the Worcester County Musical Association. The festival is the outgrowth of the joint meetings of the choirs in the vicinity, and the first festival was given in 1858. The present name was adopted in 1871. The first entire oratorio was given in 1866 with Karl Zerrahn as conductor. He continued as conductor until 1897. Albert Stoessel began conducting in 1925. Victor Herbert was associate conductor in 1889–1891 and Franz Kneisel in 1892–1908.

Government.—The city manager form of government was adopted in 1950. A mayor and council of nine select the manager. The city has an adequate water supply and the sewer system covers about 385 miles. There are about 250 miles of well-maintained streets. The principal business streets run north and south.

Population.—The city ranks second in the state in population, which is made up of 50 nationalities. Some 30 per cent are foreign born. About 45 per cent of the male and 38 per cent of the female working population is engaged in manufacturing. Some 20 per cent of each group is employed in wholesale and retail trade. According to 1950 census figures civilian employees numbered 104,000, of which 31 per cent of the men and 28 per cent of the women in the labor force were between 45 and 64 years of age. Many clerical workers were employed in the six fire and life insurance companies which have their home offices in Worcester.

Many famous men have lived in or near Worcester, including the inventors Elias Howe, Eli Whitney and Erastus Bigelow; also Gen. Artemas Ward, Col. Timothy Bigelow, Gen. Charles Devans and George Bancroft. Edward Everett Hale was a pastor here in 1842–1856. Clara Barton was born in the vicinity.

Beginning with 1800 the federal census returns have given the following: (1800) 2,411; (1820) 2,962; (1850) 17,049; (1870) 41,405; (1880) 58,291; (1890) 84,655; (1900) 118,421; (1910) 145,986; (1920) 179,754; (1930) 195,311; (1940) 193,694; (1950) 203,486.

Consult Blake, F. E., *Incidents of the First and Second Settlements of Worcester* (Worcester 1884); Hurd, D. H., *History of Worcester County* (ib. 1889); Lincoln and Hersey, *History of Worcester* (1837–62); Metcalfe, *Illustrated Business Guide to the City of Worcester* (1880); Spears, *Old Landmarks and Historic Spots of Worcester* (1932); Nutt, Charles, *History of Worcester and Its People* (New York 1919); Rice, F. P., *Worcester in 1898* (Worcester 1899); Farnsworth, Albert, and O'Flynn, G. B., *The Story of Worcester, Massachusetts* (ib. 1934).

WORCESTER, town, South Africa, in Cape Colony, on Breede River, at the foot of Hex River Mountains, 60 miles northeast of Capetown. Irrigation from the Hex River facilitates the growing of grapes, fruits and vegetables for local canneries. Textiles, furniture, brick and asbestos-cement products are manufactured. Pop. (1946) 19,001, half of which is white.

WORCESTER COLLEGE, Oxford, England, originally called Gloucester Hall, was founded in 1714 by Sir Thomas Cookes of Bentley, Worcestershire, for a provost, six fellows and six scholars. Under the statutes of 1882 Worcester College consists of a provost, 9 or 10 fellows, and 19 scholars. There are a number of exhibitions, two of which are connected with the Charterhouse School, and three with Bromsgrove School. There are 10 livings within the gift of the college. See also Oxford University.

WORCESTER POLYTECHNIC INSTITUTE, a professional school of engineering and chemistry located at Worcester, Mass. It was founded by a gift of $100,000 from John Boynton of Templeton; was chartered in 1865, and opened to students in 1868. Since that time its resources have been largely increased both by private benefactions and state donations.

Though one of the earliest schools of the kind in the United States, it has in every way kept pace with the progress in scientific and technical education, and is recognized as one of the leading American technical schools. From the time of its organization, laboratory and shop work have been a distinctive feature of its plan; it was one of the first schools to emphasize the importance of laboratory methods and the first in the United States to establish a workshop as an essential part of the training in mechanical engineering.

The institute offers five courses of four years each leading to the degree of B.S.; these are mechanical, civil and electrical engineering, chemistry and general science. English, political science, French or German, and mathematics are included in all courses; the work of the freshman year is practically the same for each course; with the sophomore year the special work of each course begins. The work of the junior and senior years of the general science course is largely elective; otherwise the courses are practically all prescribed. Motion pictures and field trips are part of the curriculum. Graduate courses are provided leading to the degrees of M.S., D.S., M.E., C.E., E.E., and Ch.E.

The students maintain a Christian association, student branches of the national engineering societies, chapters of several Greek fraternities and an athletic association. The institute publishes a bi-monthly *Journal,* containing original articles on technical and scientific subjects by the alumni and faculty and news of the institute and general scientific progress. The students publish a weekly paper. The institute campus comprises 40 acres on a slight elevation in the northwestern part of the city; it slopes on the north to Institute Park which includes a large athletic field with a quarter-mile track, gridiron and baseball diamond.

The buildings on this campus are Boynton Hall, the Washburn shops, the Salisbury laboratories, the electrical engineering laboratories, the mechanical laboratories, the power laboratory, the foundry, the magnetic laboratory, and the alumni gymnasium. The Alden hydraulics laboratory is in Chaffinsville, five miles distant. The laboratories and shops are all excellently equipped; the library including departmental libraries contains more than 50,000 volumes. Free tuition is given to 40 Massachusetts students in consideration of which the institute receives an annual state appropriation. The institute has about 90 instructors and enrollment averages 700 men, including some foreign students.

WORCESTER PORCELAIN. In 1751, Dr. John Wall, physician, and William Davis, apothecary, established the "Worcester Tonquin Manufacture," to imitate Chinese blue-and-white ware. Many connoisseurs declare some of the porcelain pieces were the best ever made in England. Robert Hancock, the clever engraver at the Battersea Enamel Works, helped by introducing transfer-printing; his fine work made the ware famous with such decorative pictures as "Garden Scene," "Milkmaid in a Farmyard," "The Hunt," etc., from noted artists as Gainsborough, Watteau, etc. Hancock left in 1774 and Dr. Wall died in 1776; then Thomas Flight purchased the factory, and, with his sons, John and Thomas, ran the works. Frequent changes of partnership changed the firm name respectively to Flight and Barr; Barr, Flight and Barr; Flight, Barr and Barr, when, in 1840, the competition of Robert Chamberlain forced an amalgamation in the firm name "Chamberlain's." Oriental decoration and English silverware forms characterize the Dr. Wall period (1751–83). The quality of the potting, as well as decoration, was first class from the start, but the "inky" quality of the blue (through impurity) was a defect of early pieces. Worcester soon acquired a deserved reputation for its wonderful gilding. O'Neal and Donaldson painted lovely figure decoration. The "Japan" pattern gained fame. A number of pieces in Worcester paste are facsimiles of Bow and Chelsea ware ("quail" pattern, etc.). Wall period blues (all underglaze) as backgrounds were "scale blue" and "powdered blue," of very variable quality. Other early colors were canary yellow, turquoise, copper green, apple green and purple. In enameling sprays and stripes, a dead-surface opaque *gros bleu* is frequent. Favorite decorative motifs were "exotic birds," flowers, fruit, figures, landscapes, etc., also handpainted camaieu "sprig pattern" in pink or overglaze blue. The early transfer-printing was in dark blue, chocolate brown, red, *puce* or purple, in overglaze. Decoration in the Flight period changed to "armorial" services of a gorgeous character; Grecian fret, anthemion and "Early Empire" conceptions (then in vogue) are favored. The great change in decorative treatment appears to have been without a transition period. The heavy gilding was still of fine execution but excessive and changed too in style. The final period is noted for grand services made for the emperor of Russia, George III, George IV and William IV. Artists were, besides Hancock, such men as Valentine Green, James Ross, Thomas Baxter, engravers; Donaldson, Williamson, Dyer, O'Neal, Fogo, etc., painters. The products were large vases after Sèvres and Dresden, table services, jugs, beakers, etc. Documentary evidence adds figures to Worcester ware, but none are known. Early Worcester paste was a glassy, translucent, beautiful frit of greenish tinge when looked through. This gave way to a semi-opaque paste of yellowish tone, of which inferior body some of Worcester's most costly pieces is composed. The Flight period paste was no longer a soft, but hard, opaque, greyish body, often both thick and heavy. From 1783 to 1793 we have a pure, translucent, fine paste of bone-ash, china stone and china clay. *Marks:* First came a crescent or the Chinese square "seal" mark, and the letter W, two on the same piece sometimes. At times a capital E lies within the horns of the crescent. Then we get "FLIGHTS" or the same in italics, some with a superposed crown. These are followed by the changed firm names. Crossed swords closely resembling the Dresden mark are on some pieces.

Chamberlain Worcester.— On the purchase of the Worcester factory by Flight, Robert Chamberlain (about 1783), whose capacity is a mooted point, left the factory and started on his own account at the Diglis works. His brother Humphrey and Richard Nash were partners. H. Chamberlain, Junior, and Robert Chamberlain, Junior, ran the works from 1798 to 1811, and, from 1804 to 1811, G. Boulton was a partner. Competition between the Worcester factories was so keen that Barr, Flight and Barr, after heavy losses, combined with Chamberlain (1840) when the work was continued in the Chamberlain plant only. The art value of the product soon fell off. Under Kerr and Binns the later factory produced, in the 19th century, very fine work. "Chamberlains" started the lovely, translucent "Regent" body in their finest pieces, but it was very costly and unprofitable. Chamberlain ware so closely resembles the Flight and Barr product that they are hard to sometimes differentiate. Both did spiral-fluted table services. "Japan" style was used by Chamberlains for many years. Marks were "Chamberlain's" or "Chamberlain's Worcester," also "Chamberlains Worcester." The crown appears on "Regent Paste" pieces and over some Flight firms' names. The factory is still running as the Royal Worcester Works.

Grainger Worcester.—A nephew of Humphrey Chamberlain, a porcelain painter in the Worcester works, named Thomas Grainger, opened (about 1801) an independent factory with a partner in the firm name of Grainger and Wood. In 1812 the firm became Grainger, Lee and Company, then G. Grainger and Company in 1839. Their chief product was services, and excellently painted views in panels with handsome gilding appear on extant pieces. Among other marks are "George Grainger, Royal China Works," "Grainger, Lee and Co.," the last mark being "G. & Co." in a shield with three martlets in a canton.

Bibliography.— Binns, W. M., 'The First Century of English Porcelain' (London 1906); Blacker, J. F., 'ABC of Old English China' (3d ed. 1930) and others of his books; Church, A. H., 'English Porcelain made during the Eighteenth Century' (London 1904); Hobson, R. L., 'Worcester Porcelain' (London 1910); Jewitt, Ll., 'The Ceramic Art of Great Britain' (London 1883); Nightingale, J. E., 'Contribution towards the History of Early English Porcelain' (Salisbury 1881); Solon, M. L., 'Brief History of Old English Porcelain' (London 1903); Hayden, A., 'Chats on English China' (1930). CLEMENT W. COUMBE.

WORCESTER VS. GEORGIA. A statute of Georgia which prohibited residence within the territory of the Cherokee nation without the license of the State governor. Worcester was prosecuted in the criminal courts for having violated this statute. He appeared from his conviction to the Supreme Court of the United States claiming that the decision of the lower

court was in derogation of rights and privileges claimed by him under treaties existing between the government of the United States and the Cherokee nation. The latter was held to be a sovereign nation having the inherent power of negotiating treaties with the United States government subject only to the protection of the latter against the aggression of foreign powers. It was held also that the State of Georgia within whose limits lay the territory of the Cherokees had no power to legislate as to the rights of white persons residing in said territory and consequently his conviction of a crime against the laws of the State for residing in such territory without the license of the State governor, was without authority and void. Consult Canfield, G. F., in *American Law Review,* Vol. XV (1881); Thayer, J. B., in *Atlantic Monthly* (Vol. LXVIII, 1891); and Willoughby, W. W., 'Constitutional Law' (1910).

WORDE, wôrd, **Wynkyn de,** English printer and stationer: b. Alsace, late 15th century; d. London, about 1534. His name was properly Jan van Wynkyn, de Worde being a place-name referring to Worth in Alsace. He probably went to England with Caxton from Bruges in 1476, and later was an apprentice in Caxton's printing office, in which he established himself in 1491. He printed between 700 and 800 works, which are known through fragments or at least one complete copy. This is thought to be not more than half his work. Among the books printed by him were Higden's 'Polychronicon' (1495), in which occurs the first specimen of music type; Wakefield's 'Oratio' (1524), in which italic type was first used in England; and Trevisa's rendering of Bartholomæus Anglicus' 'De Proprietatibus Rerum' (1496).

WORDEN, wôr'dn, **John Lorimer,** American naval officer: b. Ossining, Westchester County, N. Y., 12 March 1818; d. Washington, D. C., 18 Oct. 1897. He was appointed a midshipman in the navy in 1834. At the beginning of the Civil War he was captured by the Confederates, but after seven months was exchanged and was subsequently ordered to the command of the *Monitor,* which left New York 6 March 1862. He arrived at Hampton Roads on the evening of the 8th, after the iron-clad *Merrimac* had destroyed the wooden frigates *Cumberland* and *Congress.* On the morning of the 9th a memorable battle was fought by the *Merrimac* and *Monitor,* the former of which was partly disabled and abandoned the fight, after several violent collisions with the *Monitor.* Promoted commander in 1862 and captain in 1863 he commanded the iron-clad *Montauk* in the operations against Fort Sumter in April of that year. In June 1868 he was promoted commodore, and in 1872 rear admiral. He was superintendent of the Naval Academy at Annapolis in 1870–74; commander-in-chief of the European squadron in 1875–77; and was retired in 1886.

WORDSWORTH, wêrdz'wêrth, **Charles,** Scottish prelate, son of Christopher Wordsworth (1774–1846) (q.v.): b. Lambeth, 22 Aug. 1806; d. Saint Andrews, Scotland, 5 Dec. 1892. He was educated at Harrow and Christ Church, Oxford, and, becoming a private tutor, had Gladstone and Manning as pupils. From 1835 to 1846 he was second master at Winchester School, and from 1846 to 1854 was the first warden of Trinity College, Glenalmond, Perthshire. He was elected bishop of Saint Andrews, Dunkeld and Dunblane in 1852, and was a prominent figure in the ecclesiastical life of Scotland, being filled with an earnest desire to heal the dissensions between the different churches and pave the way for their reunion. Besides volumes of sermons, discourses, etc., he published a widely-used 'Greek Grammar' (written in Latin) (1839); 'Shakespeare's Knowledge and Use of the Bible' (1864; 4th ed. 1892); 'Annals of My Early Life' (1891). Consult 'Annals of My Life' (1893), edited by Hodgson; and 'The Episcopate of Charles Wordsworth' (1899) by John Wordsworth.

WORDSWORTH, Christopher, English Anglican clergyman, youngest brother of William Wordsworth (q.v.): b. Cockermouth, Cumberland, 9 June 1774; d. Buxted, Sussex, 2 Feb. 1846. He was educated at Hawkshead Grammar School and Trinity College, Cambridge, and was elected a Fellow of his college in 1798. He held various livings in the Church and was master of Trinity College 1820–41. He published 'Ecclesiastical Biography' (1810); 'Sermons on Various Subjects' (1814); 'Christian Institutes,' a series of discourses and tracts (1836); 'Who Wrote Eikon Basilike?' (1824–25), etc.

WORDSWORTH, Christopher, English Anglican prelate, son of the preceding: b. Lambeth, 30 Oct. 1807; d. Harewood, Yorkshire, 21 March 1885. He was educated at Winchester and at Trinity College, Cambridge, and from 1836 to 1844 was head master of Harrow School. He then became canon of Westminster, and after being made archdeacon of Westminster in 1865 was appointed bishop of Lincoln in 1868. He was the author of writings connected with classical, theological or ecclesiastical subjects, among which are 'Athens and Attica' (1836); 'Greece: Pictorial, Descriptive, and Historical' (1839); an edition of 'Theocritus' (1844; fuller one, 1877); 'Memoirs of William Wordsworth' (1851); 'Saint Hippolytus and the Church of Rome in the 3d Century' (1853); 'The New Testament in the Original Greek' (1856–60); 'The Old Testament in the Authorized Version,' with notes and introduction (1864–71); 'A Church History to the Council of Chalcedon, 451 A.D.' (1881–83). Consult 'Life' by his daughter Elizabeth and J. H. Overton (1888).

WORDSWORTH, Christopher, English Anglican clergyman and scholar, second son of Bishop Christopher Wordsworth (q.v.): b. Westminster, 26 March 1848. He was educated at Trinity College, Cambridge, in 1870–88 was a Fellow and tutor of Peterhouse College, and in 1877 was appointed rector of Galston, in Rutland. In 1886 he became a prebendary of Lincoln cathedral, and in 1889 rector of Tyneham, Dorset. In 1897–1911 was rector of Saint Peter's, Marlborough; from 1911–17 sub-dean, 1917–28 chancellor, and from 1911 until his death 30 Jan. 1938 prebendary of Salisbury Cathedral. His works comprise 'University Society in the 18th Century' (1874); 'Breviarium ad Usum Sacrum' (1879–86), edited with F. Proctor: 'Pontificale Ecclesiæ S. Andreæ' (edited 1885); 'Lincoln Cathedral Statutes' (1892–97); 'Coronation of King Charles I' (1892–94); etc.

WORDSWORTH, Dorothy, English writer: b. Cockermouth, 25 Dec. 1771; d. Grasmere, 25 Jan. 1855. She was the only sister of the poet and was a woman of remarkable mental powers, who described country life with keen observation and much literary skill. Besides her 'Recollections of a Tour in Scotland' (1874) other journals and letters of hers have been published, the manuscripts having been finally collected by Knight in 1897. Her mind was latterly clouded. Consult Lee, 'Dorothy Wordsworth' (1886; new ed., 1894)

WORDSWORTH, John, English Anglican prelate, eldest son of Bishop Christopher Wordsworth (q.v.): b. Harrow, 21 Sept. 1843; d. 16 Aug. 1911. He was educated at New College, Oxford, was ordained deacon in 1867, and in 1868 became an assistant master in Wellington College. In 1870 he was made prebendary of Lincoln, and in 1883–85 was Oriel professor of the interpretation of Holy Scripture, Fellow of Oriel and canon of Rochester. He was Bampton lecturer in 1881 and in 1885 became bishop of Salisbury. His chief publications are 'Fragments and Specimens of Early Latin' (1874); 'University Sermons of Gospel Subjects' (1878); 'The One Religion' (1881, Bampton Lectures); 'Old Latin Biblical Texts' (1883–86), with Sanday and White; 'The Holy Communion' (1891); 'Novum Testamentum Latine, secundum editionem S. Hieronymi' (1898); 'The Episcopate of Charles Wordsworth' (1899); 'Teaching of the Church of England for Information of Eastern Christians' (1900); 'The Ministry of Grace' (1901); 'Unity and Fellowship' (1910), etc. Consult Watson, E. W., 'Life of Bishop John Wordsworth' (London 1916).

WORDSWORTH, William, English poet: b. Cockermouth, Cumberland, 7 April 1770; d. Rydal Mount, Westmoreland, 23 April 1850. He was the second son of John Wordsworth, attorney-at-law, who was descended from a Yorkshire family dating back to the Norman Conquest. His mother, Anne Cookson, belonged to an ancient family of Crackanthorpes, who had lived in Westmoreland from the times of Edward III. He was educated at Hawkshead Grammar School and at Saint John's College, Cambridge, where he entered in 1787, taking his B.A. degree in January 1791. In the summer vacation of 1790 he went to the Continent with Robert Jones, a fellow-collegian, starting, as he says, "staff in hand, without knapsacks, each his needments tied up in a pocket-handkerchief, with about 20 pounds apiece in our pockets." They spent most of the time in walking through Switzerland.

He left Cambridge with no definite plans for the future. He did not feel himself, as he said afterward, "good enough for the church," and had no inclination to the law. He had studied military history with much interest, and at one time thought of going into the army, but on reflection gave up the plan. He finally went to London, where he lived for a time on a small allowance with no special aim or employment. In November 1791, he went to France, with the idea of spending the winter and learning French, but, becoming interested in the revolutionary politics of the period, remained in the country until October 1792, when his friends, fearing for his safety, stopped his funds, and he reluctantly returned to England.

He soon began to turn his attention to literary work. He had written verse in his school days, at first as a task imposed by his master, the subject assigned being "The Summer Vacation," to which of his own accord he added a poem on 'The Return to School.' This was before he was 15, for in 1785 he was called upon to write verses in commemoration of the second centennial anniversary of the founding of the school. These, he says, "were much admired — far more than they deserved — for they were but a tame imitation of Pope's versification, and a little in his style." His first publication was in 1792 (not 1793, as generally stated), a thin quarto entitled 'An Evening Walk — an Epistle in Verse addressed to a Young Lady from the Lakes of the North of England. By W. Wordsworth, B.A., of Saint John's College, Cambridge.' This was followed, the same year, by 'Descriptive Sketches in Verse, taken from a Pedestrian Tour in the Italian, Grison, Swiss and Savoyard Alps.' The books attracted little attention, and sold very slowly; but they led to the friendship between Wordsworth and Coleridge, which proved to be a lifelong intimacy. Coleridge says in his 'Biographia Literaria': "During the last year of my residence at Cambridge I became acquainted with Mr. Wordsworth's 'Descriptive Sketches,' and seldom, if ever, was the emergence of an original poetic genius above the literary horizon more evidently announced." Wordsworth himself did not estimate these early poems very highly. In a letter to a friend at the time he says: "It was with great reluctance that I sent those two little works into the world in so imperfect a state. But as I had done nothing by which to distinguish myself at the university, I thought these little things might show that I *could* do something. They have been treated with unmerited contempt by some of the periodicals, and others have spoken of them in higher terms than they deserved."

In the latter part of 1794 Wordsworth received a legacy of £900 from a young friend, Raisley Calvert, son of the steward of the duke of Norfolk, who owned large estates in Cumberland. They had long been very intimate when Calvert was attacked by consumption, and Wordsworth was his devoted companion and nurse until his death. The poet now felt that he could make a home for himself and his only sister, with whom the next autumn (1795), he settled down in a cottage at Racedown in Dorsetshire. In July 1797, they moved to Alfoxden, in Somersetshire, in order to be near Coleridge at Netherstowey. Here Wordsworth added to his income by taking a young son of Basil Montague as pupil; and here he wrote many of the poems included in the 'Lyrical Ballads,' published in the autumn of 1798 by Mr. Joseph Cottle of Bristol, who had been rash enough to pay 30 guineas (about $150) for the copyright. The volume contained Coleridge's 'Ancient Mariner,' which he and Wordsworth had planned together, and to which the latter had contributed a few lines; together with Wordsworth's 'Idiot Boy,' 'We are Seven,' and 20 other poems. Among these were the famous lines on 'Tintern Abbey.'

which were written just before the book appeared. Five hundred copies were issued, but most of them were afterward sold to a London bookseller at a sacrifice. When Cottle gave up business soon afterward, his copyrights were transferred to Mr. Longman of London, and in the estimation of their value the 'Lyrical Ballads' were put down as "worth nothing." Cottle, therefore, asked that the copyright might be given back to him, and, the request being granted, he made a present of it to the authors, who both lived to see it become a piece of really valuable literary property. It is not easy to imagine a book containing 'The Ancient Mariner' and the 'Tintern Abbey' reckoned absolutely worthless, from a commercial point of view, only about a century ago.

Immediately after the publication of the 'Lyrical Ballads,' Wordsworth, his sister and Coleridge sailed for Hamburg, with a view of perfecting their acquaintance with the German language by a winter at Goslar. During the four months spent in that dull and dismal town, in a particularly cold and disagreeable season, Wordsworth wrote some of his best and most characteristic poems, full of the loveliness of English rural scenery and life. Coleridge traveled independently of his friends a part of the time they were abroad, but the three made excursions together in the rural districts of Germany, and had some unpleasant experiences. Sometimes they found it difficult to obtain food and shelter in the wretched inns of the country. In one instance, as Coleridge records, they were actually driven out of doors and had to spend the night in the fields. But they met with no worse misadventures than these, and the Wordsworths got safely back to England in the spring of 1799.

The poet was always fond of travel, and in later years frequently indulged in it both in the British Isles and on the Continent. In August 1802, he went to France again, and in 1803 and 1814 visited Scotland. In 1820 he went with his wife and sister through Switzerland and Italy. In 1823 he traveled in Holland, in 1824 in North Wales, in 1828 in Belgium with Coleridge, and in 1829 in Ireland with his friend Marshall. In 1831 he and his daughter visited Scott at Abbotsford. In 1833 he made another tour in Scotland, and in 1837 a long one in Italy with Crabbe Robinson. In all these journeys he found more or less material and inspiration for his poems.

After his return to England in 1799 he and his sister decided to settle down in their ancestral Lake Country, and soon took a small cottage at Grasmere. Here and in the immediate vicinity the remainder of their lives, except for the occasional journeys abroad, was passed in domestic and poetic seclusion, with few important incidents to disturb the calm current of the lapsing years. In 1802 the poet married Mary Hutchinson, whom he had known from childhood and with whom he had attended the same "dame's school" at Penrith, where his boyhood was partly spent with his mother's parents. After his marriage he and his wife continued to reside with his sister at Grasmere, and there three of his children were born. From 1808 to 1813 the family lived in the same neighborhood in two other houses, and then removed to Rydal Mount, a few miles distant, which was the poet's home for 37 happy years. There, among his native lakes and hills, he died in his 81st year.

In his early manhood the poet's resources were very slender, but his tastes were simple and he made what he had suffice for his needs. He and his sister managed to live for six or seven years on about $500 a year. Later he came into possession of a little property, and later still was appointed stamp-distributor for Cumberland and Westmoreland, an office worth £500 a year, the duties of which were mostly discharged by a clerk, leaving the poet leisure for his literary pursuits. In 1803 he became acquainted with Sir George Beaumont, a descendant of the dramatist and a cultivated man, who presented him with a beautiful piece of land at Applethwaite, near Skiddaw, hoping that he might be induced to settle there, but he could not make up his mind to leave his chosen home at Grasmere. His friendship with Beaumont remained unbroken until the death of the latter in 1827.

Wordsworth retained the stamp-collectorship until 1842, when it was transferred to his second son. A more lucrative office, the collectorship of Whitehaven, was offered him, but he declined it, being unwilling to exchange his secluded life at Rydal "for riches and a load of care." In 1843, he was made poet-laureate on the death of Southey. He declined the honor at first as imposing duties which at his advanced age he hesitated to undertake; but he finally accepted it, at the personal solicitation of Sir Robert Peel, who assured him that nothing "should be *required* of him," adding that the appointment was "a tribute of respect justly due to the first of living poets," that "the queen entirely approved of the nomination," and that there was "one unanimous feeling on the part of all who had heard of the proposal that there could not be a question about the selection."

In 1800 a second edition of 'Lyrical Ballads,' with other poems, was published, and others appeared in 1802 and 1805. Meanwhile, the poet had made few friends and many and bitter enemies. The issue of two more volumes of 'Poems' in 1807 led to a fresh onslaught upon the author, who persisted in writing verse after the autocratic *Edinburgh Review* had given judgment against him. Jeffrey, in noticing the new volumes in the *Review,* remarked: "Even in the worst of these productions there are, no doubt, occasional little touches of delicate feeling and original fancy; but these are quite lost and obscured in the mass of childishness and simplicity with which they are incorporated." Such was the high critical verdict upon a collection of poems that included the 'Ode to Duty,' the 'Sonnets dedicated to Liberty,' 'The Happy Warrior,' the exquisite lines, "She was a Phantom of Delight," etc., and the sublime 'Ode on the Intimations of Immortality.' Eight years elapsed before another edition of the poems was printed; and the year previous (1814) Wordsworth had published 'The Excursion.' Five hundred copies of this sufficed to supply the demand for six years. The new poem was savagely treated by Jeffrey, who boasted that he had "crushed 'The Excursion.'" Southey remarked: "He might as well seat himself on Skiddaw, and fancy that he crushed the mountain." Jeffrey

began his crushing criticism with «This will never do,» and went on to pronounce the poem «longer, weaker and tamer than any of Mr. Wordsworth's other productions»; but though he and his fellow reviewers prevented the sale of the poem, they could not kill it, in spite of its obvious faults.

Other volumes were brought out by the undismayed poet in 1815 ('The White Doe of Rylstone'), in 1819, 1820 and 1822, and all were condemned by the *Edinburgh Review,* as they appeared; but the reaction had now begun among the critical authorities, and henceforth Wordsworth had powerful defenders in literary circles. «War was no longer waged *against* his poems, but rather *concerning* them.» It was, however, a long fight yet before their rightful position was accorded them by the general consent of the contending parties. De Quincey has well summed up the matter thus: «From 1800 to 1820 the poetry of Wordsworth was trodden under foot; from 1820 to 1830 it was militant; from 1830 and onward it has been triumphant.» And the triumph was complete. There were still those who could see little to admire in the meditative measures of the Cumberland recluse, but the general verdict was in his favor, and his place among the great poets of our literature was secure beyond dispute. Honors, too, were conferred upon him. In 1839 he received the degree of D.C.L. from Oxford University; and the enthusiasm of the audience on the occasion was such as had never been known except upon the visits of the Duke of Wellington. One who was present says: «Scarcely had his name been pronounced than from 3,000 voices at once there broke forth a burst of applause, echoed and taken up again when it seemed about to die away, and that thrice repeated.» The poet no doubt went through the ceremony with his wonted calmness and composure; but it was none the less significant as a tribute to the man and a testimonial that he had fairly won the laurel crown. A few years later, as we have seen, he received the further honors of a government pension and the laureateship.

Wordsworth's famous theory of poetic art was first set forth in the preface to the second edition of the 'Lyrical Ballads' (1800), and more at length subsequently in prefaces and appendixes. He took the ground that not only might the poet draw his subjects from common life, but he might treat of them in the language of common life. «I have proposed to myself,» he says, «to imitate and, as far as is possible, to adopt the very language of men. . . . I have taken as much pains to avoid what is usually called poetic diction as others ordinarily take to produce it.» And again he asserts that «there neither is, nor can be, any essential difference between the language of prose and metrical composition.» But his theory was the result of his rebellion against the highly artificial style of Pope and his school, and, like many reformers, he was at first inclined to go too far in the opposite direction. He himself admitted this later by giving up the puerile style in which many of his earlier poems were written, and adopting a more elevated diction, and also by changing some of the most prosaic expressions in those early poems. To take a single brief example of these emendations, in 'The Thorn,' one of the 'Lyrical Ballads,' as printed in 1798 and 1815 we have this arithmetical statement

> And to the left, three yards beyond,
> You see a little muddy pond
> Of water never dry.
> I've measured it from side to side,
> 'Tis three feet long and two feet wide.

Crabbe Robinson told Wordsworth that «he dared not read these lines aloud in company.» «They ought to be liked,» was the poet's reply; but he nevertheless modified the last two lines in 1820, so that now they read:

> Though but of compass small and bare
> To thirsty suns and parching air.

Wordsworth was much gratified at the comparatively early appreciation of his works in America. The 'Lyrical Ballads' were reprinted at Philadelphia in 1802, and an edition of his poems in four volumes appeared in Boston in 1824. A complete edition was brought out (Philadelphia 1837) by Prof. Henry Reed, with whom the poet interchanged many letters. In one of these he says: «The acknowledgments which I receive from the vast continent of America are among the most grateful that reach me.» Reed's edition was revised and enlarged in 1851. In 1854, a Boston edition in seven volumes was published, with a biographical introduction (though without his name) by James Russell Lowell. Thirty years later (1884) when Lowell was Minister to England, he was made president of the Wordsworth Society, and in the closing words of an address on that occasion he thus aptly and admirably expressed what we may call the «true mission» of the poet:

«As in Catholic countries men go for a time into retreat from the importunate dissonances of life to collect their better selves again by communion with things that are heavenly and therefore eternal, so this Chartreuse of Wordsworth, dedicated to the Genius of Solitude, will allure to its imperturbable calm the finer natures and the more highly tempered intellects of every generation, so long as man has any intuition of what is most sacred in his own emotions and sympathies, or of whatever in outward nature is the most capable of awakening them and making them operative, whether to console or strengthen. And over the entrance gate to that purifying seclusion shall be inscribed:

> Minds innocent and quiet take
> This for a hermitage.

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WORK, Henry Clay, American song writer and inventor: b. Middletown, Conn., 1 Oct. 1832; d. Hartford, Conn., 8 June 1884. He was a printer for a time, but studied harmony and became widely popular during the Civil War period by his songs, such as 'Kingdom Comin'; 'Wake Nicodemus'; 'Babylon is Fallen'; and 'Marching Through Georgia.' He wrote also temperance songs, which had a wide circulation, among them, 'Father, Dear Father, Come Home with Me Now'; and sentimental melodies like 'My Grandfather's Clock' and 'Lily Dale.' Among inventions by him were a rotary engine, a knitting machine and a walking doll.

WORK, in mechanics. See ENERGETICS; MECHANICS.

WORKHOUSE, in the United States, a correctional prison for petty offenders. In England the poorhouse is called a "workhouse." Workhouses appear to have been correctional originally in England also and were first erected in the reign of Charles II in order to compel rogues and vagabonds to work for a living. Act 8 Charles I, ch. vii, entitled the churchwardens or overseers of the poor, with consent of the majority of the inhabitants to establish workhouses for lodging and maintaining the poor, and made various arrangements for union of parishes for this purpose. By 34 and 35 Victoria, ch. cviii, the guardians of every union are bound to provide casual wards, with such fittings as the poor-law board consider necessary, for the accommodation of the casual poor. Every workhouse has to keep a register of religious creeds and also a register of persons under 16, hired out as servants or apprentices, whom the relieving officer must visit to inquire into their food and treatment. The inmates of workhouses are not allowed to go out and in at pleasure and the able-bodied are compelled to work when required. In suitable situations they are often employed in field labor. Married persons are separated unless both are above 60 years of age. Drunkenness, misconduct or refusal to work exposes to the penalty of imprisonment with hard labor. The workhouses, after being under the control of the poor-law board, were placed under the local government board in 1891.

In Scotland the legal designation of houses provided for the accommodation of the poor is "poorhouses," as in America, the designation "asylum for the poor" being also used in the United States. See CHARITIES, PUBLIC; PENSIONS; PAUPERISM; SOCIOLOGY.

WORKINGMEN'S ASSOCIATION, International. See INTERNATIONAL WORKINGMEN'S ASSOCIATION; SOCIALISM.

WORKINGMEN'S CLUBS, organizations for educational and social purposes composed of workingmen, but having none of the benefit or industrial features of the trade-union. In the United States they are not numerous, and where they exist are organized by those interested in philanthropic work for the benefit of workingmen, and are usually largely educational. In Europe, however, clubs are often formed by the workingmen themselves, and are sometimes political, usually socialistic, and sometimes purely social; there are also numerous philanthropic clubs, especially in England, organized generally under church auspices. These are both social and educational.

WORKINGTON, wĕr'kĭng-tŏn, England, a seaport and manufacturing town in Cumberland, near the mouth of the Derwent, which enters the Solway Firth 33 miles from Carlisle. It has a good harbor furnished with a breakwater, and is provided with docks. The municipal borough, incorporated 1888, does not include the whole of the previously existing urban district. The town is of importance from its industrial establishments, which comprise large iron-smelting works and works for steel rails, iron plates, etc.; it has a shipbuilding yard and collieries, and carries on a considerable shipping trade. The salmon fishery is increasing in importance and seaborne commerce has made great advances in recent years. Pop. 26,480.

WORKMAN, Fanny Bullock, American traveler and mountain climber: b. Worcester, Mass., about 1850; d. Cannes, France, 23 Jan. 1925. She was a daughter of Gov. A. H. Bullock of Massachusetts, and was educated in New York and in France and Germany. She was married in 1881, afterward traveling with her husband in Northern Africa, Asia Minor

and the Far East. In 1889 she made several record first ascents for women in the Himalayas, of which the highest was Mt. Koser Gunge, 21,000 feet in altitude. She gained the women's world record for mountaineering in 1906 by her ascent of the Nun Kun Peaks, reaching an altitude of 23,300 feet. In 1912 she surveyed the Rose Glacier, and discovered the watershed between the Indus and the Turkestan regions.

WORKMAN, George Coulson, Canadian educator and theological writer: b. Grafton, Ontario, Sept. 28, 1848; d. Toronto, April 22, 1936. He was graduated at Victoria University in 1875, and received the degree of Ph.D. at the University of Leipzig in 1889. In 1876–1878 he was assistant editor of the *Christian Guardian,* and he afterward served several years as a pastor in the Methodist Church. He was professor at Victoria University, Coburg, in 1884–1891; and in 1904–1908 he was professor of Old Testament exegesis and literature at the Wesleyan Theological Seminary, Montreal. He was later engaged in writing and gained a high reputation as a Biblical critic.

WORKMAN, William Hunter, American surgeon and explorer: b. Worcester, Mass., Feb. 16, 1847; d. Newton, Mass., Oct. 7, 1937. He received his A.B. degree from Yale in 1869, an A.M. there in 1872, the year he took his medical degree at Harvard, and thereafter practiced his profession in Worcester, Mass., until his retirement in 1889 on account of poor health. He was married to Fanny Bullock in 1881, and together they set out for travel and exploration, using bicycles extensively. In 1902–1903, while they were exploring the Himalayas in the northern part of Baltistan, he reached a record height for mountain climbing, up to that time, of 23,392 feet. They were in Kashmir in 1906 and established their camp in snow at as high as 21,300 feet, a record for mountain camps. In 1911–1912 Workman made his seventh Himalayan expedition, exploring glaciers and high passes, and making discovery of some of these. He was a member of many geographic and mountain clubs and recipient of many medals for his topographic work. With his wife (see WORKMAN, FANNY BULLOCK) he collaborated as author of a half-dozen or more books of travel, including *Two Summers in the Icy Wilds of Eastern Karakoram* and *Peaks and Glaciers of Nun Kun.*

WORKMEN'S COMPENSATION, a type of social insurance which provides medical care and partial wage compensation for wage earners or their dependents for economic losses caused by industrial injuries or diseases. Under workmen's compensation laws the injury or disease must arise out of and be received during the course of the employment.

The principle of workmen's compensation started in Germany (1883–1884), spread throughout Europe, and then to other parts of the world. It really began when the old theory of employers' liability proved inadequate to care for injured workers and their dependents. Under employers' liability, an injured employee could only recover damages if he could prove that the accident was caused by the negligence of the employer or his agent. This was difficult if not impossible to prove in many instances and involved costly and prolonged litigation. Even if it were proved that the employer had been negligent, he was not required to compensate the employee if it were shown that the employee had assumed the risk of the employment, that he was contributorily negligent or that the injury was caused by the negligence of a fellow employee.

It was to remedy this situation that the first workmen's compensation law was enacted. Under the compensation law the question of fault or blame for the accident is not raised and the employee is entitled to be compensated for an injury if it arises out of and in the course of his employment. These laws are based on the theory that the cost of industrial injury should be charged against industry as one of the costs of production. This theory extends not only to industrial accidents but also to diseases contracted in the course of employment.

United States.—It was more than 25 years after the enactment of the first workmen's compensation law in Germany before the principle began to be accepted in the United States. Numerous states had appointed commissions to study the subject but no legislation was adopted until 1911. At that time, 10 states adopted such laws. By 1920, a total of 41 states had some form of workmen's compensation on their statute books. With the passage of the Mississippi law in 1949, all states have such legislation together with federal laws covering public employees, longshoremen and harbor workers, and workers in the District of Columbia.

When workmen's compensation laws were first enacted, it was felt that it would be unconstitutional to require employers to come under the act. As a result most of the early state laws were made elective. There is no longer any question of constitutionality, as the courts have repeatedly upheld compulsory workmen's compensation laws. The following 22 states now have compulsory laws: Arizona, Arkansas, California, Delaware, Idaho, Illinois, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Nevada, New Hampshire, New York, North Dakota, Ohio, Oklahoma, Utah, Virginia, Washington, Wisconsin, and Wyoming. Compulsory laws are also in operation in Alaska, the District of Columbia, Hawaii, Puerto Rico, and under the longshoremen and harbor workers and the United States civil employees acts. A compulsory statute is one which requires every employer within the scope of the compensation law to accept the act and pay the compensation specified. An elective act on the other hand is one in which the employer has the option of either accepting or rejecting the act, but in case he rejects it he loses the customary common law defenses—assumed risk of the employment, negligence of fellow servants, and contributory negligence.

To make certain that benefit payments will be made when due, all of the states require that the covered employer shall obtain insurance or give proof of his qualifications to carry his own risk, which is known as self-insurance. In most of the states the employer is permitted to insure with private insurance companies. State insurance systems exist in 18 states and in Puerto Rico.

Because of the wide variations in the coverage of the laws, it has been difficult, if not impossible, in the United States to measure the extent of coverage. No workmen's compensation law covers all employment in the state. Some laws cover only the so-called hazardous employments. Others cover only employers having more than a

specified number of workers. Since many of the laws are elective, they allow employers the choice to remain outside the scope of the act. Other restrictions on coverage result from specific exclusion of a designated industry or employment and by questions of jurisdiction between state and federal control, especially in regard to interstate transportation and maritime work. Railroad employees engaged in interstate commerce are covered by the Federal Employers' Liability Act, while many maritime employees are subject to the so-called Jones Act. Under this latter law the provisions of the Federal Employers' Liability Act apply. Workers engaged on farms and agricultural pursuits are the largest population group deprived of workmen's compensation. These employees are usually specifically excluded from the act as are domestic servants, casual workers, and employees of charitable institutions.

In the laws of 30 states as well as Alaska and Puerto Rico, employers of less than a stipulated number of workers are exempt from compensation coverage requirements. These range from 2 employees in Oklahoma and Nevada to 15 employees in South Carolina. In 11 states (Illinois, Kansas, Louisiana, Maryland, Montana, New Mexico, New York, Oklahoma, Oregon, Washington and Wyoming) the compensation laws apply mainly to listed "hazardous" or "extrahazardous" employments. While these terms were adopted as expedients in the early days of workmen's compensation legislation to assure constitutionality, their retention in some instances is a major obstacle to the wide coverage of workers. In some of the laws with this type of coverage the list of hazardous industries is comprehensive, as in New York where most employments are covered. However, even in those states where the list is comprehensive there are difficulties of interpretation since the laws in some cases contain both specific and general provisions. The Maryland law, for example, lists extrahazardous employments covered, and then also provides that the act shall apply to all extrahazardous employments not specifically enumerated and to all work of an extrahazardous nature. Hence determination of the hazardous nature of an employment may have to be made after instead of before an inquiry.

Compensation laws are limited not only as to persons and employments included, but also as to injuries covered. The usual definition of a compensable injury is one "arising out of and in the course of employment." Under most of the early laws, only "accidental" injuries were covered. Some laws omitted the word "accidental" but specifically excluded occupational diseases. Under several laws, however, the terms "injury" and "personal injury" have come to include by definition or court interpretation occupational diseases. An increasing number of the states have changed the specific exclusion of occupational diseases to specific or general inclusion. An occupational disease is usually held to be an injury of gradual or slow development, by comparison with the sudden effect of an accident. However, in states not covering occupational diseases, the courts sometimes attribute a sudden or "accidental" origin to an injury known to physicians as a disease. States are now adopting occupational disease coverage amendments or laws.

In 43 states as well as Alaska, the District of Columbia, Hawaii, and Puerto Rico, some provision is made for coverage of occupational diseases. Such protection is also given to employees covered by the Federal Employees' Compensation Act and the Longshoremen's and Harbor Workers' Compensation Act of March 4, 1927. Twenty-five states and also Alaska, the District of Columbia, Hawaii and the United States (civil employees' and longshoremen's act) cover all occupational diseases, while 18 other states and Puerto Rico cover only listed diseases.

The amount of compensation paid under the various workmen's compensation laws is determined by the rate, usually a percentage of the wage; the term or period of payment; the weekly maximum, and the aggregate maximum. The amount and method of payment may also differ according to the type of injury. The acts prescribe certain payments in case of death, permanent total disability, permanent partial disability, and temporary total disability.

Most of the acts base the compensation on varying proportions of wages. In Alaska, Oregon, Washington and Wyoming, however, the laws specify the flat amount of compensation to be paid, except that in Alaska and Oregon, compensation for temporary disability is based on the wages received. A few acts provide fixed lump sums or pensions for certain injuries but apply the percentage system to all others. Workers do not necessarily receive the amount which would be indicated by these percentages, as in most states there is a limitation on the maximum amount of weekly benefits. In some states the percentage varies with the worker's conjugal status and the number of children.

Maximum periods during which compensation may be paid vary widely in the different acts. Maximum weekly payments are as high as $40.00 or more including allowance for dependents in Arizona, Massachusetts, North Dakota, Oregon, Washington, Wyoming and federal civil employees' compensation acts. In the greater number of states, however, the maximum is between $25 and $30. Especially when earnings are relatively high, the maximum weekly payments may be only a fraction of wages, making it difficult for the worker to meet living costs.

Methods of determining compensation for death vary considerably and do not in all cases depend upon the fact that the deceased was a source of support to legal beneficiaries. In Arizona, District of Columbia, Nevada, New York, North Dakota, Oregon, Washington, West Virginia and the United States the law provides for the payment of benefits to a widow for life, or until remarriage, and in the case of children until a specified age is reached. The other states limit the period or total amount of payments. In 33 states the death benefits are limited to payments for a specified period ranging from 240 to 600 weeks, but in some cases payments continue to children until they reach a specified age. Some of these states also set a total maximum ranging from $3,500 to more than $20,000 in Wisconsin. Seven states, Alaska, Hawaii, and Puerto Rico limit the maximum amount but not the number of weeks during which compensation is payable.

In 19 states and also under the United States acts for compensating injuries to federal civil employees, to longshoremen, and to employees of private employers in the District of Columbia, life benefits are paid for permanent total disability. In the other states the payments are limited as to time, amount, or both. The time periods range from 260 to 700 weeks and the money limitations range from $6,000 to $12,500.

A noticeable feature of many of the workmen's compensation acts in the United States is the schedule of specific benefits payable for an expressed number of weeks covering the loss of certain parts of the body. In the case of temporary partial disability, compensation is based on a fixed percentage of wage loss; the term and amount both weekly and total being limited in most cases. Permanent partial cases are considered either by paying a percentage of the wage loss, or by payments over a fixed period for specified injuries. A number of state laws provide for the payment of compensation in addition to the period of temporary total disability or the healing period, while in other states compensation for permanent partial disability is exclusive, which means that the temporary total benefit payments are subtracted from the amount due for permanent partial disability.

In all the compensation acts medical aid is required to be furnished to injured employees. In 31 states full medical benefits are required to be paid and in 13 of these, Arizona, California, Connecticut, Idaho, Illinois, Massachusetts, Minnesota, Mississippi, Nebraska, New York, North Dakota, Washington and Wisconsin—the statutes specifically provide that medical aid must be furnished without limit as to time or amount. In 18 additional states medical benefits are virtually unlimited because the administrative agency can extend such services indefinitely. However, in 17 states and Alaska, the laws limit the amount or the time of medical treatment and where extensions are authorized, these are restricted to specified periods or amounts or both.

A specific provision regarding the rehabilitation of the injured worker is contained in 20 of the workmen's compensation acts (Arizona, Arkansas, District of Columbia, Florida, Massachusetts, Mississippi, Missouri, New Jersey, New York, North Carolina, North Dakota, Ohio, Oregon, Rhode Island, Utah, West Virginia, Wisconsin, and United States Civil Employees' Act and Longshoremen's Act). In most of these acts the provision pertains to special maintenance and other compensation to facilitate the vocational rehabilitation of the worker. The Arizona law gives the commission broad authority to provide such awards as may be necessary for the promotion of vocational rehabilitation. Under the Wisconsin law, provision is made for the payment of full compensation for a maximum period of 40 weeks during rehabilitation training. In addition, the actual and necessary costs of maintenance and travel are paid for a maximum period of 40 weeks, if the training is elsewhere than at place of residence. For amputees, there is no limit on the number of weeks for which full compensation is paid while training in the use of artificial members. In the other laws providing special maintenance or other compensation for rehabilitation, there is a maximum limit on the amount of compensation or period of weeks or both.

The Rhode Island law establishes a curative center within the Department of Labor to make available to injured workers the full facilities necessary to restore their ability to perform a job. The center is financed by a special fund secured by an assessment on insurance carriers of 1 per cent of the gross premiums received and in the case of self-insurers by an equivalent charge. In addition, a payment of $750 into the fund is required in no-dependency death cases. Rehabilitation centers for workmen's compensation cases have been estbalished also by the Washington State Department of Labor and Industries and by the state fund in Puerto Rico. Oregon and Ohio are planning the establishment of similar centers during 1951.

In addition to any special rehabilitation benefits and services provided under the workmen's compensation law, an injured worker may also be eligible for the services provided by the state-federal program of vocational rehabilitation. This program is operated in all the states, the District of Columbia, Hawaii, and Puerto Rico by the state divisions of vocational rehabilitation. The services rendered include medical care, counsel and guidance in selecting the right job, and training for and placement on the right job. In addition, the medical treatment, transportation, maintenance, occupational tools and equipment, and training supplies are provided without cost where the client's inability to pay has been established.

All of these states except Oregon provide that during a specified period of time immediately following the injury compensation shall not be paid. This waiting time ranges from a minimum of one day to a maximum of 10 days with the majority of the states requiring a 7-day waiting period. This period relates only to compensation. Medical and hospital care is provided immediately regardless of the fact that compensation is not paid for a specified period. Most of the compensation acts provide that if the disability continues for a certain number of weeks the payment of compensation is retroactive to the date of injury.

All of the compensation laws except those of Louisiana, and the United States Civil Employees' Act contain provisions regarding the payment of compensation on account of second injuries. Some of the laws limit the amount to be paid the worker to the usual award that would be paid for an injury of the type last received regardless of his actual disability resulting from the combined injuries. Under more advanced legislation, however, payment is made for the actual disability resulting from the combined injuries but if the cost of such compensation is to be imposed upon the latest employer, handicapped persons may be refused employment. To meet such problems "second-injury funds" have been created so that when a second injury occurs the employer has to pay only for the last injury, yet the employee is compensated for the disability resulting from the combined injuries, the remainder of the award being paid from the fund.

Second injury funds or equivalent arrangements have been established in 42 states. The method of financing these second injury funds differs in the various acts. As a rule the funds are supported by a charge ranging from $300 to $1,500 made against employers when a worker has been killed and leaves no dependents. In 10 states and Alaska the fund is supported in part or entirely by the levy of a small percentage of the award for permanent partial disability, and in 2 states, California and Pennsylvania, by appropriations, and in 9 states by a tax on insurance carriers of a certain percentage of the compensation payments or premiums received.

Industrial accident reports show that many minors are injured in industrial accidents. All of the workmen's compensation laws cover legally employed minors and in 18 of the compensation acts extra compensation is paid in the case of

injury to minors who are illegally employed. Of these 18 jurisdictions which provide compensation in case of injury to illegally employed minors, 13 of them require the payment of double compensation by the employers. In California, Illinois, and Missouri the compensation on account of illegal employment is increased 50 per cent and in Pennsylvania 10 per cent. The Wisconsin law provides that compensation shall be double if a minor of permit age is employed without permit and tripled in case of a minor of permit age or over employed in prohibited work or in any employment for which the commission has ruled that permits shall not be issued, or if a minor under permit age is employed illegally.

None of the workmen's compensation acts make any distinction between resident alien dependents and resident citizen dependents. But as to non-resident alien dependents, the laws vary.

The laws of five states and the United States act relating to civil employees specifically place non-resident alien dependents on the same footing as resident dependents, while the laws of nine other states and that of Puerto Rico contain no provisions regarding non-resident alien dependents.

In more than half of the states and in Alaska and Hawaii, benefits to such dependents are limited to a reduced amount or excluded entirely.

In connection with the limitations on benefits to non-resident alien dependents, it may be noted that this country has treaties with 13 countries mutually guaranteeing non-resident alien workers and dependents of such workers injured within any of its territories the same rights and privileges as are or hereafter may be granted under like conditions to their own nationals. In view of this fact, the laws of several States with discriminatory provisions use the saving clause, "where there is no treaty to the contrary."

In establishing the workmen's compensation system, the principal objective was to provide a simple, convenient, and inexpensive method of settling claims of injured workers. The usual methods of adjudicating workmen's compensation claims are: by direct payments, as in Wisconsin; by the agreement system, as in Pennsylvania; and by the hearing system, as in New York.

In 22 states (Arizona, California, Colorado, Florida, Georgia, Illinois, Kentucky, Maine, Minnesota, Missouri, Montana, Nevada, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, South Dakota, Utah, Vermont, Washington, and Wisconsin), Alaska, Hawaii, and Puerto Rico, the labor department administers or participates in the administration of the state workmen's compensation law. In 17 of the 22 states, the full responsibility for administration is vested in the labor departments while in 5 (Georgia, Illinois, Maine, Montana, and Nevada) the labor departments participate, usually through representation of the labor commissioner on the workmen's compensation board or commission. In three states, Idaho, North Dakota, and Oregon, the law is administered by the agency which also administers the unemployment insurance law. In 18 states, the law is administered by an independent agency. Court administration exists in five states (Alabama, Louisiana, New Mexico, Tennessee, and Wyoming). The federal acts relating to longshoremen, private employment in the District of Columbia, and civil employees of the federal government, are all administered by the Bureau of Employees' Compensation of the United States Department of Labor.

In regard to administration of workmen's compensation laws by the courts, it has been generally recognized that courts are not properly equipped to render the type of service needed for workmen's compensation administration because of many correlated responsibilities involved. The national conferences on labor legislation have repeatedly recommended administration by a commission or board rather than by the courts.

In states where the law is administered by a commission or board, the state agency has exclusive jurisdiction over the determination of facts, with appeals to the courts limited to questions of law. However, in some states the court is permitted to consider the issues anew.

Along with the movement to pay compensation benefits to injured workers, there has developed in the United States a program of accident prevention. To be effective such a program must be developed and directed by state departments of labor with assistance and cooperation from labor unions, management, and other interested groups. The Bureau of Labor Standards of the United States Department of Labor has sponsored such programs for a number of years. As a method of assisting the states, it has aided in the development of safety codes, given technical assistance to the states, conducted accident prevention drives in particular industries, and has prepared inspector training courses for use by the states.

In an intelligent approach to a well-rounded safety movement it is necessary to obtain complete and adequate records of industrial accidents and occupational diseases. Nearly all of the workmen's compensation acts in the United States require the reporting of industrial accidents. Some states require the reporting of those causing disability of one day or more, others where the disability lasts longer than a specified time. Where the agency administering the workmen's compensation law is an integral part of a coordinated labor department, statistics gathered by the workmen's compensation agency with regard to accidents can be used by other agencies in the department in connection with factory inspection and accident prevention work.

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Bureau of Labor Standards, United States Department of Labor.

WORKSHOP TERMS. The following list of terms includes a selected number of the most significant terms and phrases commonly used in workshops by mechanics, machinists and metalworkers, describing briefly the various methods, processes, equipment and operations usually required in the execution of a general line of shopwork, either in wood or metal.

For information relative to similar terms specifically applied to the making and handling of hand machine tools; to the construction of engines and machines, etc., consult articles under the

following title headings: ELECTRICAL TERMS; ENGINE; ENGINEERING TERMS; FOUNDRY AND FORGE SHOP TERMS; LOCOMOTIVE; MECHANICAL TERMS; TOOLS; VALVES; VALVE TERMS.

Abrasive Cutting.—Severing a piece of material from a bar or length with a thin abrasive wheel.

Acumulators.—Pressure tanks for hydraulic or pneumatic systems in which pressure is built up (receiver); also used to prevent line pressure surges.

Adapter.—A unit interposed between parts or pipes of unlike size so they can be used together.

Adjustable-speed Drive.—Power transmission that can be adjusted to any output speed within its over-all range; electrical or mechanical.

Aging.—A process by which properties of metals can change; elevated temperature speeds this change.

Age Hardening.—A method of hardening that also increases strength but decreases ductility. Usually follows rapid cooling or cold working.

Allowance.—(1) A specified difference in size between mating parts; (2) the amount of stock left on a part so that succeeding finishing operations can be accomplished.

Alloying.—The adding of specific quantities of metals or nonmetals to base metals to result in specific physical, mechanical and chemical properties.

Ambient.—Conditions surrounding any particular operation, specifically it refers to temperature.

Annealing.—A process of heating and cooling a metal part to induce softening. Can also be used to alter characteristics of metal.

Anodizing.—Applying oxide coatings to aluminum and magnesium. It offers protection and, by adding dyes, can be decorative.

Arbor.—A temporary or permanent shaft or spindle on which is mounted a rotating tool or rotating workpiece.

Arc Welding.—Joining metal parts by fusion in which heat is supplied by an electric arc between two electrodes or between one electrode and the grounded part.

Ashing.—Method of polishing plastic parts with wet pumice and a cloth wheel.

Atomic Hydrogen Welding.—Arc welding process using two electrodes and a stream of hydrogen gas.

Automatic.—(1) Usually refers to automatic screw or chucking machine; (2) any piece of machinery or equipment that functions without an operator.

Automation.—Indefinite term loosely applied to the automatic operation of a single machine or a line of production machines, which automatically load, operate and unload themselves.

Babbitting.—The process of lining bearings with babbitt or with other of the white metals.

Backing Off.—Reversing direction of a cutting tool at the end of its cut; backing out.

Backlash.—Amount one element of a mechanism moves before transmitting motion to second element, especially with gears.

Balancing.—Process of determining the out-of-balance of rotating parts and the adding of weights or drilling of holes to produce balance.

Band Sawing.—Cutting off or cutting shapes with a machine employing a saw band. For use with wood or metal.

Barrel Finishing.—Mechanical grinding or honing of parts in rotating barrel where parts, abrasive and fluid tumble together.

Beading.—(1) Forming a curl to add strength to sheet metal parts and by spinning; (2) the laying down of weld deposit.

Bench Work.—Work done at the bench as compared to machine tools and on the erecting floor.

Bending.—Forming metal about a straight-line axis rather than a curved axis; usually as part of the stamping process.

Blank.—(1) A piece of metal that has been roughly worked and which will subsequently be finished; (2) a disk used to close off a pipe.

Bleeding.—(1) Removal of unwanted fluids or gases from systems; (2) the working through the surface coat of paint by an undercoat of different color.

Blister.—(1) Unwanted bubble caused by heat or moisture under paint; (2) raised area on surface of metal caused by gases in metal while it is hot and plastic.

Blueing.—(1) Production of blue oxide film on polished steel by heating in contact with saltpeter or wood ash; (2) smearing pigment on surface plate to check workpiece for low spots, which remain uncolored when workpiece is moved across flat.

Blushing.—Cloudy film formed on lacquer by too rapid drying or exposure to moisture.

Boring.—Enlargement of a pre-existing hole in a metal part or forming a hole from the solid in wood.

Boss.—A projection on a machine part (usually a casting) that has been strengthened to hold a pin or shaft, or to provide for a tapped hole to receive a threaded fastener.

Bossing.—Operation of shaping malleable metal (sheet lead) to conform to an irregular surface by tapping with a mallet.

Bottoming.—(1) Act of moving the punch of a press to the bottom of its stroke; (2) undesirably hitting bottom of a blind hole with a tap.

Brake.—(1) Any of a variety of holding devices; (2) a press for bending metal.

Brazing.—Joining metal parts by fusion of an intermediate nonferrous metal that has a melting point above 800° F. but lower than those of the parts to be joined.

Bright Annealing.—Annealing in a controlled furnace atmosphere so part surface remains bright rather than oxidizing.

Briquetting.—Making preforms of metal powders before sintering, or plastic powders before molding.

Broaching.—Internal shaving process to accurately form pre-existing holes; can also be used to finish external surfaces.

Bucking.—Backing up the head of a rivet during riveting.

Buffing.—Polishing with an abrasive rouge on a cloth wheel.

Bulging.—Expanding lower portions of a drawn cup with segmented dies, rubber or fluid pressure.

Burning.—(1) Damage of metal part or tool caused by overheating resulting from improper use, grinding, flame cutting, welding, etc.; (2) cutting parts with an oxygen torch.

Burnishing.—Smearing or friction polishing of a metal surface with a metal tool.

Burring.—(1) Lancing process with punch to form outward projection for receiving bolt or threaded fastener; (2) process of removing sharp burrs left by cutting or stamping tools.

Butt Welding.—Resistance welding where parts butt together at joint.

Calender Rolls.—(1) Rollers used to feed timber into sawing or planing machines; (2) rollers used to form patterns on plastic sheets.

Calorizing.—Rendering iron or steel rust resistant by spraying surface with aluminum and heating to 800-1000° C.

Capstan Lathe.—British variant of turret lathe.

Carbides.—Metal cutting tool material or wear surface material that is extremely hard.

Carbon Arc Welding.—Fusion of parts by heating with an electric arc between a carbon electrode and the workpieces; with or without filler metal.

Carburizing.—Heating steel part in contact with carbonaceous matter to produce a hardened case.

Case Hardening.—(1) Addition of carbon to surface of steel part and subsequent hardening; carburizing, cyaniding, etc.; (2) other hardening methods such as induction heating, nitriding, flame, etc.

Cathead.—Multiple tooling operating as a single unit.

Cemented Carbides.—Tungsten carbide particles held together by cobalt.

Center Drilling.—Drilling holes in workpieces to receive lathe or grinding machine centers.

Center Punching.—Pricking point in workpiece to indicate where hole should be drilled.

Centerless Grinding.—Method of grinding wherein workpiece is supported by the grinding wheel, a feed wheel and a support blade.

Ceramics.—Metallic oxides used as cutting tools, for wear surfaces, for drawing dies, and as grinding wheel grits and bonds.

Chamfer.—Putting a bevel on an otherwise rectangular edge.

Chasing.—Putting threads on external or internal surfaces with a single-point tool; also with a multithread diehead.

Chatter.—Lack of rigidity in a machine tool setup that leads to noise and unsightly marking of the workpiece.

Chipping.—Removing surface defects from semifinished metal products by means of a pneumatic chisel.

Chucking.—Method of holding and rotating a tool or workpiece.

Chucking Machine.—A turning machine in which the work is held in a chuck rather than between centers.

Circular Pitch.—Distance between same points on successive gear teeth measured along the pitch circle.

Circular Saw.—Machine used to make straight or angled cuts in wood or metal.

Clearance.—(1) The amount of space between mating parts as specified on a drawing and; (2) angles on cutting tools that prevent rubbing.

Coining.—Embossing process, to produce shallow configurations, in which metal is constrained against lateral flow by use of confining die.

Cold Drawing.—(1) Producing rod or wire by pulling through die without prior heating; (2) forming cup in die from cold, flat blank.

Cold Heading.—Forming heads on wire and rod by upset forging machine and without heat.
Cold Rolling.—Finish sizing of strip or coil metal without heat.
Cold Working.—Shaping metals at shop temperatures by rolling, pressing, drawing, stamping, spinning, etc.
Collet.—Small work or tool holding chuck.
Collimation.—Alignment of various parts of an optical system, especially in optical tooling setups.
Compression Molding.—The process of flowing thermosetting plastic compounds into a hot mold to form plastic moldings.
Contouring.—Cutting to shape in one, two or three dimensions.
Copying.—Use of a master or templet and control system to guide the cutting tool when duplicating parts.
Counterboring.—Enlarging a hole to some depth below the surface.
Countersinking.—Recessing a hole conically so that a rivet or screw head will lie flush with the surface.
Creep.—Gradual elongation of metal under load; accelerated under elevated temperatures.
Crimping.—The interfolding of two metal edges to form a joint holding the parts together.
Crush Truing.—Use of steel rolls to shape grinding wheels to a wide variety of forms. Roll is forced radially against wheel.
Cupping.—The first draw in a metal forming operation.
Curing.—Term loosely applied to the process of achieving final properties in plastics, rubber, organic finishes, etc.
Curling.—The operation of rolling over the sharp edge of a drawn part.
Cutting Fluid.—Frequently called "coolants," there is question as to whether these fluids, which are applied to cutting operations, result in better work because of a cooling or lubricating effect, or both.
Cyaniding.—Case hardening steel parts by heating them in molten cyanide, causing the part to absorb both carbon and nitrogen. Parts are then usually quenched.
Cylindrical Grinding.—External grinding of a part rotating between centers.
Dado.—Cutting of a wide groove, usually in wood.
Damping.—The reduction of vibration through the use of vibration absorbers such as rubber, cork, springs, etc.
Deburring.—Process of removing sharp burrs left by cutting or stamping operations.
Deep Drawing.—Use of press and dies to form metal parts.
Degreasing.—Removing petroleum soils with solvents prior to finishing operations.
Depositing.—Act of plating, welding or spraying metal onto a metal part.
Descaling.—Removing scale or metallic oxide from surfaces by pickling or by mechanical means.
Die Casting.—Use of permanent metal molds for casting aluminum and zinc parts in large quantities with accurate detail.
Die Sinking.—The process of machining the correct form into a blank die block.
Dimpling.—Forming dimples in sheet metal parts so they can be accurately located during assembly.
Dinking.—Similar operation to blanking but for plastic novelty items. Lower half of dinking die is flat plate or board; upper half is made up of strip tool steel mounted on edge.
Dipping.—Putting parts into vats, one at a time or in batches, to accomplish pickling, galvanizing, cleaning, painting, etc.
Dishing.—Forming metal parts with dish shape for added strength.
Dog.—(1) A device attached to the workpiece by means of which it is rotated; (2) a positive adjustable stop in a mechanism.
Dowelling.—A metal pin fixed in one part fits hole in mating part and assures alignment in metal parts and tools. Wooden pins are used to strengthen glued joints in wood.
Downtime.—The time a machine is inoperative because of failure, tool changing or setting, set up or maintenance.
Drag-out.—Fluid that is removed from a dipping tank by the part being dipped.
Draw Filing.—Pulling file across work at right angles to length of file.
Drawing.—(1) Pulling wire or rod through die to reduce diameter; (2) formation of cup by action of dies; (3) heating and quenching cycle to achieve specific hardness.
Dressing.—Act of sharpening or forming grinding wheels by removing or fracturing abrasive grains.
Drifting.—Aligning holes in two or more pieces by inserting tapered pin.
Drilling.—Act of forming holes from the solid by hand brace or drilling machine.
Driving Fit.—An interference fit in which mating parts must be driven or pressed together.
Drossing.—Process of removing copper from lead.
Dwell.—Any period in which cam followers, linkages, tools, etc. have no motion.
Ear.—A lug or projection on a casting that receives a bolt or other attachment.
Ejector.—A mechanism, spring or pin used to remove the workpiece from a fixture or die.
Elastic Limit.—Maximum stress that a material can stand without permanent deformation after the load has been removed.
Electrical Discharge Machining.—A process of forming holes of any shape in any electrically conducting material.
Electroforming.—Building up a complex shape by deposition of metal on a form in an electroplating bath.
Electrolytic Refining.—Making pure metals by using impure metal as anode of electrolytic cell and depositing a pure cathode.
Electroplating.—Method of using an electrolytic cell to deposit another type of metal onto a base metal part. The plate can be for different characteristics or to improve appearance.
Electrostatic Detearing.—Use of an electrical field to remove excess paint from freshly finished parts.
Electrostatic Painting.—A method whereby the paint is charged and attracted to the oppositely charged metal workpiece.
Embossing.—Producing a shallow configuration on one side of a piece without change to the other side. Done in press dies having no constraint against lateral flow.
Erecting.—Final building of machines from subassemblies and finished parts.
Etching.—Process of revealing structure of metal samples by the preferential attack of reagents.
Extrusion.—Shaping metals or plastics into continuous forms by forcing them through shaped dies.
Facing.—The lathe operation of cutting radial plane surfaces.
Fatigue.—Tendency for a metal to break under cyclic stressing below the value for ultimate tensile strength.
Faying Surface.—That surface of a member in contact with another part to which it is to be joined.
Feather—(1) A key that is permanently fastened to a shaft; (2) act of thinning a part or cutting edge.
Feed.—(1) Rate of advance of cutting tool or workpiece; (2) machanism for achieving this movement.
Feedback.—Control of tool positioning by information fed back automatically by a gage.
Female.—Part designed with recess to receive male part or stud.
Fettling.—Cleaning, trimming and finishing of casting after it is removed from the mold.
Fillet.—Rounded joint between flat surfaces joining each other in an angle.
Filler Rod.—Welding rod used to add metal to joint during welding.
Fin.—A thin projection on a casting or forging.
Finger.—A narrow projection of metal or plastic used to guide working operations.
Finishing.—(1) Taking light machining or grinding passes; (2) painting or other applied surface coats.
Fit.—The kind of contact between mating parts such as: drive, force, pressure, shrink, running, sliding and wringing.
Fixture.—Holds workpiece securely but allows tool to find own path.
Flame Cutting.—Cutting a metal piece by melting a portion out with an oxyacetylene torch.
Flame Hardening.—Hardening a ferrous alloy by heating it above transformation temperature and then allowing it to cool.
Flash.—Molten metal squeezed from a joint during welding, from a metal die; the same in molding of plastic.
Flash Welding.—Resistance welding process in which fusion is obtained over entire weld area at once by heating parts with arc formed between them and then forcing them together.
Flattening.—Achieving flatness in metal sheets by passing them through a series of rolls.
Flocking.—Applying short fibers to metal parts to give them the appearance of plush cloth.
Flux.—Fusible material used in soldering, brazing and welding or oxygen cutting to dissolve and facilitate removal of oxides.
Flycutting.—Cutting large diameter circles or holes with single-point tool that is adjustable radially.
Forming.—(1) Straining metal beyond yield point in press operation to achieve desired shape; (2) use of cutting tool or grinding wheel of shape that mirrors desired shape and achieving desired form simply by feeding tool or wheel into work.
Fog.—Finely divided spray of cutting fluid or lubricant.
Force.—Total load applied to an area measured in pounds.
Free Machining.—Types of metals that can be cut easily.
Freezing.—Solidification of molten metals.

Frosting.—(1) Scraping exposed machine surfaces for ornamental purposes; (2) etched surface.
Full Anneal.—The heating of steel above the critical temperature, followed by a slow, controlled cool.
Fullering.—Caulking a riveted joint to make it pressure tight.
Gage Pressure.—Pressure shown on a gage. The amount that measured pressure is greater than atmospheric pressure. Atmospheric pressure and gage pressure add to equal absolute pressure.
Gaging.—Inspection for size and quality.
Galling.—The mechanism of rapid wear, by removal of particles, between parts exposed to sliding friction.
Galvanizing.—Coating steel or iron with zinc by immersion in a molten bath.
Gear Cluster.—A series of gears integral with or permanently attached to a shaft.
Generation.—The forming of gear teeth where both the cutting tool and the gear blank have regular motions.
Geneva.—Intermittent drive involving a star wheel and a cam.
Gland.—(1) Unit to prevent leakage at a point where a rotating or reciprocating shaft emerges from a housing; (2) sleeve or nut used to compress the packing in a stuffing box.
Glazing.—Filling in of the voids between abrasive grains on a grinding wheel, which reduces grinding action.
Grinding.—Process of removing large or small amounts of material with a rotating abrasive wheel.
Grinding In.—Method of obtaining good seat or seal between mating parts by rotating them in contact and in the presence of an abrasive compound.
Gullet.—Open spaces between the teeth of a saw.
Gumming.—(1) Thickening of lubricants; (2) deepening gullets.
Gun Drilling.—Method and tools used to produce straight, deep holes.
Hammering.—Beating metal sheet into desired shape over a master form.
Hammer Welding.—Welding by heating metals to near melting and then hammering until the joint is firm.
Hand Feed.—Feeding of tool or workpiece manually as contrasted with automatic feeding.
Hard Facing.—Fastening on an insert or depositing hard weld rod onto a soft base metal to improve wear at critical areas.
Hard Plating.—Thick chromium plating on base metal, without copper or nickel flashes, to protect against rust and abrasion.
Hardening.—Process of making metals hard by cooling from above the critical temperature at a rate that prevents formation of undesirable components.
Hardness Testing.—By indenting metal, its hardness can be determined; by measuring bounce of object from metal surface, hardness can be determined. Brinell, Vickers, Knoop, Rockwell, Shore Scleroscope, etc.
Heat Treating.—Thermal treatment of metal to achieve desired properties or characteristics.
Hemming.—Grinding flat surfaces such as cutlery blades.
High-speed Steel.—High-alloy steel used as a tool and which can cut at high speeds when compared with carbon steel.
Hobbing.—(1) Method of cutting gears with rotating, helically toothed cutter; (2) method of forcing a hob into a plain die blank to form a die cavity.
Honing.—An abrasive finishing operation performed on internal surfaces by use of bonded abrasive sticks in special holders.
Hot-short.—Said of metals that are brittle at temperatures usual for hot working. Also called red-short.
Hot Working.—Forming, rolling, upsetting, etc., operations performed at an elevated temperature. Lower temperature limit for this process is the recrystallization temperature.
Hunting.—Automatic mechanism trying to achieve correct speed but overcontrolled.
Hydraulic.—The use of fluid as the force-transmitting medium in a mechanism or system.
Impact Extrusion.—Cold forming process in which the metal is forced by impact to flow around the punch to form a tube with a bottom.
Indexing.—Method of moving work under successive tools; moving tools in succession to operate on workpiece.
Induction.—Electrically induced heat used in hardening and heating.
Injection Molding.—Heating of thermoplastic compounds in a cylinder and then forcing them into a cold mold where they set.
Internal Grinding.—Grinding the inside surfaces of holes.
Ironing.—Operation to increase the depth of previously drawn cups by thinning the side wall.
Jig.—Unit that may or may not hold workpiece but which guides the tool.
Kellering.—Three-dimensional contouring with an end mill; usually in die making.
Keys and Keyways.—Keys are metal parts used to fasten a pulley or a gear to a shaft so they will rotate as part of the shaft without slipping. A keyway is the slot milled or broached in the gear bore and on the shaft to receive the key.
Knurling.—The raised, diagonal pattern formed on cylindrical parts to prevent them from slipping in the hand; the act of forming such a pattern with a suitable tool.
Lamination.—Building up specific thickness or properties of parts with a number of pieces of similar or different materials.
Lancing.—Combined cutting and forming operation in metal to result in a louver.
Lap.—A piece of material charged with abrasive particles, or a flat plate on which lapping can be done with loose abrasive.
Lap Joint.—A riveted, glued or welded joint in which one piece is fastened to overlap another.
Lap Weld.—A welded joint in which the parts overlap.
Lapping.—An abrading process for refining surface finish and geometrical accuracy of flat, cylindrical or spherical surfaces. Loose abrasive is used between the flat or formed cast-iron lap and the work. Relative movement between lap and work is random and follows no set pattern.
Layout.—Transferring blueprint information directly to workpiece prior to machining.
Leveling.—Flattening of plate and sheet by rolling or stretching.
Limit Switching.—Control of machine movements by motions of machine parts.
Limits.—The assigned maximum and minimum dimensions to insure proper fit and function of mating parts.
Loading.—Filling of the voids in a grinding wheel surface by the metal being ground.
Lofting.—The drafting of large parts at full size.
Machining.—Cutting away of the surface of materials with machine tools.
Magnetizing.—Placing a magnetic material in an electrical field to induce residual magnetism in the part.
Male.—A projection that fits into a recess in the mating part.
Mandrel.—(1) A tapered bar that can be driven through a workpiece, mounted between centers and then rotated during the finishing of the part; (2) an articulated unit inserted in tubing to prevent collapse during bending.
Mash Seam Welding.—A seam weld made in a lap joint in which the thickness of the joint is reduced plastically to about the thickness of one of the parts being joined.
Masking.—The blocking off of certain areas to prevent action on them such as in electroplating, electroforming, etching, painting, etc.
Metal Arc Welding.—Arc welding process in which metal electrodes melt and act as filler in the joint.
Metallizing.—Coating metal products for protection or to increase size by melting wire or metal powders and spraying on the base metal.
Milling.—(1) The cutting of metal or plastic parts to shape with rotating multitoothed tools in a milling machine; (2) the grinding with steel balls of pigments, etc.
Mist.—A finely divided spray of lubricant or cutting fluid.
Moh's Hardness.—An arbitrary hardness scale in which diamond is valued at 10 and talc at 1, with other representative materials between. Each material on the list can be scratched by materials with higher numbers.
Mounted Points.—Small bonded abrasive shapes and wheels that are mounted permanently on steel spindles.
Necking.—The reduction in diameter of a turned piece adjacent to a shoulder so that turning tools will not hit the shoulder or so threads can be run off without hitting the shoulder.
Nibbling.—Removing metal to rough shape by use of a punch that moves rapidly up and down.
Nicking.—The cutting of a shallow groove around a pipe or rod, or across a plate so that it can be broken easily.
Nitriding.—Process of case hardening alloys by absorption of nitrogen to form hard, wear-resistant nitride.
Normalizing.—Heating steel parts of heavy section to about 100° F. over the critical temperature and allowing to cool in still air to relieve stresses induced by coldworking or machining.
Notching.—Cutting straight or curved notches in the edges of sheet material with discontinuous punches.
Nut Running.—The tightening of nuts with power tools.
Offhand Grinding.—Freehand grinding in which the workpiece is held by hand rather than mechanically.
Operations Research.—Use of a team of scientists, mathematicians and engineers to determine the optimum methods of production for a specific product in a specific plant.
Oxygen Cutting.—A group of cutting processes wherein cutting is effected by the chemical reaction of oxygen with the base metal at elevated temperature.
Pack Hardening.—Case hardening by carburizing.
Parting.—(1) Separating the blank from the stock in stamping; (2) separating the finished part from the raw rod on a screw machine or lathe.

Pass.—A single trip of the cutting tool or a welding head across the work.

Peening.—(1) Hammering or riveting with a hammer having a hemispherical head; (2) surface hardening of metals by action of shot hurled at the surface.

Percussive Welding.—Resistance welding in which a heavy current is momentarily discharged across electrodes and heavy force is momentarily applied simultaneously.

Perforating.—Multiple piercing operation for stamping regular or irregular holes in coil or sheet stock.

Pickling.—Removal of scale oxide, tarnish, etc., from metals by immersion in an acid bath.

Piercing.—Hole cutting with punches in the stamping press.

Pilot.—Any part or unit that leads the way, such as in counterboring and valve operation.

Planing.—Process of producing flat surfaces on workpieces as the work, mounted on a moving table, passes underneath a fixed tool.

Planishing.—Smoothing and polishing of metal surfaces by hammering or rolling instead of cutting or abrasion.

Plating.—Applying metallic coatings on workpieces by deposition in an electrolytic cell.

Play.—Freedom of movement between moving parts.

Plunge Cutting.—Operation of completely forming a shape in workpiece by forcing a formed tool or grinding wheel into it.

Pneumatic.—The use of air as the force-transmitting medium in a mechanism or system.

Polishing.—Finishing operation with fine abrasive yielding lustrous surface.

Polymerization.—Hardening of fluid plastics through addition of other chemicals and catalysts to promote chemical reaction.

Precipitation Hardening.—Altering metal properties by reheating to precipitate certain constituents.

Preheating.—(1) Heating a part before further heating or before working on it; (2) heating the tooling that will be used in hot working.

Press Fit.—A class of fit between parts whereby they can be joined only by pressure.

Pressure.—Force per unit of area, usually pounds per square inch (psi).

Pressure Welding.—Any welding process in which pressure is used to complete the weld.

Preventive Maintenance.—Planned maintenance on machines and mechanisms to keep them operating economically; done before failure.

Profiling.—Making die impressions on milling machine with cutting tool controlled by tracer in contact with a master.

Programming.—Setting up punched tape or cards, or magnetic tape to automatically control production machines for the best production process.

Projection Welding.—A resistance welding process in which fusion occurs at predetermined points where projections have been designed as part of one workpiece.

Prototype.—Model in full size used to test various methods of production. Production process is set up in terms of experience gained in making the prototype.

Punching.—Cutting of holes from strip or sheet stock by a punch in a press.

Quality Control.—Through planned production and inspection, and with the use of statistical methods, product quality level is set and maintained.

Quenching.—Rapid cooling from an elevated temperature by contact with liquids, gases or solids; a step in heat treating.

Rack.—Straight gear (infinite radius) used with pinion in mechanisms to change rotary movement to linear movement.

Reaming.—Finishing a drilled hole to size with a longitudinal or spiral-fluted rotating tool.

Recrystallization Temperature.—That temperature at which recrystallization occurs. Hot working or annealing after cold working results in recrystallization. Grain size is reduced but if heating is prolonged, grain coarsening may occur.

Reddle.—Mixture of red lead and oil which is wiped over one of two surfaces that are to be matched to indicate the high spots to be removed by scraping.

Reducing.—(1) Drawing operation in which part of previously drawn container is reduced in diameter; (2) carburizing effect of flame rich in acetylene gas.

Reheating.—Heating in a furnace to prepare metal part for hot working.

Relief.—The amount one plane surface of a piece is set at an angle, above or below another to provide clearance; all cutting tools have relief of some sort.

Resistance Welding.—Pressure welding in which heat of fusion is produced by current through the contact resistance between the surfaces to be welded.

Riveting.—The fastening together of parts through the use of rivets.

Roll Forming.—The use of shaped rolls to form metal into intermediate or final form.

Roll Threading.—Applying external thread by rotating piece between circular, grooved dies.

Roll Welding.—Forge welding process in which fusion is produced by furnace heating and application of pressure by rolls.

Roughing.—Initial cuts taken by grinding wheels or cutting tools to remove large amounts of material but without regard to finish.

Routing.—Formation of grooves in wood with rotating tool usually having two longitudinal cutting edges.

Runout.—The amount by which the outside of a rotating, circular part is untrue.

Sand Blasting.—(1) Cleaning castings and previously heated metal parts with streams of sharp, clean sand; (2) polishing with any of a number of types of materials, from peanut shells to shaped metal slugs.

Sawing.—Use of hack, circular, band and contour-cutting machine saws.

Scale.—An oxide of iron that forms on the surface of hot steel.

Scalping.—Machining the surface layers from ingots, billets and slabs before fabrication.

Scarfing.—(1) Cutting surface defects from pieces of steel with a gas torch; (2) beveling of plate edges prior to welding.

Scribing.—Laying out dimensions on pieces of metal, specifically scratching straight lines with a carbide-tipped scribe.

Seam Welding.—Resistance welding process in which two current-carrying rolls force sheet metal together and weld a seam.

Seaming.—Joining the ends of sheet metal parts to form a lock joint.

Secondary Operations.—Machining operations that take place after casting, blanking, forging, etc.

Seizing.—The condition when overheated parts become locked.

Selective Fitting.—Gaging parts so that those which fit best will be used together; parts are not interchangeable.

Sensitive Drilling.—Special equipment used to drill the smallest holes.

Serrating.—Act of cutting longitudinal grooves in cylindrical parts so that when joined there can be no relative rotation between them.

Shaping.—Producing flat surfaces through use of machine tool in which the workpiece remains stationary while the tool moves across it.

Shaving.—(1) Secondary press operation for increasing the accuracy of first-operation press parts; (2) secondary operation on gear cutting to increase accuracy of tooth form and result in added smoothness.

Shearing.—Separating a part from bulk stock by use of a shear. Operation is similar to parting except that no scrap is produced by a shearing cut.

Shell.—An article formed by deep drawing.

Sherardizing.—Galvanizing with zinc using a dry heating process and zinc powder.

Shielded Metal Arc Welding.—An arc welding process with heat furnished by an arc between a covered electrode and the work. Shielding from the atmosphere is obtained through decomposition of the electrode covering. Pressure can be used and filler metal comes from the metal electrode.

Shimming.—Accurately positioning parts in an assembly by introducing thin sheets of material between them.

Shop Air.—Air at pressures normally available from shop compressed air supplies.

Shot Blasting.—Directing streams of shot, sand and other materials at workpieces to clean, polish or alter their surfaces.

Shot Peening.—Specifically the process of using a stream of steel shot to toughen the surface of a metal part by cold working.

Shrink Fitting.—The process of expanding a cylindrical part through the application of heat so that it can go over a mating part. When the enfolding part cools, shrinkage produces an inseparable joint.

Silver Soldering.—A hard soldering process which is more like brazing than soldering because of the high melting point of the solder.

Sine Bar.—Used in conjunction with gage blocks, the sine bar sets angles very accurately.

Sintering.—A heating of powders in a furnace to fuse them together. This can be done with or without pressure and need not be at a temperature as high as the melting point of any of the powders.

Sizing.—A cold-forging operation used to produce the desired size of a forging or sheet metal assembly by squeezing it between constraining punch and die elements. The assembly is thoroughly stressed and retains the desired shape because of permanent set.

Slicing.—A dicing operation in which materials are sawed by a thin abrasive disk.

Slitting.—(1) Cutting process in die without final removal of the cut piece; (2) cutting wide coil stock into narrow strips.

Slotting.—The cutting of slots with a vertical shaper.

Snagging.—Removal of gates, fins and sprues from castings by grinding.

Soaking.—Heating a metal part in a furnace for a sufficient length of time so that the temperature throughout is the same.

Soldering.—Joining metal parts by fusion of an intermediate nonferrous metal that has a melting point below 600° F. and below those of the parts to be joined.

Solution Heat Treatment.—A process in which an alloy is heated in order to take the hardening constituent into solution. A quenching step retains the constituent in solution. The alloy is then age-hardened at atmospheric or elevated temperature.

Spalling.—The cracking and flaking of metal particles from a surface, frequently occurring in overloaded or improperly designed bearings.

Spheroidizing.—Any process of heating and cooling that produces a rounded or globular form of carbide in steel.

Spinning.—The forming of flat metal sheets to conform to wooden blocks mounted on a spinning lathe. The form must be one of revolution.

Splining.—The cutting of equally spaced longitudinal grooves in a shaft and in its mating gear so there can be no relative rotation between them when they are joined. Splining can also be done by rolling.

Spot Facing.—Finishing a round spot on a rough surface, usually around a hole, to give a good seat for a screw or bolt head.

Spot Welding.—A resistance welding process in which heat is generated by resistance to current flow through metal sheets between opposite electrodes.

Spotting.—Turning a small width on a bar or forging to form a journal by which the piece is supported in a steadyrest.

Spray Painting.—The application of finishing coats by atomizing and carrying the material with air.

Stabilizing.—Thermal treatment to precipitate material from solid solution to improve workability, decrease age-hardening or obtain dimensional stability at slightly elevated temperature.

Staking.—A press operation used for assembly of parts by displacing the metal around a hole so it firmly grips a projection of the mating part, which is in the hole.

Stamping.—(1) A shallow forming operation involving no substantial change in thickness; (2) now describes all press operations on metal sheet.

Standards.—Government, military, American Standards Association and company specifications for design and production procedures.

Steadyrests.—Supports for pieces of small diameter and long length being turned or ground between centers.

Steam Cleaning.—Process of using live steam to clean smut, soil, oil, grease, etc. from workpieces before finishing.

Stock.—Raw material, especially coil stock, bar stock and die stock.

Stop.—Machine part that can be adjusted to cause another part to cease moving at a particular point.

Straightening.—A step sometimes required to remove the warp left by heat treating.

Strain Ageing.—An increase in strength and hardness that proceeds with time but which can be speeded by heating.

Strain Hardening.—Increase in resistance to deformation and increased hardening caused by deformation below the recrystallization temperature.

Stress Raisers.—Sharp corners, grooves, reductions in area where stress can be increased under load and which can lead to fracture.

Stress Relieving.—Heating procedure for relieving the stresses induced in metal by casting, machining, welding, cold working, etc.

Stretch Drawing.—Press operation of forming large-area parts so that wrinkles do not form.

Stretch Flattening.—Applying tension to ends of a sheet and elongating it a small amount to remove bow and warpage.

Stretch Forming.—With tension on a sheet or strip, it is wrapped over a die to result in the desired shape.

Stretch Straightening.—Similar to stretch flattening except rod, tubing and shapes are straightened.

Stud Welding.—An arc welding process in which an arc is drawn between the stud and the workpiece. At the proper instant, the stud is plunged into the workpiece and fuses with it.

Submerged Arc Welding.—Fusion is produced by heat of an arc between a consumable electrode and the part, which are submerged in a blanket of granular, fusible material.

Superfinishing.—A process similar to honing in which shaped abrasive blocks oscillate as the external surface of the cylindrical part rotates underneath them.

Surface Grinding.—Grinding plane surfaces with a grinding machine.

Surface Plate.—A granite or stabilized cast iron plate finished to a high degree of flatness on which flatness of parts can be determined, and with which accurate vertical measurements can be made with a height gage.

Swaging.—(1) A relatively thick blank is squeezed in compression between a punch and die causing the metal to flow outward through the diminished orifice between the two; (2) rotary swaging consists of hammering bar, rod, wire or tubing into round cross sections without appreciably decreasing the original amount or volume of the work.

Swarf.—Metal chips and turnings.

Sweating.—Soldering pieces together by tinning each, then heating them with pressure applied.

Swing Frame Grinding.—Grinding with a grinder suspended from a chain at its center so that it may be turned and used in any direction.

Tack Welding.—Small welds made to hold parts together in proper alignment until final weld is made.

Taking-up.—A general term signifying the making of adjustments to compensate for wear.

Tapering.—Gradual, smooth reduction in diameter along a workpiece.

Tapping.—The internal threading of parts.

Tempering.—Reheating of a hardened steel part at any temperature below the critical to decrease the hardness.

Tenth.—A shop abbreviation for one ten-thousandth inch, 0.0001 inch or 1/10000 inch.

Thermal Stresses.—Stresses in metal resulting from nonuniform distribution of temperature, regardless of the source of heat.

Thermit Welding.—Welding of steel objects by running molten iron into the space between them. Metal is produced by igniting a mixture of iron oxide and finely divided aluminum powder.

Thermoplastic.—Plastic material that will soften each time it is heated.

Thermosetting.—Plastic material that cannot be resoftened once it has been set by heating.

Thou.—Abbreviation for one thousandth of an inch, 0.001 inch, 1/1000 inch.

Threading.—Forming threads on outside of cylindrical part.

Tinning.—Preparation of soldering iron and/or parts by flowing on solder and flux.

Tolerance.—Allowable variation in size of a single part.

Tooling.—Machine tools, the cutting tools used in them, presses, grinders, jigs, fixtures, etc. used in the production of products.

Tooth.—(1) A single cutting point on a multi-cutting-point tool; (2) the rough character of a surface which provides a bond for paint.

Torquing.—Applying specified torque to a nut to achieve correct tightness; usually with hand torque wrench but now with machines having torque limiting clutches.

Trammel.—Method for generating an ellipse.

Transfer Machine.—Conveying equipment built into or between machine operations to transfer parts in process.

Transfer Molding.—Thermosetting compounds are preheated in a chamber then ejected into the mold when plastic.

Trepanning.—Method of producing holes from the solid. A core of metal is left uncut, which reduces time and power necessary for the cut. Can be used only with through holes.

Trial and Error.—Arriving at correct solutions to production problems by attempting logical methods and then improving on them.

Trimming.—Cutting off excess stock after forming or blanking operations.

Truing.—Dressing a grinding wheel for sharpness or conformance with the desired shape.

Tube Drawing.—Production of seamless tube by drawing a roughly formed tubular piece through progressively smaller dies.

Tumbling.—Cleaning, smoothing or polishing castings or forgings in a rotating barrel by friction with each other and any of a variety of tumbling media.

Turning.—Cutting diameters of cylindrical parts on a lathe.

Turret Lathe.—A lathe in which tools for successive operations are mounted in a turret, which rotates to present one tool at a time to the workpiece.

Ultrasonics.—Sound vibrations, used for cleaning and machining (inaudible to the human ear as contrasted with "supersonic," which means faster than the speed of sound).

Upset Welding.—A resistance welding process in which fusion is achieved simultaneously over the entire abutting area or progressively along a joint. Pressure is applied before heating and maintained throughout the heating period.

Upsetting.—(1) A metal working operation similar to forging; (2) the axial flow of metal under axial compression as in forming heads on rivets by flattening the end of the wire. It can be done uniformly or locally, depending on how heat is applied.

Vacuum Metallizing.—Process for coating plastic parts with metals under vacuum.

Vapor Degreasing.—Removing soils from metal parts in a cleaning machine in which the solvent and its vapors act on the soil.

Vernier.—A small auxiliary scale that enables accurate readings, usually to 1/10 graduation of the main scale.
Welding.—The joining of metals by raising part temperatures to induce fusion, with or without pressure, and with or without filler metal.
Wire Drawing.—(1) Reduction in diameter of wire resulting from drawing it through dies; (2) fall in pressure when a fluid is throttled by passing it through a small orifice or restricted valve opening.
Work Hardening.—Action of hardening produced by deformation of a part, most pronounced when done at ambient temperature.

WORKSOP, wûrk'sŭp, municipal borough, England, in Nottinghamshire, on the Ryton River, 15 miles east-southeast of Sheffield. It lies near the northern extremity of Sherwood Forest. Its parish church, dating from 1103, was an ancient Norman abbey church. Worksop has metal foundries, glassworks, and chemical works, and is in a coal mining area. Pop. (1951) 28,886.

WORLD, the globe or planet on which we live. The word is also used to designate any celestial orb considered as the scene of interests analogous to those of mankind; the present state of existence; the enjoyment and cares of the present life; the customs and practices of men; people in general; mankind, or some particular section of mankind; a large and more or less definite division of the globe, as the New World; the whole human race; the ungodly as contrasted with the self-styled "children of light"; a great number or quantity, very much or a great deal, as a "world of good." See also EARTH.

WORLD BANK. See BANKS AND FINANCE —*18. International Bank for Reconstruction and Development.*

WORLD COURT. See PERMANENT COURT OF INTERNATIONAL JUSTICE (League of Nations); INTERNATIONAL COURT OF JUSTICE.

WORLD ECONOMIC, POLITICAL, AND SOCIAL DEVELOPMENTS IN THE 20TH CENTURY. At mid-century the historian of world developments in the 20th century must record what looks like a paradox. In those fields of activity most usually measured by statistics, that is, material growth of all kinds, the optimistic hopes of late 19th century publicists of progress are fully confirmed: the lines on the charts move right on upward. But in matters of the spirit, less easily measured by statistics, it is at least quite clear that among contemporary publicists in the free Western World doubts about progress, and even a kind of fundamental pessimism about human capacity to solve such major problems as war, crime, divorce, race tension, and the like, are extremely common. No one in the mid-20th century is likely to entitle a survey of our century, as F. S. Marvin did his survey of the 19th century, *The Century of Hope.* By a final paradox, the most remarkable material achievement of our time, the splitting of the atom, has driven some publicists to a doctrine of despair not really paralleled by apocalyptic religious doctrines of doom in the past, that is, the belief that man himself, without supernatural intervention, is capable of destroying his whole species, perhaps even all life on this planet.

ECONOMIC DEVELOPMENTS

So much has been written by these prophets of doom that many educated people are not fully aware of the degree to which the 20th century so far has made material progress. The world wars and a great world depression have not, in fact, turned most of the charts permanently downward. In the simplest, and in some ways most satisfactory of measures, the total population (q.v.) of the world, the figures are decisive. The population of the world in 1900 had reached about one and six-tenths billions; in 1950, it had just about turned the two and one-half billion mark, an average gain of over one per cent each year, a net gain of almost a billion human beings. Moreover, the span of individual life has been greatly increased, from about 50 to about 70 years in the most advanced Western countries; even in backward countries like India there has been a lessening of infantile mortality and of communicable disease, so that the life span has been increased. Indeed, the increase in population in Asian and African lands has been so great, thanks to technological improvements in medicine, sanitation, communication, food production, and government administration that publicists have begun to worry—not without reason—as to whether the world's food supply can keep up with the increasing population.

The reader can substantiate further this material progress in the 20th century in almost any article of this encyclopedia dealing with such matters as industrial production, output of energy, real incomes per capita, number of telephones or automobiles, gross national product, literacy and the like, and, furthermore, with such matters in almost any national or regional entity around the globe. The point attained in 1950 would, of course, be very different in different parts of the world, but in few or no nations would the statistics show actual material retrogression as compared with the year 1900. Such decay as appeared would be strictly local, as, for example, the decline of New England textile towns, the depopulation of certain rural *départements* in south central France, the exhaustion of a given mining deposit almost anywhere. Were so firm a believer in progress as Herbert Spencer, who died in 1903, to be permitted to return to life and do no more than look at the surface of our world in 1950, he would surely feel his hopes justified. A glance at New York, an Iowa farm, Kyoto, New Delhi, Paris, even the Kremlin, would, if he could be kept from noticing in his brief glance the increased importance of the military, confirm his hopes for an industrial society.

The State and the Economy.—It would not do to let Spencer stay too long, or, above all, to let this author of *The Man versus The State* learn what the contemporary state really is and does. In a rapid survey of economic, political, and social developments throughout the world in this crowded half-century, a good start can be made in the greatly increased role of the state in almost all forms of human activity, but notably the economic. In Russia, China, and the satellite nations of eastern Europe, the state is at least in theory socialistic; there are no private capitalists, no private businessmen, no private property of the sort we Westerners understand by "personal estate" transmissible by will. In actual practice there are apparently small traders in these countries. The peasants, especially in China and the satellite states, have had to be conceded some chance to work holdings on their own, and, above all, there are signs that in Russia, the oldest of these socialistic societies, privileged classes of administrators, managers, and intellec-

tuals are acquiring bank accounts, bonds, and other forms of "property," or at least status which they can pass on to their children. Still, there can be no doubt that the basic economic policy decisions in these countries are made by servants of the state, not by private businessmen or managers, and that ownership of the great productive economic forces, both industrial and agricultural, is in the hands of the state.

Judged by such economic indices as real income per capita, gross national product, and the like, these socialist states are clearly below the advanced countries of the West. But if such indices in these socialist countries in the 1950's are compared with the same indices for the same countries in 1900 it is clear that they are now richer than they were. Just how much richer, the notorious unreliability of statistics from behind the Iron Curtain prevents us from knowing. So far in the 20th century, experience has shown that capitalist economies are more productive—in purely economic terms—than socialist economies; but experience has also shown that socialist economies can survive if their governments survive.

In the Western countries the first 50 years of the 20th century have seen what to economic conservatives seems at least a dangerous approach to socialism (q.v.): that is, they have seen increased governmental regulation of industry, increased governmental control, subsidies, monetary manipulation, and many other examples of governmental intervention. In England after the victory of the Labour Party in the general election of 1945, the railways, road transport, coal, electricity, and steel were nationalized—that is, taken over from private owners, who were compensated at a fair current value, put under direct governmental ownership, and administered as public corporations. Even the victory of the Conservative Party in 1951 resulted in no more than withdrawal from the still incomplete nationalization of the steel industry. The major nationalizations of the Labour Party have been maintained by the Conservatives. Social insurance, begun in Britain early in the 20th century, was in 1948 extended into national health insurance, so that in addition to compulsory insurance against unemployment, industrial accidents, and old age, Britishers are now so insured against sickness. The scheme involves the creation of a National Health Service under which most of the medical profession is essentially under governmental control.

In France there was, especially after the creation of the Fourth Republic following the liberation of 1944, a series of extensions of government intervention in economic life which left France at mid-century far from a laissez-faire economy. The railroads and the electrical industry were nationalized. Social security measures were strengthened, and notably generous family allowances were extended to encourage larger families. Almost everywhere in western Europe the state has taken similar steps, if not such extensive ones. Indeed in Sweden many of these partially socialistic compromise measures were taken even before World War II, and Sweden was known in the 1930's for its "middle way" between capitalism and socialism.

The United States had in 1900 a post office, which is in a sense a socialist institution, and it had long intervened in economic life through the tariff. Still, the United States had at the beginning of the 20th century an economy relatively close to the classical laissez-faire ideal. By the mid-century the United States, especially during the administrations of Woodrow Wilson and Franklin Roosevelt, had departed a long way from this classic ideal. Two wars left a heritage of price controls and the like, and accustomed the public to a much stronger federal government. The Wilson administration, even before United States entry into World War I, set up the Federal Reserve System, by no means a form of nationalized banking, but still involving a strong degree of federal control of the banking system; formed a Federal Trade Commission; established an eight-hour day on interstate railways; and began active governmental aid to farmers through a Federal Farm Loan Act. Under Franklin Roosevelt, and impelled by the world-wide depression that began in 1929, the United States, the last of the great Western states to do so, established its own system of compulsory social insurance. The Roosevelt New Deal was, in fact, a long series of measures which, though they did not nationalize, extended governmental controls to almost the whole range of economic activity. It should be noted that just as the victorious Conservatives in Great Britain in 1951 accepted the increased power of the state in economic life created by the Labour Party, so too in the United States the victorious Republicans of 1952 accepted most of the work of the Democrats in previous administrations. See also STATE CONTROL, GROWTH OF.

Industrial Organization and Techniques. —The state all over the world has been able to take over, or at least regulate, industry more easily because so many individual industries have grown big. Large-scale political organizations and large-scale economic organizations have grown up together in the 20th century, each influencing and indeed making possible the other. This factor of size holds for both the democratic world and the totalitarian world, and especially for the leader of each world, the United States and the Soviet Union.

Throughout most of the free world at least, this growth of large-scale economic enterprise has by no means wholly eliminated the small family or individual enterprise in commerce, industry, and above all, in agriculture. Prophetic writers, gloomily or cheerfully according to their temperaments, have predicted an economy composed wholly of large-scale enterprises; with, for instance, all retail outlets in the form of chain stores, all farms giant farms, all factories huge assembly-line factories. So far, the 20th century has not seen any such radical process. Big enterprise is on the increase *relative* to small and middling enterprise; but the latter are increasing *absolutely* as population and wealth increase.

Large-scale enterprises of all sorts are made possible by another inheritance from the last three centuries which the 20th so far has continued to develop: that is, the fruitful collaboration of pure scientists, applied scientists, engineers, and managers in technological advance. This advance was by no means limited to such obvious and spectacular achievements as the internal-combustion engine, the airplane, radio, and atomic power. It included less conspicuous but equally important social inventions such as the assembly-line technique, a whole range of business machines from mimeograph to calculating machines without which large-scale enterprise would be impossible, right on down to such an

WORLD

Aden Prot., 650,000....S 5
Afghanistan, 12,000,000....T 4
Africa, 190,000,000....R 5
Albania, 1,112,355....R 3
Aleutian Islands, 5,600....F 3
Algeria, 8,681,785....P 4
Amazon River....L 6
Amsterdam Island....T 7
Amur River....C 3
Anglo-Egyptian Sudan, (Sudan), 8,309,663....R 5
Angola, 4,094,000....P 6
Antipodes Islands....F 8
Arabia, 10,700,000....S 4
Arabian Sea....T 5
Arctic Ocean....E 1
Argentina, 16,108,573....L 7
Ascension Island, 159....O 6
Asia, 1,301,000,000....B 3
Atlantic Ocean....M 4
Auckland Islands....D 8
Australia, 7,579,358....C 7
Austria, 6,918,959....P 3
Azores, 287,091....N 4
Baffin Bay....L 2
Baffin Island....L 2
Bahama Islands, 79,000....L 4
Baltic Sea....P 3
Banks Island....H 2
Barents Sea....R 2
Beaufort Sea....H 2
Belgian Congo, 11,121,463....R 6
Belgium, 8,512,195....P 3
Bengal, Bay of....U 5
Bering Sea....E 3
Bermuda, 37,000....L 4
Biscay, Bay of....O 3
Bismarck Archipelago, 145,000....D 6
Black Sea....R 3
Bolivia, 3,019,031....L 6
Bonin Islands, 76....D 4
Bothnia, Gulf of....R 2
Bouvet Island....P 8
Brazil, 52,645,479....M 6
British Guiana, 375,701....M 5
British Somaliland, 700,000....S 5
Bulgaria, 7,022,206....R 3
Burma, 18,489,000....A 4
Cambodia, 4,073,967....B 5
Cameroons (*Br.*), 1,027,100..P 5
Cameroun (*Fr.*), 3,065,800....P 5
Campbell Island....D 8
Canada, 14,009,429....K 3
Canal Zone (*U. S.*), 52,822...L 5
Canary Islands, 776,912....N 4
Cape Verde Islands, 147,328....N 5
Caribbean Sea....L 5
Caroline Islands, 36,980....D 5
Caspian Sea....S 3
Celebes, 5,500,000....C 6
Central America, 8,918,547...K 5
Ceylon, 6,657,339....U 5
Chagos Archipelago, 1,048....T 6
Chatham Islands, 505....F 8
Chile, 5,809,000....L 7
China, 461,006,285....B 4
Christmas Island, 866....G 5
Cocos Islands, 1,814....A 6
Colombia, 11,260,000....L 5
Congo River....R 5
Cook Islands, 14,088....G 7
Coral Sea....D 6
Costa Rica, 800,875....K 5
Crozet Is....S 8
Cuba, 5,348,000....K 4
Czechoslovakia, 12,090,164....P 3
Davis Strait....M 2
Denmark, 4,279,151....P 3
Denmark, Strait of....N 2
Dominican Republic, 2,121,083....L 5
Dutch Guiana (Surinam), 219,000....M 5
East China Sea....C 4
East India (Malay) Archipelago....B 5
Easter Island, 563....J 7
Ecuador, 3,076,933....L 6
Egypt, 19,087,304....R 4
Ellice Islands, 4,487....F 6
Eritrea, 1,086,000....R 5
Ethiopia, 10,000,000....S 5
Europe, 551,000,000....R 3
Falkland Islands, 2,239....M 8
Fanning Island, 259....G 5
Federation of Rhodesia and Nyasaland, 6,043,000..R 6
Fiji Islands, 259,638....E 6
Finland, 4,028,910....R 2
Formosa (Taiwan), 6,126,000....C 4
France, 40,502,513....P 3
Franz Josef Land....S 1
French Equatorial Africa, 4,168,910....P 5
French Guiana, 25,499....M 5
French West Africa, 16,377,000....O 5
Galápagos Islands, 1,346....K 6
Germany, 68,216,579....P 3
Gibraltar, 23,232....O 4
Gilbert Islands, 27,824....E 6
Gold Coast, 3,735,682....O 5
Gough Island....O 8
Great Britain and Northern Ireland, 50,210,472....O 3
Greece, 7,856,000....R 4
Greenland, 21,412....M 2
Guam, 59,498....D 5
Guatemala, 2,787,030....K 5
Guinea, Gulf of....P 5
Haiti, 3,111,973....L 5
Hawaii, 499,794....F 4
Heard Island....T 8
Honduras, 1,505,465....K 5
Hong Kong, 1,857,000....B 4
Hudson Bay....K 2
Hungary, 9,204,799....P 3
Hwang River....B 4
Iceland, 144,263....O 2
India, 356,891,624....T 4
Indian Ocean....T 6
Indonesia, 79,260,000....C 6
Iran (Persia), 19,000,000....S 4
Iraq, 4,799,500....S 4
Ireland, 2,958,878....O 3
Israel, 1,554,000....R 4
Italy, 47,020,536....P 3
Jamaica, 1,237,391....K 5
Japan, 83,199,637....D 4
Japan Sea....C 3
Java, 52,000,000....B 6
Jordan, 1,250,000....R 4
Kamchatka Pen....D 3
Kara Sea....T 2
Kenya, 5,377,393....R 5
Kerguelen Islands....T 8
Kermadec Islands, 23....F 7
Korea, 29,291,000....C 4
Kuril Islands, 15,000....D 3
Laccadive Islands, 18,393....T 5
Laosi, 200,000....B 4
Laptevykh Sea....C 2
Lebanon, 1,165,208....R 4
Lena River....C 2
Liberia, 1,600,000....O 5
Libya, 1,100,000....P 4
Lord Howe Island, 179....E 7
Lower California, 278,342....J 4
Mackenzie River....H 2
Macquarie Islands....D 8
Madagascar, 4,294,985....S 7
Madeira Islands, 269,179....N 4
Magellan, Strait of....L 8
Malayan Fed., 4,908,086....B 5
Maldive Islands, 82,068....T 5
Mariana Islands, 6,286....D 5
Marquesas Islands, 2,976....H 6
Marshall Islands, 11,033....E 5
Mauritius, 432,468....T 7
McDonald Island....T 8
Mediterranean Sea....P 4
Mexico, 25,581,250....J 4
Mexico, Gulf of....K 4
Midway Islands, 437....F 4
Mississippi River....K 4
Missouri River....K 3
Mongolian Republic, 2,000,000....B 3
Morocco (*Fr.*), 8,617,387....O 4
Mozambique, 5,730,930....R 6
Mozambique Channel....R 7
Nepal, 6,910,000....U 4
Netherlands, 9,625,499....P 3
New Caledonia, 61,250....E 7
New Guinea, Neth., 1,000,000....D 6
New Hebrides Islands, 48,538....E 6
New Siberian Is....C 2
New Zealand, 1,702,298....E 8
Newfoundland, 361,416....M 3
Nicaragua, 1,053,189....K 5
Niger River....P 5
Nigeria, 24,300,000....P 5
Nile River....R 4
Norfolk Island, 1,231....E 7
North America, 216,400,000..J 3
North Borneo, 331,361....B 5
North East New Guinea, 1,100,023....D 6
North Sea....P 3
Norway, 3,156,950....P 2
Novaya Zemlya, 500....S 2
Ob River....T 2
Okhotsk, Sea of....D 3
Oman, 830,000....S 4
Orange River....R 7
Pacific Ocean....E 4
Pakistan, 75,687,000....A 4, T 4
Palestine....R 4
Palmyra Island, 32....G 5
Panama, 801,290....K 5
Papua Territory, 282,072....D 6
Paraguay, 1,251,517....M 7
Paraná River....M 7
Persia (Iran), 19,000,000....S 4
Persian Gulf....S 4
Peru, 8,405,000....L 6
Philippine Islands, 19,234,182....C 5
Phoenix Islands, 984....F 6
Pitcairn Island, 138....H 7
Plata River....M 7
Poland, 24,976,926....R 3
Portugal, 8,490,455....O 3
Prince Edward Islands....R 8
Puerto Rico, 2,210,703....L 5
Queen Charlotte Islands....H 3
Red Sea....R 4
Réunion, 242,067....S 7
Rhodesia and Nyasaland, Federation of, 6,043,000....R 6
Rumania, 15,872,624....R 3
Saint Helena Island, 4,748....O 6
Saint Paul Island....T 7
Sakhalin Island, 35,400....D 3
Salvador, El, 1,858,656....K 5
Samoa, Am., 18,937....F 6
Samoa, Western (*N.Z. Mand.*), 78,155....F 6
Sarawak, 546,385....B 5
Saudi Arabia, Kingdom of, 5,500,000....S 4
Seychelles, 34,637....T 6
Siam (Thailand), 17,324,581....B 5
Sicily, 4,452,773....P 4
Sierra Leone, 1,858,275....O 5
Society Islands, 29,684....G 6
Solomon Islands, 144,032....E 6
Somaliland, 916,300....S 5
South America, 109,500,000...L 6
South China Sea....B 5
South Georgia, 300....N 8
South Orkney Islands....M 9
South Sandwich Is....N 8
South Shetland Islands....L 9
South West Africa, 350,037....P 7
Spain, 27,909,009....O 4
Spanish West Africa, 113,958....O 4
Sudan, 8,309,663....R 5
Sumatra, 12,000,000....B 6
Surinam (Dutch Guiana), 219,000....M 5
Svalbard (Spitsbergen), 1,539....P 2
Sweden, 7,046,920....P 2
Switzerland, 4,714,992....P 3
Syria, 3,135,000....R 4
Tahiti Island, 29,684....G 6
Taiwan (Formosa), 6,126,000....C 4
Tanganyika Territory, 7,408,096....R 6
Tasman Sea....D 7
Tasmania, 257,078....D 8
Thailand (Siam), 17,324,581....B 5
Timor, 424,132....C 6
Togo (*Br.*), 382,768....O 5
Togo (*Fr.*), 923,000....O 5
Trinidad and Tobago, 557,970....M 5
Tristan da Cunha, 230....N 7
Tuamotu Archipelago, 5,127....H 6
Tunisia, 3,230,952....P 4
Turkey, 20,934,670....R 4
Tutuila Island, 15,556....F 6
Uganda, 4,959,196....R 5
Union of South Africa, 11,418,349....R 7
Union of Soviet Socialist Republics, 191,595,000..B2-S 3
United States, 150,826,004....J 4
Uruguay, 2,353,000....M 7
Vancouver Island, 147,262....H 3
Venezuela, 4,985,716....L 5
Vietnam, 21,928,500....B 5
Volga River....S 3
Wake Island....E 5
West Indies, 27,000,000....L 4
White Sea....R 2
Yangtze River....B 4
Yellow Sea....C 4
Yemen, 3,500,000....S 5
Yenisei River....U 2
Yugoslavia, 15,751,935....P 3
Yukon River....G 2
Zanzibar, 264,162....S 6

THE WORLD

A 100° B 120° C 140° D 160° E 180° F 160° G 140° H 120° J 100°
ARCTIC OCEAN
PACIFIC OCEAN
INDIAN OCEAN
SOUTH PACIFIC OCEAN
UNION OF SOVIET SOCIALIST REPUBLICS
UNITED STATES
CANADA
AUSTRALIA
NEW ZEALAND
CHINA
JAPAN
INDONESIA
MONGOLIAN REP.
Komsomolets I.
SEVERNAYA ZEMLYA (NORTH LAND)
October Revolution I.
Bolshevik I.
NEW SIBERIAN IS.
LAPTEV SEA
EAST SIBERIAN SEA
BEAUFORT SEA
BERING SEA
SEA OF OKHOTSK
ALEUTIAN ISLANDS
Arctic Circle
Tropic of Cancer
Tropic of Capricorn
HAWAIIAN IS.
MARIANA IS.
CAROLINE IS.
MARSHALL IS.
GILBERT IS.
SOLOMON IS.
CORAL SEA
TASMAN SEA
Anadyr
Yakutsk
Magadan
Okhotsk
Khatanga
Verkhoyansk
Bear Is.
Wrangel I.
Barrow
Nome
Fairbanks
Anchorage
Dawson
Yellowknife
Prince Rupert
Edmonton
Saskatoon
Calgary
Vancouver
Regina
Seattle
Portland
San Francisco
Los Angeles
Salt Lake City
Denver
Minneapolis
Chicago
St. Louis
Dallas
Houston
El Paso
Guadalupe
Monterrey
Mexico City
Veracruz
Guadalajara
Revillagigedo Is.
Clipperton I.
Galapagos Is.
Easter I.
Sala y Gomez
Ducie I.
Pitcairn I.
Tuamotu Arch.
Papeete
Tahiti
Cook Is.
Tonga
Fiji
New Hebrides
New Caledonia
Loyalty Is.
Norfolk I.
Lord Howe I.
Kermadec I.
Auckland Is.
Campbell I.
Macquarie I.
Antipodes I.
Bounty Is.
Chatham Is.
North I.
South I.
Wellington
Christchurch
Dunedin
Auckland
Sydney
Melbourne
Canberra
Brisbane
Newcastle
Adelaide
Perth
Fremantle
Albany
Kalgoorlie
Darwin
Townsville
Rockhampton
Onslow
Hobart
Tasmania
Stewart I.
Peiping
Tientsin
Shanghai
Nanking
Hankow
Chungking
Chengtu
Canton
Taipeh
Hong Kong
Kunming
Changsha
Changchun
Harbin
Vladivostok
Khabarovsk
Komsomolsk
Nikolaevsk
Sakhalin Island
Hokkaido
Honshu
Tokyo
Osaka
Nagoya
Yokohama
Kobe
Seoul
Pusan
Ulan Bator
Kerulen
Irkutsk
Chita
Shilka
Amur
Lena
Yana
Indigirka
Kolyma
Khatanga
Taimyr Per.
L. Taimyr
L. Baikal
Yenisei
Krasnoyarsk
Tunguska
Lower Tunguska
Vilyui
Vilyuisk
Aldan
Olekminsk
Upper Tunguska
Tibet
Lhasa
Sinkiang
Gobi Desert
Burma
Rangoon
Thailand
Bangkok
Vietnam
Hanoi
Haiphong
Saigon
Luzon
Manila
Philippines
Republic of the Philippines
Mindanao
Palau Is.
Borneo
Singapore
Sumatra
Java
Celebes
Djakarta
Timor
Arafura Sea
Malaya
Brunei
Sunda Islands
New Guinea
Bismarck Arch.
Guinea
Port Moresby
Darwin
Cocos Is. (Austr.)
Christmas I. (Br.)
Bonin Is. (U.S. Adm.)
Wake I. (U.S.)
Midway Is.
Johnston I. (U.S.)
Palmyra I. (U.S.)
Washington I.
Fanning I. (Br.)
Christmas I. (U.S. & Br.)
Howland I. (U.S.)
Baker I. (U.S.)
Jarvis I. (U.S.)
Phoenix Is. (U.S. & Br.)
Malden I. (U.S. & Br.)
Starbuck I. (U.S. & Br.)
Ellice Is. (Br.)
Rotuma (Br.)
Fiji (Br.)
Tutuila (U.S.)
Samoa (N.Z.)
Tubuai (Australes) (Fr.)
Marquesas Is. (Fr.)
Equator
Territory of the Pacific Islands (U.S. Trust Ter.)
Mackenzie
Yukon
Great Bear L.
Great Slave L.
Athabasca
Melville I.
Banks I.
Victoria I.
Borden I.
Prince Patrick I.
Lands End
Baffin I.
Hudson Bay
Gulf of Alaska
Gulf of Mexico
Gulf of California
Panama Canal
Panama
Colombia
Ecuador
Peru
Chile
Bolivia
Paraguay
Uruguay
Argentina
Brazil
Venezuela
Guyana
Suriname
French Guiana
Trinidad
Jamaica
Cuba
Haiti
Dominican Rep.
Puerto Rico
Virgin Is.
Leeward Is.
Windward Is.
Barbados
Curaçao
Aruba
Bonaire
Netherlands Antilles
Caribbean Sea
Gulf of Mexico
Florida
Georgia
South Carolina
North Carolina
Virginia
Maryland
Delaware
New Jersey
New York
Pennsylvania
Ohio
Indiana
Illinois
Michigan
Wisconsin
Minnesota
Iowa
Missouri
Kansas
Nebraska
South Dakota
North Dakota
Montana
Wyoming
Colorado
New Mexico
Arizona
Utah
Nevada
Idaho
Oregon
Washington
California
Alaska
Hawaii
Greenland
Iceland
Norway
Sweden
Finland
Denmark
United Kingdom
Ireland
France
Spain
Portugal
Belgium
Netherlands
Germany
Poland
Czechoslovakia
Austria
Switzerland
Italy
Hungary
Romania
Bulgaria
Yugoslavia
Albania
Greece
Turkey
Soviet Union
Estonia
Latvia
Lithuania
Byelorussia
Ukraine
Moldavia
Georgia
Armenia
Azerbaijan
Kazakhstan
Uzbekistan
Turkmenistan
Kirgizia
Tadzhikistan
Mongolia
China
Japan
Korea
Taiwan
Vietnam
Laos
Cambodia
Thailand
Burma
India
Pakistan
Afghanistan
Iran
Iraq
Syria
Lebanon
Israel
Jordan
Saudi Arabia
Yemen
Oman
United Arab Emirates
Qatar
Bahrain
Kuwait
Egypt
Libya
Algeria
Tunisia
Morocco
Mauritania
Western Sahara
Senegal
Gambia
Guinea-Bissau
Guinea
Sierra Leone
Liberia
Ivory Coast
Ghana
Togo
Dahomey
Nigeria
Cameroon
Gabon
Congo
Zaire
Angola
Zambia
Rhodesia
Mozambique
Malawi
Tanzania
Kenya
Uganda
Rwanda
Burundi
Ethiopia
Somalia
Sudan
Chad
Niger
Upper Volta
Mali
Botswana
South Africa
Lesotho
Swaziland
Namibia
Madagascar
Mauritius
Réunion
Comoro Is.
Seychelles
Maldive Is.
Sri Lanka
Nepal
Bhutan
Sikkim
Bangladesh
Andaman Is.
Nicobar Is.
Malaysia
Singapore
Brunei
Philippines
Indonesia
Sumatra
Java
Borneo
Celebes
Timor
New Guinea
Australia
New Zealand
Fiji
Tonga
Samoa
Guam
Micronesia
Marshall Is.
Gilbert Is.
Ellice Is.
Solomon Is.
New Hebrides
New Caledonia
Norfolk I.
Lord Howe I.
Kermadec I.
Auckland Is.
Campbell I.
Macquarie I.
Antipodes I.
Bounty Is.
Chatham Is.
Easter I.
Sala y Gomez
Ducie I.
Pitcairn I.
Tuamotu Arch.
Marquesas Is.
Tahiti
Papeete
Cook Is.
Tubuai (Australes)
Tutuila
Samoa
Fiji
Tonga
Rotuma
Norfolk I.
Lord Howe I.
Kermadec I.
Auckland Is.
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Macquarie I.
Antipodes I.
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Adelaide
Perth
Fremantle
Albany
Kalgoorlie
Darwin
Townsville
Rockhampton
Onslow
Hobart
Tasmania
Stewart I.
Antarctic Circle
Longitude East of Greenwich
Longitude West of Greenwich
THE WORLD
MERCATOR PROJECTION
EQUATORIAL SCALES
MILES
0 500 1000 1500 2000 2500
KILOMETRES
0 500 1000 1500 2000 2500
Capitals of Countries.....
Post-war territorial changes shown on this map do not necessarily represent the final status of such boundaries. Only after the signing of the Peace Treaties can changes be considered official and definite.

THE WORLD

K 80° L 60° M 20° O 0° P 20° R 40° S 60° T 80° U
LINCOLN SEA
PEARY LAND
KING FREDERIK VIII LAND
Ellesmere Island
Kane Basin
GREENLAND (Den.)
Thule
Devon I.
Baffin Bay
Lancaster Sd
Upernivik
Baffin Island
Foxe Basin
Disko I.
Godhavn
Davis Strait
Arctic Circle
Scoresby Sd.
FREDERIK VI COAST
KING CHRISTIAN IX LD
Str. of Denmark
Angmagssalik
Southampton
Godthaab
Frederikshaab
Hudson Str.
Julianehaab
HUDSON BAY
Cape Farewell
Hopedale
LABRADOR
Str. of Belle Isle
NEWFOUNDLAND
St. John's
Race
Cape Race
St. Pierre & Miquelon (Fr.)
Moosonee
Quebec
Montreal
Ottawa
Detroit
Cleveland
Boston
Halifax
New York
Philadelphia
Washington
Atlanta
Savannah
Bermuda (Br.)
New Orleans
Miami
Havana
BAHAMA IS. (Br.)
WEST INDIES
DOM. REP.
PUERTO RICO (U.S.)
JAMAICA
HAITI
Hispaniola
LESSER ANTILLES
Caribbean Sea
Curaçao (Neth.)
Trinidad
Caracas
VENEZUELA
Georgetown
Paramaribo
Cayenne
FR. GUIANA
COLOMBIA
Bogotá
Panama
Panama Canal
Quito
ECUADOR
Guayaquil
Equator
Manaus
Belem (Para)
Fortaleza (Ceara)
Natal
Recife (Pernambuco)
Salvador (Bahia)
Rio de Janeiro
São Paulo
Santos
Asunción
Lima
Callao
La Paz
Cuzco
Arica
Iquique
Arequipa
Tacna
Sucre
BOLIVIA
Cuiaba
Belo Horizonte
Antofagasta
Tucumán
Córdoba
Rosario
Coquimbo
S. Ambrosio (Chile)
Valparaiso
Santiago
Talca
Concepción
Valdivia
Pto. Montt
Chonos Arch.
Pto. Alegre
URUGUAY
Montevideo
Rio de la Plata
Buenos Aires
Bahia Blanca
Rawson
Sta. Cruz
FALKLAND IS. (Br.)
Port Stanley
Tierra del Fuego
Punta Arenas
Magellan Str.
C. Horn
S. Georgia (Br.)
SCOTIA SEA
Drake Passage
S. Shetland Is.
SOUTH ORKNEY IS. (Br.)
SOUTH SANDWICH IS. (Br.)
PALMER ARCH.
BELLINGSHAUSEN SEA
Bouvet I. (Nor.)
Tristan da Cunha (Br.)
Gough I. (Br.)
Ascension (Br.)
St. Helena (Br.)
Tropic of Capricorn
Tropic of Cancer
C. Blanco
C. St. Vincent
Madeira (Port.)
Canary Is. (Sp.)
Azores (Port.)
Villa Cisneros
SP. W. AFRICA
Rabat
Marrakech
Sidi Ifni
MOROCCO
Gibraltar (Br.)
C. Spartel
C. Finisterre
Lisbon
PORTUGAL
SPAIN
Madrid
Barcelona
Sardinia
Algiers
Tunis
TUNISIA (Fr.)
Bizerta
Tripoli
ALGERIA (Fr.)
LIBYA
Gat
SAHARA
Bilma
Timbuktu
Dakar
Bathurst
PORT. GUINEA
Bissau
Bamako
FRENCH WEST AFRICA
CAPE VERDE IS. (Port.)
Freetown
SIERRA LEONE (Br.)
Monrovia
LIBERIA
Abidjan
Accra
GOLD COAST
TOGO
NIGERIA (Br.)
Lagos
CAMEROON
Douala
Gulf of Guinea
SP. GUINEA
FR. EQUAT. AFRICA
Libreville
Cabinda (Port.)
Luanda
Benguela
Nova Lisboa
ANGOLA
Port Lusaka
Windhoek
S.W. AFRICA
Walvis Bay
Pretoria
Johannesburg
UNION OF SOUTH AFRICA
Durban
Port Elizabeth
Capetown
C. of Good Hope
Brazzaville
Leopoldville
BELGIAN CONGO
Elisabethville
Victoria
Tanganyika
TANGANYIKA
Nairobi
Mombasa
ZANZIBAR
Dares Salaam
Lourenco Marques
Beira
Nyasaland
Mozambique
RHODESIA
Salisbury
KENYA
Mogadiscio
Chisimaio
Addis Ababa
ETHIOPIA
Berbera
BR. SOM.
FR. SOM.
Gulf of Aden
YEMEN
Khartoum
SUDAN
Aswan
Asyût
Cairo
EGYPT
Suez Canal
Port Said
Alexandria
Bengasi
Mecca
Riyadh
SAUDI ARABIA
Aqaba
Gaza
LEB.
ISR.
JOR.
SYRIA
Damascus
Beirut
Cyprus
Krete
Athens
TURKEY
Ankara
Istanbul
Black Sea
Bulgaria
Belgrade
YUGO.
Sicily
Sardinia
Marseilles
Bay of Biscay
FRANCE
Milan
Rome
Paris
Bonn
Prague
CZECHO.
Vienna
AUST.
HUN.
Budapest
Bucharest
Odessa
Rostov
Astrakhan
Caspian Sea
Baku
Tbilisi
Kuwait
IRAQ
Basra
Baghdad
IRAN
Tehran
Kabul
AFGHANISTAN
Lahore
Delhi
New Delhi
Karachi
PAKISTAN
Muscat
Ahmadabad
Bombay
Hyderabad
GOA (Port.)
Madras
Calcutta
Chittagong
NEPAL
TIBET
Kashgar
Yarkand
Tashkent
Samarkand
Mary
Aral Sea
Amu
Caspian Sea
Ural
Volga
Kuibyshev
Saratov
Stalingrad
Kharkov
Kiev
Minsk
Kaunas
Warsaw
POLAND
Berlin
Hamburg
Frankfurt
Cologne
Amsterdam
Brussels
Paris
Lyon
Geneva
Milan
Venice
Trieste
Zagreb
Belgrade
Sofia
Istanbul
Ankara
Smyrna
Athens
Crete
Cyprus
Beirut
Damascus
Jerusalem
Amman
Baghdad
Basra
Kuwait
Riyadh
Mecca
Aden
Muscat
Karachi
Lahore
Delhi
Calcutta
Bombay
Madras
Colombo
CEYLON
Maldive Is.
Chagos Arch. (Br.)
SEYCHELLES (Br.)
Comoro Is.
Mauritius (Br.)
Réunion (Fr.)
Rodrigues
Tananarive
MADAGASCAR
Diego Suarez
Majunga
Tamatave
Fort Dauphin
Mozambique Channel
C. Sta. Marie
Durban
Port Elizabeth
Capetown
Pr. Edward Is. (S. Afr.)
Crozet Is. (Fr.)
Kerguelen (Fr.)
Heard I. (Austr.)
McDonald I.
Amsterdam I. (Fr.)
St. Paul I. (Fr.)
Antarctic Circle
Longitude West of Greenwich
Longitude East of Greenwich
Steamship and Air Distances
234
Nautical Miles
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1 80° 2 60° 3 40° 4 20° 5 0° 6 20° 7 40° 8 60° 9

undignified timesaver as the zipper. Here too the prophets are at work, forseeing a future in which almost all work will be done by fully automatic machines run by skilled workers who push the right buttons at the right time. There were by the 1950's, notably in such fields as electric power, remarkable examples of such "automation"; and already automatic and semiautomatic machines and other technological advances had cut normal working hours in the Western World down to 40 or less a week. (See AUTOMATION.) But in mid-20th century, and over the whole world, we are still very far indeed from the technologists' push-button Utopia. In much of Asia, Africa, and in parts of Latin America there is still a basic peasant economy, or a plantation economy in which human labor bulks larger than machines. Indeed, in terms purely of economic productivity, it is pretty clear that in the 1950's the technological gap between advanced and backward areas on this earth is greater than it has ever been in history.

Again, wherever large-scale organization prevails, there have arisen major problems by no means yet solved. Some of these problems, familiar ever since the Industrial Revolution (q.v.) of the 18th century, center on the adaptation of human nature to the impersonality and routine character of the labor involved at the less responsible levels of large-scale organization. Human beings are not yet fully adapted to the assembly line and the time card. Yet the 20th century has witnessed in the advanced countries of the West first the great reduction of the actual working hours spent on routine tasks, and perhaps more important, an improvement in relations between management and labor, a recognition by state and management alike of the role of labor unions (q.v.), an elaborately developed psychological study of industrial relations, many "fringe benefits" for labor, and, especially in the last three decades, a very considerable absolute and relative rise in the real incomes of industrial workers.

Another series of problems of large-scale economic organization centers on the top level of management. In large-scale private industry the 20th century has seen the growth of a gap between management and ownership in the great corporations. As individual stockholders have grown more numerous in a given corporation the old methods of voting have ceased to give these nominal owners any real control over the broad policies of "their" corporation. The management, though many individual managers usually own some shares in their own company, are not very directly responsible to the mass of shareholders. More serious problems, perhaps, are first, the increasing difficulty of finding managers able to cope with the human difficulties of getting the thousands of members of a giant corporation to work successfully together, and second, the danger that competition among these giants ("oligopolistic" competition) may prove to heighten rather than diminish the dangers of overproduction, boom psychology, in short, the old-fashioned business cycle.

Economic and Social Control.—On the other hand, the recorder of economic developments in the 20th century must in mid-century note that many professional economists believe that in the last few decades their own science has so far developed that it enables the economist, with the collaboration of businessmen and civil servants, to contrive arrangements to avoid the worst boom-and-bust of the business cycle. We have the means at hand, these economists say, the "built-in safeguards," at least in the United States and in most of the Western democracies. We can adjust the supply of money and credit through the Treasury and the regulated banking system and stock exchanges; we can absorb the unemployed through great and rapidly undertaken public works, or if necessary, by generous payment of insurance to actual unemployed, maintain the mass demand essential to a modern economy; we can by various regulative devices curb, control, level off income even among such individualistic and competitive groups as farmers and small retailers; we can control, if only by indirect pressures, even such oligopolistic competitors as the makers of automobiles; we have, in short, so say these hopeful economists, ways and means to avoid great depressions and maintain a dynamic but not dangerously inflationary economy. In the mid-1950's this claim of the economists has yet to meet a decisive empirical test. If the Western World can so far control its economic growth as to avoid another major depression like that begun in 1929, then this development will indeed be the greatest economic achievement of the 20th century. (See also ECONOMICS; PUBLIC FINANCE.)

There remains, however, even for the most optimistic, the challenge presented by the extraordinary rate of worldwide population growth thus far achieved by the 20th century. Under the most efficient systems of food production technologically possible as far as we can now see, another half century of population growth in countries like India, Indonesia, China, Japan, Egypt, and many others, some behind the Iron Curtain, would raise the old Malthusian dilemma in an almost unavoidable way. Actually, it seems by no means possible in these lands to achieve a rapid and spectacular rise in efficiency of agricultural production. Age-old traditions of small peasant farming are too hard to change. American surpluses of food so far distributed have helped, but their distribution is neither politically nor economically easy; and besides, they are not nearly big enough. Short of a technological miracle which could provide a vastly increased food supply cheaply—such, for instance, as a way to make cellulose readily digestible for human beings—there seems no clear way out of the difficulty. Voluntary reduction in the birth rate is difficult in economically and educationally backward populations and in Roman Catholic countries because of religious objections. However, there are signs even in countries like India that such voluntary reduction of births is possible.

POLITICAL DEVELOPMENTS

Politics and economics are scarcely separable in real life. Most of the 20th century economic problems above outlined are also political problems. But the two are separable for analytical purposes. Politically, as economically, the 20th century is clearly no absolute break from the 19th. The growth of the nation-state, the development of the large-scale bureaucracy (q.v.), even, and in spite of publicists who bemoan its troubles, the continuing development of democracy as a government and way of life, all are common to the 19th century, indeed to earlier centuries, and to the 20th. Old institutions, old ideas, old problems do indeed take on different

forms in the 20th century, sometimes look almost wholly new or different; but this new look is what is meant by growth, development, by history, in short.

The Nation-State System.—In terms of international or world politics, the 20th century is very clearly indeed a continuer of the 19th. The type unit of political organization achieved in Western civilization by the later 19th century has spread throughout the world. This is the independent or "sovereign" nation-state, the state (q.v.) posited in Woodrow Wilson's famous phrase "self-determination of peoples." It is true that in mid-20th century there were still areas, notably in Africa, where an outside "colonial" power ruled a people or peoples without self-government. Yet over the whole world vast areas—India, Pakistan, Indonesia, the Arab countries, the Philippines, China—which in 1900 had been in a colonial or dependent status had by 1950 achieved independence; and throughout Africa the colonial peoples were astir, demanding concessions from the possessing power, concessions aimed at ultimate independence.

Although the constituent elements of international politics are still sovereign nation-states held together in the loose and varying equilibrium commonly called balance of power (q.v.), the total situation has changed greatly since 1900. First, the number of constituent sovereign states has increased with the breakup of the Turkish, Austro-Hungarian, and Russian empires after World War I and the achievement of independence by such formerly dependent states as India, Pakistan, Libya, the Philippines, and others after World War II. It must be noted that in purely juridical terms the great Russian expansion after 1945, though it erased Estonia, Latvia, and Lithuania from the list of actually independent nation-states, still left the so-called satellites like Poland, Rumania, Czechoslovakia, and Albania theoretically and formally independent.

Second, what was in 1900 so clearly Europe-centered as to be essentially a balance-of-power system not unlike that of the whole period from about 1500 on, had by 1950 become for the first time genuinely world wide. The expansion of Western culture, begun with Vasco da Gama and Columbus, had at last moved on from ties of trade, colonial exploitation, cultural interchanges, and increasingly rapid transportation and communication, to the kind of political interdependence implied in a term like balance of power. There was really One World in 1950, though it was not a peaceful world, not a world with one government, any more than the Europe of 1500 had been.

Third, the expansion of membership in the system of international politics had been accompanied by a remarkable change in the distribution of power among the leading nation-states. In 1900 publicists ranking what were called the great powers by strength and prestige would have been in pretty general agreement as to an order like this: Great Britain, Germany, France, Russia, Austro-Hungary, and Italy. The United States and Japan would have been recognized as strong nations, but still "outsiders" to the system. The gap between Britain and Italy was clearly great, but the series as a whole showed a gradual falling off from first place to sixth; and not even the leaders—and chief rivals—Britain and Germany—were put in a class by themselves as "superpowers."

By mid-20th century, the leaders and chief rivals were the United States and Russia, two superpowers by common agreement among publicists not really approached in actual strength by any other single power. Great Britain would be ranked next, but a Britain which in its home islands was no more than a second-class power, and which could no longer be wholly sure of carrying with it into actual war the constituent members of what as late as the 1940's was called the British Commonwealth and Empire, but by the 1950's simply the Commonwealth of Nations (q.v.). France, with a home base weaker than Britain's, and the remains of an empire much less to be relied on was, especially by American publicists, often dismissed as *less* than a second-class power. Yet for the customary apparatus of international power politics, conferences "at the summit" and such like, France was still in mid-century accepted by its partners the United States and Britain as a formal equal. Italy indeed had dropped out at this level; Austro-Hungary had been broken up in 1918, and none of the successor states to the old Habsburg complex was nearly strong enough to rate as a great power. In mid-20th century both Communist China, apparently a firm ally of Russia, and the Republic of India were known to have populations and ultimate economic potentials sufficient to rank them in this new worldwide international politics as major powers. But both were as yet insufficiently industrialized and modernized to take that rank at once. Germany and Japan, if now without their former empires and with home bases hardly more adequate than those of Britain and France, had nonetheless once been major powers, and were sure to be important elements in future equations of balance of power; for the moment, however, disastrous defeat in World War II and for Germany actual partition into a West Germany in the United States system and an East Germany in the Russian system had left these nations greatly weakened. The United States and the Soviet Union looked to be in a class by themselves.

Fourth, this change in international politics from a center in old Europe to a genuinely world-wide system of which Europe was only a part—though still a most important part—had forced upon all sensible Europeans and Americans a recognition of the fact that white men could no longer always beat non-white men in actual battle. With the exception of an occasional Custer's defeat or an Aduwa, it is quite true that until 1900 white men with their governments really behind them could always defeat red, yellow, and black men in the field. The Japanese victory in the war of 1904–1905 with Russia was the first clear evidence that this old superiority in arms no longer held; World War II together with the successes of colonial peoples in guerrilla war, in terrorist tactics, in passive resistance made it clear that the peoples of Asia and Africa are, in terms of international power politics, to be reckoned with as potential, if not actual, equals of Europeans and Americans. See also NATIONALISM AND INTERNATIONALISM.

National Power and International Conflict.—To many publicists who pay no attention to history, the mid-20th century division of the world between two rival camps headed by the United States and Russia, and with extremely few—if any—really neutral or indifferent states in what is called the cold war seems alarmingly

new, indeed unprecedented. The historian will see in the present world situation an extension to the whole world of a situation in its broad lines the same as that in which the Western World has found itself, as far as international politics go, since the end of the Middle Ages. Since then there has always been a preponderant power—the Habsburg Empire, centered first in the Germanies and then in Spain, the France of Louis XIV and Napoleon, the Britain of the 19th and early 20th centuries—with its allies, dependencies, even "satellites." And there has also always been a challenger and major rival—the France of the Valois kings, the England that opposed first Spain and then France, the Germany of yesterday that challenged Britain—and of course *its* allies, *its* coalition. Neutrality (q.v.) has always in modern times been difficult and a worrisome matter for the would-be neutral, as the history of Switzerland or of Holland will show.

Now in terms of power analysis which must not be confused with moral judgments about the degree of aggressiveness shown by any given power, the United States is in mid-20th century the preponderant power, the Soviet Union the challenging power. Each has its allies and followers in a coalition as well organized as the leading power can contrive to make it. Actual general or world wars, of which since 1494 there have been some six or eight, are therefore always wars of coalition, and indicate the failure of the equilibrium implied in the phrase balance of power. Unfortunately, the social sciences are not yet nearly sufficiently developed for their wisest practitioners to be able in a given situation to analyze the many factors which break the precarious balance and produce a general or world war. No one factor—not even the degree of intensity of mutual hatred and fear between the leaders, the "opinion makers" or even the masses, of the two major rival powers—would appear to be in itself decisive. Those who believe that the current equilibrium is most precarious, and that therefore another world war will break out shortly, emphasize the fact that the rivalry between the United States and the Soviet Union is not merely a conventional rivalry between great and successful nation-states but one between two very different ways of life, indeed religions, symbolized as Western Christian and humanist democracy and Russian materialist and totalitarian communism.

Many other factors clearly make the equilibrium which has somehow endured since 1945 precarious enough so that the phrase cold war does not yet by any means seem old-fashioned: the fact that both the United States and Russia are new to the predominant positions they now have, and that their professional diplomats may lack the caution long experience can provide; the existence of many "danger spots" unsettled after the last war, such as a divided Germany, the tension between Israelis and Arabs, the revolts in many parts of Asia and Africa against France and Britain, a divided Korea, an eastern Europe restless under Soviet control; the intense new nationalism of the underdeveloped or poorly developed nations politically emancipated since World War II; the very existence of a wholly new factor, the atomic bomb which by itself or in combination with new possibilities of chemical or germ warfare makes it at least conceivable that another general war might end with the annihilation of all human life on earth.

Yet against this formidable list of factors making for a new world war soon, or fairly soon, the objective observer can bring forward a list of factors making, if not for universal peace, an end which still seems to most people Utopian, at least making for the continued, and possibly long-continued, existence of something like the present rough international equilibrium. Such factors include the following: the very maintenance of this equilibrium since 1945 in spite of actual shooting wars in such touchy spots as Korea, Vietnam, and Israel; the success of the United States policy of containment, under which direct territorial expansion of Russia was stopped; the apparent lessening of Russian quasi-religious crusading fervor, which reminds the historian that even crusading religions like medieval Islam and medieval Christianity have in fact found it possible to live in the same world; the worldwide economic rally and consequent general prosperity, some of which has gone to raise, if only slightly, the standard of living even in backward countries; the possibility that the existence of the atomic bomb and other new factors in actual warfare may act as a deterrent rather than as a stimulant and temptation to those civil and military leaders who make the final decisions that lead to war or peace—the possibility, in short, that we may in the future have limited instead of total wars; the existence of some beginnings of international or supranational government, of methods of negotiation and conciliation superior to the traditional diplomacy of the balance of power system.

International Cooperation and Organization.—This last point is worth separate treatment as one of the major political developments of the 20th century. There has been a clear progress in the machinery of international politics since 1900, although nothing like a world government or world federation transcending the sovereign nation-state has been attained. The League of Nations (q.v.) which emerged from World War I and the United Nations (q.v.) which emerged from World War II were not true federations, but they were both somewhat more than the informal, *ad hoc* gatherings of diplomats in congresses and conferences which were all that had been hitherto achieved. Both the League and the United Nations sought to include all nations, though jealousies and other difficulties have prevented this achievement; still, the United Nations has from the start included both the United States and Russia and their principal allies. The United Nations has served as a sounding board for nations with grievances, and has made possible a good deal of worldwide education in international politics. In its so-called "functional activities," the guidance of actual specific international cooperation in a wide range of activities from control of narcotics and other illicit traffic to international labor relations and cultural exchanges the United Nations has continued the valuable work of the League of Nations. What is perhaps more important, under its auspices there has begun to grow up a skilled group of experts in international politics, international civil servants of a kind, who though they remain for the most part good citizens of their respective nation-states, have begun to have a loyalty toward a *respublica,* common thing, above the individual nation-state. The United Nations is, in a world like ours, under severe and constant attack, not only from ardent patriots and isolationists, for

whom it is too strong, but also, and especially in the United States and in western Europe, from ardent internationalist idealists, sponsors of a world-state and world-government, for whom it is too weak.

In addition to the United Nations, the 20th century has seen the development of a large number of regional groups, not mere alliances of the classic type, but real attempts to achieve at least partial governmental administrative and legislative work at a supranational level. Of these the most remarkable, since it involves the member nations in the abandonment of some of their sovereignty in a specific field of action, is the European Coal and Steel Community (q.v.) founded in 1951, in which Belgium, France, West Germany, Italy, Luxembourg, and the Netherlands joined together to create a free trade area for the coal and steel industries. At the opposite extreme, since it has no real powers at all, but is purely a sounding board and consultative group, is the Council of Europe (see EUROPE, COUNCIL OF), founded in 1949, with its seat at Strasbourg. Its 15 member nation-states, plus the Saar as associate member, cover free Europe almost completely. The important thing about this group is that, though it cannot juridically compel any member state to do anything, its personnel is recruited from among legislators and other political figures, and not merely from private do-gooders organized as a pressure group. The agencies developed out of the basic alliance between the United States and the free European states, furthermore, have in fact taken on many functions of international government—the word is hardly too strong—not associated with the comparatively loose alliance systems of the 19th and earlier centuries. The North Atlantic Treaty Organization, the Western European Union, the Organization for European Economic Cooperation, and the European Payments Union taken all together achieve a degree of actual cooperation among the agents of nation-states hardly conceivable in 1900. (See NORTH ATLANTIC TREATY AND WESTERN EUROPEAN UNION; EUROPEAN ECONOMIC COOPERATION, ORGANIZATION FOR.)

In the Western Hemisphere the International Bureau of American Republics founded in 1890 became in 1910 the Pan American Union (q.v.), which carried on, and continues to carry on, work at a cultural and educational level. The Union became in 1948 a constituent member of the much more ambitious Organization of American States, which provides for consultation among the governments of the 21 republics of the Western Hemisphere, and in particular, for the cooperative solution of problems, such as internal revolution or tensions among the constituent states, which threaten to disturb the general peace. Beginnings of regional groupings are perhaps discernible in south and southeast Asia and among the Arab countries, but so far these groupings look more like traditional military alliances than like real experiments in supranational governmental cooperation. It is also clear that the necessities of modern economic and military effort have made of the Russian system of alliances something much more firmly knit than was possible until the 20th century. The Iron and Bamboo curtains have made it difficult for Westerners to study the actual workings of this system. It looks, however, as though the Russian-Chinese alliance were hardly more than an old-fashioned alliance, and that the relations between Russia and her East European satellites are at best but thinly disguised imperial dominance, more reminiscent of the Napoleonic system at its height in 1810 than of a genuine experiment in free international government.

Finally, there remain two 20th century attempts to achieve a free union of self-governing national entities, the outcome of which looks uncertain in mid-century, the British and the French efforts to base their former empires on the full consent of all their peoples. The British had in fact granted self-government to their colonies of settlements, for the most part with populations of British or Dutch or French descent (Canada, Australia, New Zealand, and the Union of South Africa) before World War II. The independent status of these Dominions was formally established in the Statute of Westminster of 1931, which declared the Dominions and Great Britain "freely associated" and formally recognized the right to secede. The rest of Britain's enormous empire, which in 1940 numbered nearly one quarter of the world's population, possessed various degrees of local autonomy, but had a status best put simply as colonial.

World War II, in which the nonwhite races did so well, hastened greatly the process of emancipation for large parts of the old empire. Burma was entirely freed, becoming a sovereign nation. The old geographic area of India was partitioned into three independent states, India, Pakistan, and Ceylon, all of which remained members of the Commonwealth. India, which in 1950 declared itself to be a republic, created something of a semantic problem, since the head of the Commonwealth system is the British crown. The former African colony of the Gold Coast became in 1957 the self-governing state of Ghana, and in 1957 Malaya attained a similar status. Americans should note that these states of the Commonwealth are no longer under British control; they are free and independent states, a fact made clear by the membership each one has in the United Nations. Actually the adjective "British" is now commonly dropped, and the highly illogical system continues to operate, though both South Africa and Ceylon threaten secession, and Ireland, held in the 1920's and 1930's as a member under the title Irish Free State, is now juridically —though not wholly in terms of trade and travel —no longer a part of the system. All over Africa, and in the Caribbean area, there is unrest in varying degrees, and a demand for full independence and even secession. The British and their original associates in the Commonwealth are working very hard to keep together this unique federation. Perhaps, indeed, it can hardly be called a federation, when its juridical ties are so purely symbolic and its actual workings hardly more than conferences among the political and administrative leaders of constituent units. The British have widely promised their still subject peoples increasing self-government and ultimate freedom.

The French, who had hoped to assimilate the nonwhites of their great 19th-century empire directly to the unified nation-state of France, were late in learning the lessons the British learned. Not until after liberation in 1944 did responsible Frenchmen attempt to reorganize their empire with a greater degree of local autonomy under the title of French Union (q.v.). Moreover, the real concessions to colonial desires for at least something like dominion status were

slight indeed; the old desire to make Negroes and Asians into good Frenchmen was too strong. Still, after the forced partition of Indochina in 1954 and increasing troubles in her prized North African possessions, there were signs that the French were making a genuine attempt to turn the empire into some kind of federation. But intense nationalism among the Arab and Berber peoples of North Africa made such an effort very difficult indeed. Algeria was in 1957 a state of open rebellion.

Nationalism.—This spread of nationalism on the Western model to all parts of the world is, after the new rivalry of the United States and the Soviet Union, the most important political development of the 20th century. It underlies the striking revolts all over the colonial world against colonialism or imperialism (q.v.). These revolts, though those who lead them naturally enough complain of economic exploitation by their colonial masters, are not motivated by anything so simple as the economic motive; they are motivated by the whole complex of emotional and cultural values summed up in the old abstraction "nationalism." In the sense of supreme loyalty to the territorial nation-state, nationalism is a growth of the last few centuries of Western history.

For an Asian or an African to be nationalist means to abandon, or at least put in secondary place, age-old loyalties to family, clan, caste, tribe, or, notably for Muslims, religion. Yet in the first half of the 20th century this transfer of allegiance to the nation-state has already gone a long way. Islam has long been a religion that seemed to transcend nationalism more successfully than did Christianity; yet since World War I liberated the Arabs from Turkish suzerainty, nationalism of a Western type has developed to the point where, in spite of the Arab League and common Arab hatred for the Israelis, skilled observers see a characteristically Western national rivalry developing between such Muslim states as Egypt and Iraq. Even primitive Saudi Arabia begins to think and feel itself a nation, Western style. In Negro Africa, where the European colonial powers in the 19th century developed a patchwork of artificial and accidental territorial units on a culture that had not, with the exception of a few rather loosely organized "kingdoms," gone beyond the tribe as an ingroup, mid-20th century has seen at least the beginnings of nationalist feeling develop for such artificial territorial units as the Gold Coast or Sierra Leone.

Yet it would be rash to attempt to predict the political map of Asia and Africa in the next half century. Self-determination of peoples applied to current tendencies would seem to indicate a continuing multiplication of the Western model of sovereign national units around the world. But it is just these units that make the alliances and alignments, the rivalries and finally the wars of our Western state system. Ironically, just as the old units of western Europe, and perhaps even the United States, seem to have reached the point where they can achieve some kind of union transcending and thus moderating exclusive nationalism, the rest of the world seems to be entering a phase of particularly acute and intransigent nationalism. There is, however, the possibility that since these non-Western peoples have passed so rapidly from tribal and similar structural political organization, they may pass with equal rapidity through the youthful and intolerant phase of national organization, and be ready for some form of federal union. Even were this to prove true, the realist should face the fact that before a peaceful world organization could emerge, there would probably be a period of intense rivalry among great regional federations.

Popular Government.—With regard to internal or domestic political developments, the 20th century has seen the continued growth of democratic institutions, but also the growth of a series of challenges to the democratic way of life, the challenges of totalitarianism both of the left and the right. In the earliest years of the 20th century so high was the prestige of popular government, with its political apparatus of wide and indeed usually universal manhood suffrage, an elected legislature with power to make laws, an executive responsible to the legislature, or directly to the people, that even in the peripheral regions of the West, even in the then politically undeveloped colonial lands of the Near East and Asia it was assumed that parliamentary government (democracy) was bound to come.

Of the two great systems of popular government, the parliamentary with responsible cabinet along British lines and the congressional with an independently elected executive along American lines, it was the British which most of the world, with the exception of Latin America, had flattered by imitation. By 1914 there were "parliaments" with strange names all through the Balkans, and even in the absolute monarchies of Germany, Austria-Hungary and Russia parliamentary bodies were by 1914 in their own minds on the eve of attaining something like the British system of cabinet responsibility to a popularly elected legislature. Indeed in Germany many felt that in spite of the posturing of Kaiser William II the German state was in fact beginning to be a kind of democracy. When in 1911 there began in China a successful revolution against the Manchu dynasty, all the world assumed that the apparatus of Western democracy would be set up, as indeed leaders like Sun Yat-sen attempted at once to do. See also CABINET AND CABINET GOVERNMENT; CONGRESSIONAL GOVERNMENT.

Totalitarianism of the Right.—The outbreak of World War I in 1914 was a shock to the optimists of democratic government, and in the troubled years that followed the unsatisfactory Peace of Versailles, challenging systems of government rose in the European heart of Western civilization. It is true that even before the rise of fascism in Italy in the early 1920's there had been groups which refused to accept democratic government, old established conservative or reactionary groups in countries like Russia, Austria-Hungary, and Germany, and in France the unreconciled royalists and Catholics who had never accepted the great revolution of 1789. Yet though the new antidemocratic totalitarian systems, which under the names fascism, Nazism, and falangism (qq.v.) had by 1939 triumphed in Italy, Germany, and Spain, and namelessly, so to speak, had won over Portugal, made full use of such legitimist old aristocratic allies, in no case was the new system very much like the old pattern of the monarchies before the American and the French revolutions of the 18th century. A new 20th century element had come in; as the full name for the Nazis—National Socialist German Workers' Party—indicates, no matter how much these totalitarian systems leaned on and in turn bolstered the old possessing classes, they at least claimed to rest on a popular basis among the

masses. And in true historical perspective 20th century totalitarianism should be seen not merely as a defensive system set up by privileged groups to oppose the spread of democratic equality, but also as an offensive system of the lower middle class and workers against the libertarian side of democracy so dear to the successful middle classes. Though the formula is oversimple, it may be said that 20th century totalitarianism nowhere triumphed where an old middle class was strong. In Germany, at first sight an exception to this rule, the middle class was much newer than in western Europe, the United States, or the British self-governing Dominions; and, most important, this German middle class was particularly weakened by the wiping out of much of its assets in the war of 1914, the complete inflation of 1923, and the disastrous depression of the early 1930's.

Nationalism, which in the 19th century had been one of the strongest of political forces, became in these 20th century totalitarian movements of the right a kind of obsession. Worship of the nation, as embodied in the leader, the party, and the state, became in the mind of the faithful Nazi, Fascist, or Falangist, an almost complete substitute for religion, indeed for any other set of social values. There was among their publicists almost no serious attempt to explain how these ferociously exclusive nation-states were to get on together in any kind of international relations. For the Nazis, at least, it seems true that their ultimate goal was literally world rule by the supreme nation, Germany. In practice, the rightist totalitarian nations arrived during the 1930's at a precarious alliance known as the Axis; but it was an alliance in which each partner was, by the very terms of his view of the world, bound fundamentally to distrust the others.

These totalitarian movements developed certain new techniques of government, or so distorted older ones as to make them in effect new. They were all very vocal in their condemnation of democratic government, which they claimed was in fact anarchy, the concealed rule of rich capitalists, effete, decadent, yet somehow clinging to possession of parts of the world which would be much better off in German, Italian, or Spanish hands. All rested proudly on a one-party system. The single party—Fascist, Nazi, Falangist—had originally been a party organized in the democratic freedom of these states, in all of which there was a multiparty system of the conventional Continental kind. Yet these totalitarian parties from the start announced their intention of using the opportunities democratic political organization gave them to destroy democracy. Notably they all developed what came to be called paramilitary organizations, party branches of uniformed men with a special colored shirt, brown, black, green, silver, from which they often proudly took a popular name. These strong-arm troops were increasingly used for violent attacks on opposing parties as the crisis the totalitarians sought to bring on approached; but they also served as a means of developing somewhat less violent techniques—pressure-group methods not unknown to good democrats, rituals of mass meeting, parades, hymns, indeed what might be called parareligious ceremonies. There was at the head of each party a leader—duce, führer, caudillo—toward whom the faithful were trained to give absolute adhesion and trust, and who, unlike democratic leaders, was held by his followers to be incapable of making a mistake. (Perhaps in that one little fact lies the main reason for the failure of totalitarian methods: total infallibility of leaders is just bad politics.)

The specific triumph of the totalitarian parties, easy in Italy in 1923, somewhat harder in Germany in 1932, achieved in Spain in 1939 only after a bitter civil war, permitted the establishment of a totalitarian regime. The general pattern of this regime was nearly uniform: the totalitarian single party became the only legal party, and there was set up a sort of parody of democratic forms, with party congresses, legislative bodies which never really debated and certainly never divided, elections with ballots on which only one set of names appeared, even "constitutions" duly written out, with much of the phraseology of traditional democratic thought.

In practice these regimes prevented—as far as was possible—anything of what democracy really rests on, that is, reasonably free public discussion of the whole range of concrete economic, political, and social problems. There was, literally, no public opposition in press, radio, or public meeting. The actual work of governing was done by an increasingly powerful and numerous set of officials, the highest of whom had joined the party and worked their way up through its ranks. Indeed party and state, or at least party and government, were intertwined in a most complex way. In theory the leader was supreme, and in practice it seems to be true that Mussolini, Hitler, and Franco all exercised more unchallenged power to make final decisions than had any democratic leader. But more important, all policy making did in fact come from a relatively small group of men who owed nobody outside their own associates an explanation or justification of what they proposed to do. They were literally irresponsible, and with the exception of Franco, they irresponsibly led their countries to disaster in World War II. This is as true of the Balkan and indeed Japanese imitators of Mussolini and Hitler as it is of these original totalitarian dictators themselves. (See also DICTATORSHIP.)

Opinion about the actual socio-economic achievements of these Fascist dictatorships, as of the actual insolubility by democratic methods of the crises by which they got power, varied sharply in the democratic world outside. Liberal, leftist, or just plain radical opinion in the West tended to maintain that the common people in the Fascist countries got no reforms to benefit them at all, and that the crises were artificial ones fomented by the wicked totalitarian parties and their paramilitary organizations. Conservative or rightist opinion in the democracies tended, especially with respect to Mussolini, to see these dictators as having brought order to a hopelessly chaotic situation, and to have benefited the material condition of their subjects. In retrospect, it looks as if both leftist and rightist exaggerated, and saw but one side. The totalitarians did, especially before the burden of competitive armaments became too heavy, take some measures to raise the standard of living of the common people, measures not very different from the kind we in the democracies lump together as social security. They did enlist a good deal of loyalty from their followers. But they destroyed what social gains they initiated by going in at the end for "guns" almost to the exclusion of "butter"; they suppressed cultural and artistic freedom to the

point where their nations were singularly barren in these fields; and notably with the anti-Semitism of the Nazis in Germany, they were led to acts which outraged the human spirit.

With the defeat of Hitler, Mussolini, and their Japanese and Balkan allies in World War II, the totalitarians of the right lost power, save in the Iberian peninsula. In the 1920's and 1930's they had had imitators almost everywhere; there were "silver shirts" even in the United States, "black shirts" in Britain. In France the fortunes of war in 1940 put in power the so-called Vichy regime, some of whose leaders sought to imitate the occupying Germans. But it is typical of the temperament of those uneasy but deeply conditioned democrats, the French, that by 1944 efforts to set up the required *parti unique* (single party) had produced some four or five all claiming to be the *parti unique*. The Japanese, ever willing to imitate, followed their allies part way at least down the totalitarian path. Though totalitarianism of the Fascist type seems in mid-20th century no longer a threat to the democracies, acute observers are not willing to pronounce it dead. Should the free world once more face the kind of crisis the worldwide depression of the 1930's produced, Fascist totalitarian faiths may revive.

Totalitarianism of the Left.—Although they would never admit it, these totalitarians of the right owed a good deal to political techniques first set up by the Russian totalitarians of the left. Well before Mussolini, the Russians had a one-party system, the clear beginnings of the worship of a leader (Lenin, who died in 1924), and rule by a powerful bureaucracy not directly responsible to anyone outside itself. Indeed it was long the fashion among some Western publicists both of the right and the left to declare that there was no real or important difference between communism (q.v.) on one hand and fascism, national socialism, and falangism on the other; all were equally antidemocratic in practice and in spirit. This view would seem historically shortsighted. At any rate, the Communist dictatorship remains in the mid-20th century a major fact of world politics, which totalitarianism of the right does not.

The rise of an actual society presumably founded on the teaching of Karl Marx is, then, one of the great political developments of the 20th century. In principle, Marxism is an extension of the democratic principle of equality from law and politics to economics and social structure. The Marxist wants all men to be equal in the sense that no man will feel himself *unfavorably, unhappily* different from his fellows in ways such as, the Marxist maintains, capitalistic institutions, private property, inheritance, and the like inevitably make him feel. In principle, in theory, Marxism goes even further than democracy in its devotion to individualism. For in Marxist theory, once the institution of private property throughout the world has been done away with by revolution and the subsequent dictatorship of the proletariat, the state will "wither away," there will be no police and no soldiery (because no one will disobey his better self and commit a crime), no politically or socially linked unhappiness. Fascist or Nazi theory, on the contrary, denies any possibility of human equality, insists on a powerful state and powerful army and police as eternal ideals, and preaches complete obedience to a single leader.

It must be admitted that in the practice of the Russian state after the Bolshevik (q.v.) revolution of 1917 there were never the slightest signs of the withering away of the state. In spite of the difficulties Westerners have found in studying Russian society on the spot, it is quite clear that in Russia the fundamentals of government by discussion, the individual rights consecrated in the classic Western bills and declaration of rights, have been at least as far from realization as in the totalitarian societies of the right. Russia under Stalin was run by a dictator who browbeat and frightened his closet collaborators. It had a one-party system through which all leaders in government and industry were recruited. Though it gave lip service to most of the ideas of democracy, its elections were mere parodies, in which the voter had no choice among candidates or policies. Especially in the late 1930's, after the assassination of Sergei Mironovich Kirov, it went through an extraordinary reign of terror in which no person in authority at any level, and none of his family and intimates, and no foreigner in Russia, however sympathetic a Communist or fellow traveler, could feel safe from prison and death.

There are signs, as the 20th century moves into its second half, that Communist Russia is returning to something close to its traditional norms, which are *not* those of the democratic West. The extreme tensions of the 1930's were hardly possible of endurance in any long run. It looks as if Russia may be settling down into an authoritarian state, perhaps headed by a group rather than by a single dictator, in which ultimate political decisions—which are also economic and social decisions—are made by a managing oligarchy the members of which have worked their way up through the Communist Party organization, and have had a long bureaucratic training.

Among the fascinating questions the next few decades should decide is how far this ruling oligarchy will perpetuate itself as a privileged class by passing on its status to its children. So far private property and inheritance in the Western sense have not clearly reappeared in Russia. Yet experienced observers believe they see signs that the present privileged groups—the big politicians, the managers of the big nationalized industries, the engineers and other technicians, the top professional men, the stars of theater, cinema, and literature—who enjoy high incomes and many "fringe benefits," and notably superior housing and vacations, are already establishing their children in similar positions. At any rate, Russia 40 years after the Communist Revolution is far from the egalitarian, classless society of Karl Marx's hopes.

There seems little new political development in the so-called satellite countries of Europe. These "peoples' republics" are all basically totalitarian in that they have one-party systems, and no real freedom of discussion, publication, or association. They appear to have varying degrees of actual governmental collectivization of industry and agriculture, depending largely on how westernized they had been when the Russians reached them, and varying degrees of restiveness under totalitarian regimes, depending on this same factor of prior westernization. One of them, the Yugoslavia of Marshal Tito, succeeded in breaking away from Russian control, and though remaining formally a Communist state, re-established more normal relations with the outside

world. Poland in 1956 gained some degree of autonomy; in the late autumn of 1956, a bloody revolution in Hungary, basically anti-Russian and anti-Communist, was suppressed by Russian arms.

As for China, it was by no means clear in the mid-20th century how this newest of the great Communist states would develop. Its leaders talked the language of Marx—a language surely not very congruous with the long traditions of Chinese culture; and there seemed little doubt that some very fundamental changes were going on in Chinese society. Notably the process of industrialization, begun very late in China, as late as the early 20th century, was going on apace under the kind of national planning begun by Russia with her five-year plans. In Russia this forced industrialization has involved preferring capital goods and investment to consumer goods, and has led to the kind of deprivation for the masses the Marxist theorists used to call scornfully, with reference to the early Industrial Revolution in the capitalist West, "primitive accumulation." How patiently the Chinese people will put up with this process, how far the new nationalism will erode ancient family solidarity, and habits of small industry and small peasant ownership, the whole structure of Chinese society, can hardly be decided at this moment.

International Communism.—Outside the Communist bloc led by Russia and China, the Communist Party exists in various degrees of strength and formal organization. Immediately after the successful Bolshevik Revolution in Russia in 1917 Moscow became the center of a movement to convert the whole world to communism. The central organ, called the Comintern, or Third International (see INTERNATIONAL), was formed in 1919, and allowed formally at least to lapse when Russia needed capitalist allies in World War II. It was revived, however, under the new name of Cominform (q.v.) in 1947 as part of the growing cold war between Russia and the West, but was officially dissolved in 1956. In the opinion of most outsiders, the international Communist movement has been very closely directed indeed from Moscow, and the various parties in foreign lands allowed very little independence of doctrine or practice.

In most of free western Europe the Communist Party is a legal political party, operating quite openly. Only in France and Italy of the major countries is it strong, but in neither of these has it ever commanded a majority in the legislative body. Throughout much of the world the party is illegal, or very seriously cribbed by law, so that the Communists are obliged to work underground as conspirators, a role they seem to relish. In certain parts of the former colonial world which since 1945 has been in active revolt against its European rulers, notably in Malaya and French Indochina, the Communists have waged guerrilla warfare of a ferocious kind. They have not, on the whole, done very well in any of the countries of the Western Hemisphere, though they are present everywhere as a more or less active minority. In so-called neutral countries like India, they have made some local election gains, but the new native rulers of these emancipated lands, in spite of the bitter things they sometimes say about the West, make rather clear by their actions that they do not want the Communists to take over in their lands.

As far as perspective can be attained in matters so recent, it looks as though communism as an organized international movement, after a partially successful penetration of Western lands during the great depression of the 1930's, a period of apparent soft pedaling of crusading in the years of the World War II, and a renewed and more intense and varied crusading activity in the decade of cold war since 1945, had by 1957 been at least partially contained, and had for the moment at least ceased to grow in most parts of the world. In short, though many and grave sources of unrest remained all over the world, it looks as though the American policy of containment of communism by a whole series of steps had at least stemmed a Communist tide that by 1947 was running very strong indeed. Only among the dispossessed and some intellectuals of the former colonial peoples was communism in 1957 perhaps still growing.

It was in mid-century even more difficult for the historian to decide how novel, how persuasive, Communist methods and philosophy were than to measure the actual concrete achievements of the Communist crusade. In the eyes of so skilled, if scarcely well-balanced and realistic, a writer as the late George Orwell in his novel, *Nineteen Eighty-Four,* the Communists had devised ways of turning human beings in society into inhuman automata, and society as a whole into a frightful human anthill. And indeed all over the free world somewhat less imaginative publicists than Orwell had long insisted that, in Russia and wherever they spread, the new totalitarians could somehow by brainwashing, by marvelous new methods of conditioning the masses, set up a kind of complete tyranny for which history afforded no precedent, a really totalitarian society without a shred of the old rich human variety. The more cautious historian in the mid-1950's must point out signs that even in Russia the old Adam and the old Eve are beginning to emerge to reassert old human habits, religious, artistic, moral, and quite un-Utopian. And though many 20th century intellectuals in the West insist that in their own societies uniformity and leveling have made men as alike as smooth peas, the historian will incline to take this insistence as one phase of a great 20th-century development, the alienation of the intellectuals, rather than as an objective account of actual conditions. See also COMMUNIST PARTIES.

Problems of Democracy.—The democracies during the 20th century, after the great test of World War I from which they emerged victorious though weakened in 1918, went into a period of relative moral decline. All through the 1930's the democracies, and especially Britain, France, and the United States, seemed not very successfully on the defensive against their totalitarian rivals. In the world of foreign relations the democracies made concession after concession, failed to back up the League of Nations, and found themselves divided in the great crisis of 1939 which began World War II. Indeed their citizens had listened so long to what the totalitarians—and some of their own publicists—had been saying about the degeneracy and impotence of the democracies, the youth and energy of the totalitarian societies, that they almost believed it themselves. Nevertheless, the democracies, in temporary alliance with Russia, won World War II decisively against the supposed "wave of the future" represented by Germany, Italy, and Japan. As a result, even when Russia came out clearly as another totalitarian rival of democracy after

1945, the democracies under American leadership showed no signs of inferiority feelings of defensiveness. There was not in Korea in 1950 the same kind of yielding to a *fait accompli* of aggression that occurred in a series in the 1920's and 1930's, from the Corfu incident to Munich. There was on the part of the democracies, though not anything like 19th century optimism, a kind of realistic willingness to face this harsh world that had not been very noticeable in the 20 years between 1919 and 1939.

There were in the 20th century no political inventions among the democracies comparable to those—the ballot, initiative, referendum, recall, proportional representation, and the like—which had marked earlier periods. The actual machinery of democracy worked at least adequately and seemed to need no wholesale redesigning. Almost everywhere in the free world by 1946 the classic institutions of universal male and female suffrage, genuine secret ballot, freedom of press and of association had been attained in principle if not always in literal fact. The standards were established, and men of good will were trying to live up to them. Although the defense of civil rights could never be allowed to lapse, it is still true that the basic problems of political democracy were in a different area. That area is pretty clearly marked out by what has been brought out earlier in this article on economic developments.

For the great expansion of government into regulation of, and even in the United States, active participation in private business, meant a vast increase in the number of permanent governmental agents, who were not elected by the people, and not normally removable by the people, governmental agents outside the uncertainties of competitive politics. In short, the work of government, not only at the national but also at the regional and local levels, had to be done by trained experts, "permanent" officials, not elected ones limited to specific terms of office. But the problem clearly arises, how are such officials to be responsible, as they must in a democracy, to public opinion?

So far at least, most observers believe, no magic formula exists to solve this problem. The existing framework of elected legislatures and elected executive policy makers, responsible through periodic elections, has so far been sufficient to prevent the great body of experts we need in political administration from becoming the kind of oligarchy we do not want. The old-fashioned rugged individualist is likely to complain that the democratic way of life has been perverted into a bureaucratic tyranny, but he is at least partly confuted by the fact that everywhere in the free world he is allowed to express this opinion of his in public. The fundamentals of government by discussion, the existence of objective conditions which permit a wide variety of actual human behavior, and an even wider variety of human opinion, are still in the mid-20th century very much in existence in Britain, France, the United States, the smaller democracies of Europe, and in much of Latin America and the rest of the world. See also DEMOCRACY, NATURE AND HISTORY OF; REPUBLIC.

SOCIAL DEVELOPMENTS

The 20th century has been called, not without some propagandistic intent, the "century of the common man." And indeed it seems likely that the most striking development all over the world has been an improvement in the material condition of life for the many. This improvement has, of course, been most uneven. Yet the fact of this improvement is measurable, as we noted earlier in this article, in a very clear and simple way. There is hardly a political unit in the world which does not show between 1900 and 1950 a definite increase in the life span of members of that unit. Though some of that increase can be attributed to a drop in infant mortality, much of it means that the whole environment of the individual, his food, housing, and medical care, is enough better so that he lives somewhat longer.

Changes in Social Structure.—In the advanced countries of the West, economic gains in the earning power of the old lower classes have been sufficient to effect a very considerable flattening out of what the sociologist calls the "social pyramid," which in older societies really was a steep pyramid, topped by a rich and honored aristocracy, tapering down to a substantial but not so numerous middle class, and broadening at the bottom to a numerous working and peasant class not very far from the margin of existence. But by 1950 the pyramid had been squeezed together both from the top and the bottom, though there was still a figure, and not the single straight line by which one might ideally represent the classless society of the theoretical egalitarian socialist.

Notably in the United States, but to a considerable degree everywhere in the West, the lowest classes have improved their lot by union organization, by governmental aid, by technological improvements cheapening many articles of mass consumption, by the spread of the kind of social judgment which is embodied in the very phrase "century of the common man." But also the classes which formerly were economically and socially very privileged indeed have seen their predominance cut down by high income and inheritance taxes, by the high cost of the services their domestic and other retainers once gave them so inexpensively, and by the strong disapproval many of their fellow citizens feel for excessive social display and economic expenditure. Everywhere in the West the great houses and country estates, those of British peers and those of American millionaires, were by 1950 being lost to their owners, turned into schools, convents, or to other institutional uses, made into museums and public parks. There is still, however, even in semisocialist England, a great difference between incomes and standards of living at the top and at the bottom of a social pyramid by no means quite flattened out of existence. In the United States, though the days of the robber barons, the great magnates of the late 19th century are over, the executives of American business and their professional allies are in mid-century a very prosperous class indeed. Again, however, even at the bottom of the social scale in the United States, the standards of living of the poorest classes have clearly improved since 1900.

Public Health.—This improvement in living standards (q.v.) for all, and especially for the poorer classes, has been achieved in part by the great progress of public health (q.v.) administration; and this progress in turn owes much to progress in medical research. Behind all this, however, lies a change in social psychology. In the 19th century Herbert Spencer had announced that it was tyrannical violation of the rights of man for a city government to oblige a property owner to put in a sewer; he even undertook to

show that compulsory sewer facilities increased typhoid! By 1950 Spencer's attitude was about as old-fashioned an attitude as is conceivable. The public everywhere in the West, and increasingly even in the East, accepted all sorts of hygienic compulsions, including compulsory vaccination. Typhoid, diphtheria, tuburculosis, and many other diseases had yielded in large part to the combined attack of public and private medical and sanitary authorities.

The improvement in public health as measured by the average life span did not mean that the human race had conquered pain and disease. Indeed the prophets of doom insisted that there was an absolute increase in mental illness, and a compensating increase in the so-called degenerative diseases, cancer, heart disease, and the like, which had by no means been conquered by 1950; and some maintained that the long-run biological prospects of the race were bad, with teeth degenerating, hair disappearing, chests narrowing. But the base from which any such conclusions might be drawn is clearly inadequate. No one can be sure, in mid-20th century, whether the race is physically advancing or retreating. Of improved public health and sanitation we can, however, be sure. See also SOCIAL WELFARE.

Literacy and Leisure.—We can also be sure of another important social fact. In the West, the struggle to conquer illiteracy has practically been won. In Russia, even the most hostile outside observer has to grant that in the 40 years of Communist rule great strides have been taken against illiteracy. In Asia and in Africa the process of educating the masses to read and write has everywhere begun. In the West popular education now goes far beyond the earlier aim of the "three R's"; indeed education at the secondary level is now close to universal in the United States, and is approaching this goal in many parts of the Western World.

Again, the pessimistic critics point out that the masses use their literacy and their new secondary education, not to read the best of their cultural inheritance, but, if they really read at all, to follow the comics, cheap newspapers, vulgar and tasteless writing of all sorts. In the West, the masses have already attained an amount of leisure predicted in 1900 only by Utopian novelists; and elsewhere in the world the latest technological revolution bids fair to spread this leisure widely. So far, the use of this leisure made by the masses does not satisfy intellectuals bred in the tradition of Western liberal education.

Uniformity and Conformity.—Some of these intellectuals are afraid that the general social trends of the last half-century will overwhelm their own cherished culture in a wave of conformity with cheapened mass standards. To them the noticeable shift in almost all fields of social relations, the shift from laissez-faire individualism to government regulation and social controls, though it has spread greater material comfort and security more widely, still has had its bad side. To these observers the main social trend of the 20th century has been to promote uniformity at the expense of originality and individuality, security at the expense of potentially creative risk, equality at the expense of liberty.

Publicists of all sorts, from prophets to novelists, developed variants on these themes. In the United States, educators by 1950 were fond of complaining that their students no longer looked forward to making their own way in the world as individual enterprisers, as their own bosses; they wanted a safe career, with assured wages, and a pension after early retirement. Novelists, led perhaps by the Sinclair Lewis who wrote *Main Street* and *Babbitt,* had long been complaining that the United States was a desert of social and intellectual uniformity, that ours was a machine-made culture, that life in Portland, Maine, was exactly like life in Portland, Oregon.

Even in those old lands of feudal diversity, Britain and France, there were intellectuals who worriedly predicted that the Americanization of the world was at hand, an Americanization which would make western Europe one dreary round of prefabricated life, frozen food, and inane commercial art. Other commentators stressed the danger that in our 20th century Western pursuit of comfort and security for all, we might lose the stimulus to invention, innovation, and dynamic change, which, they maintained, must come from individuals trying to be different from their fellows, or forced by frustration to be different from them. In the too well-adjusted society, perhaps, decay is bound to set in; for maladjustment is the mother of invention. And without invention, a society must go backward.

Those who prefer more abstract terms of political philosophy sometimes put the social problem of the 20th century in its most general form as maintaining a fruitful tension between the ideals of liberty and of equality. Pursuit of the ideal of liberty unqualified leads, they maintain, to putting a premium on the activities of exceptionally gifted individuals, who thereby acquire excessive rewards in property and prestige, and to letting the relatively less gifted lapse into poverty and unhappiness. On the other hand, emphasis on equality of reward and condition, whether achieved by governmental intervention through differential taxation, guaranteed employment, and other semisocialist measures or by the unorganized but real pressure of public opinion, will wholly discourage individual initiative and originality, and produce a mediocre society where all are at a dead level. A sound modern society, they argue, must hold its drives toward equality and liberty in something like a fruitful balance. At mid-century it looks to even the more moderate of such critics as though the general tendency throughout the West, at least, is to overemphasize the ideal of equality at the expense of the ideal of liberty.

Yet the complex facts of the modern world do not wholly bear out these diagnoses, which have in common the assertion that our society is coming nearer a pole of static uniformity and drawing away from a pole of dynamic variety. In economic activity, as we saw earlier, the total productivity of our society has right up to 1956 continued the dynamism begun when the modern age grew out of the medieval. Indeed, this total productivity has increased since 1900 at a rate relatively more rapid than ever before.

Even in the aspect so painful to novelists and other intellectuals, it can be doubted whether the 20th century has seen a marked development of physical uniformity at the expense of diversity. Those who really persuade themselves that there are no differences between life in New England and in the Old South, or between life in Chicago and life in Los Angeles, are not fully using eyes, ears, and noses. One neon-lighted modern shopping street looks much like another, not only in a given county, but to a degree throughout the

world. But first, there are the layers the past has left, layers by no means invisible even in the newest parts of the West; there are the inescapable differences of climate and physiography, which modern man has not eliminated; there are, to the observing eye, differences even in fields where fashion should promote uniformity. Perhaps most clear of concrete details: though radio, television, schoolteachers, and wide travel ought theoretically perhaps to achieve what the intellectuals say Americans already have, a uniform spoken tongue, no one with an ear can miss the very great varieties of accent in the United States. And, though no doubt a rough standard American spoken language has emerged —as has a rough standard English or Italian— certain variants also seem to be growing, notably a kind of New York metropolitan accent.

Indeed, and even within a single nation such as the United States, the observer who took systematically into account all the range of human variation from taste in food to opinions in politics and religion, from hobbies to ultimate metaphysical commitments, might well be more impressed with existing variation than with existing uniformity. He would of course recognize that the identities of fashion often temporarily sweep all before them, but he would also recognize that fashion by its very essence must vary in time. And were he to test opinion on high matters— say religion—he could hardly fail to be impressed with the wide range of concrete, established religious affiliations, to say nothing of the almost infinite variations among the "lunatic fringe."

The Alienation of the Intellectuals.— There is no doubt that the "century of the common man" has been in a sense a period of social and economic leveling, that in some ways the kind of vulgar mediocrity and intolerance of eccentricity, of diversity, of the uncommonplace, perhaps best analyzed in works like José Ortega y Gasset's *Revolt of the Masses,* is very real, and a very real threat to traditions the West has prized for millennia. On the other hand, there is every evidence that our society has reacted and is reacting against this particular threat; there is every evidence that the human spirit is not going to steer society into the ways of the anthill or the beehive. Indeed, the excessive and unrealistic worries of some 20th century intellectuals are in themselves a sign of one of the striking social developments of the century, a development begun much earlier in the modern period, but in the last 50 years attaining an especially conspicuous growth. This is the phenomenon the sociologist calls the "alienation of the intellectuals," a consciousness shared by many, perhaps most, people devoted to the arts, to literature, to science and learning, that they are not like the rest of mankind.

Intellectuals in the Enlightenment of the 18th century were keenly aware that they were different—indeed they believed they were wiser, more "rational," and therefore better than their fellows. But they also believed that the great masses were potentially as good as the intellectuals themselves, indeed just like them, but held down in depression and ignorance by a very few privileged villains of the upper classes. The 19th century saw in the West a great development of democracy, and especially of universal education; but the newly emancipated and newly educated masses obviously did not for the most part turn into Voltaires, Rousseaus, Jeffersons, and Franklins; they seemed to confirm the liberal John Stuart Mill's illiberal remark: "but ordinary human nature is so poor a thing."

Already in the 19th century the intellectuals had begun to blame the bourgeoisie for the failure of Western culture to live up to the high hopes the Enlightenment. With the war of 1914 and the depression of the 1930's, this alienation of the intellectuals was intensified throughout the free West. The degree and nature of the alienation varied in the different countries; so too did the attitude toward intellectuals of the non-intellectuals, both in the actual ruling and possessing classes and in the masses. But it was a rare writer in any Western country who commanded the respect of the intellectuals as a serious writer and who yet could be described as conformist, as praising the existing regime after the manner of a Virgil, a Boileau-Despréaux, an English Elizabethan, or who even, indeed, tended to accept the existing regime as at least viable, as did many of the great Victorians. It was a rare painter by the 1950's who could earn the praise of the advanced, the expert, the connoisseur, and still find his paintings reproduced and hung in the new little houses of suburbia.

The depth, importance, and ultimate meaning of this separation between the "highbrows," "long hairs," "eggheads" (all recent American slang terms, and all scornful) and the rest of society in the free West could not be objectively estimated in the 1950's. The future would have to tell whether or not the breech would be healed. Moreover, it was by no means an absolute breech. In such great emergencies as World War II all groups in the great democracies—in the end, even in disrupted France—united against the totalitarian threat. It may well be that in the new society the intellectual will be called upon to play the role of gadfly or stimulant, of goad in such a way as yet not to menace diastrous social cleavages. The eggheads and their fellow men may yet settle down into something less than a cold war.

Certainly a brief review of social developments in the 20th century, though it must not lightly dismiss the danger that either the democratic or the totalitarian way of life, or both, may turn into mass conformity, the tyranny of the majority, cannot fairly conclude that in this varied, contentious, energetic, indeed restless world of today there is yet a condition of deadening social and cultural uniformity. Man is not yet subdued to the unvarying social routines of the anthill. So far, and in spite of many threats, many efforts to quiet them, even the alienated intellectuals in the democracies have generally had full freedom to publish their fears and fancies.

Certainly no one is wise enough to decide whether the present world is, in terms of 18th and 19th century concepts of progress, on its way up or down. As we stated at the beginning of this article, all the material indices of the statistician have continued since 1900 to go up, sometimes, as with total population, as fast as the most hopeful 19th century prophet could have believed they would. The fears and hesitancies, the doubts about progress, in the writings of intellectuals are also there. What we have called the alienation of the intellectuals makes it hard to decide how far they do in fact reflect the feelings of the many. It seems likely that even in the West, to say nothing of the lands of Asia and Africa now newly come to the idea of progress,

the many still believe better things here on earth are in store for them, or at least for their children. At any rate, the world remains a very lively place indeed; there are no preliminary indications of the silence of death. In one of his best-known passages, T. S. Eliot, surely a representative figure of the age, wrote in 1925 in *The Hollow Men:*

> This is the way the world ends
> Not with a bang but with a whimper.

One inclines to believe that Eliot was quite wrong. The bang may yet come. But the whimpering is hardly noticeable now, there is so much other noise, from the iron foundry and the airplane engine to the political meeting and the concert platform.

See also Social Reform Programs and Movements; Twentieth Century; War, European; World War II; also the historical sections of the several country articles.

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WORLD EVENTS FROM 1500. The following chronology of the modern world begins with the year 1500 A.D. This date is a convenient and widely-used starting point for modern times. The growth of cities and the revival of trade which go back to about the 11th century, the beginnings of the rise of national monarchies in the 12th century, the explorations dating back from the time of Marco Polo (1254?–?1324) and before, the coming of Arabic and Greek science in the 12th century—all of these things which raised medieval civilization to new heights are examples as well of the long and slow path to the modern world. Similarly, medieval forms, such as serfdom, were to remain in parts of the world for many centuries longer, often taking on a new significance in a new context. This chronology is not restricted to Western civilization, but it does emphasize it, for up to now it has been the West which has been modern, and which has enlarged the drama of history to its present worldwide stage.

1501—Second voyage of Amerigo Vespucci whose published account of it led to use of name America.
1501—Negro slavery was introduced by Spanish in West Indies.
1502—Last voyage of Columbus.
1509–1547—Reign of Henry VIII in England.
1511—Portuguese capture Malacca, center of the East Indian spice trade.
1512—Discovery of Florida by Ponce de León.
1513—Discovery of Pacific Ocean by Vasco de Balboa.
1513—*The Prince* written by Niccolò Machiavelli.
1516–1556—Reign of Charles V in Spain.
1517—Martin Luther launches Protestant Reformation by his 95 theses.
1519–1522—Ferdinand Magellan's ships circumnavigate the earth.
1519–1521—Conquest of Mexico by Hernán Cortés.
1520–1566—Suleiman the Magnificent, high point of Ottoman Empire.
1526—Baber, first Mogul emperor in India.
1531—First stock exchange at Antwerp, Belgium.
1531–1533—Conquest of Peru by Francisco Pizzaro.
1533–1584—Reign of Ivan IV (the Terrible) in Russia.
1534—Henry VIII separates Church of England from Rome: Act of Supremacy.
1534–1542—Voyages of Jacques Cartier to America.
1539–1542—Hernando de Soto explores Florida and area in future southeastern United States.
1541–1552—St. Francis Xavier's mission to the East.
1540—Official founding of the Society of Jesus.
1540–1542—F. V. Coronado explores northern Mexico and the southwest.
1543—*Revolutions of the Heavenly Orbs* by Nicolaus Copernicus.
1543—*Structure of the Human Body* by Andreas Vesalius, founder of modern anatomy.
1545–1563—Council of Trent; reforms in the Roman Catholic Church.
1555—Peace of Augsburg temporarily settles Roman Catholic-Protestant conflict in Germany.
1556–1605—Reign of Akbar the Great, Mogul emperor in India.
1556–1598—Reign of Philip II in Spain.
1558–1603—Reign of Queen Elizabeth I in England.
1562–1598—Wars of Religion in France.
1563—Thirty-nine Articles of the Church of England.
1564–1616—William Shakespeare, English dramatist and poet.
1564–1642—Galileo Galilei, Italian physicist and astronomer.
1566—Beginning of the revolt of the Netherlands against Spain.
1568–1600—Nobunaga in 1568 initiated the period of national unification in Japan.
1571—Battle of Lepanto ends Turkish supremacy in the Mediterranean.
1571–1630—Johannes Kepler, German mathematician and astronomer.
1572—Massacre of Huguenots in France on St. Bartholomew's Day.
1582—Pope Gregory XIII adjusts the Julian calendar and advances October 5 to October 15 in Catholic countries, thus establishing the Gregorian calendar.
1587—John White, under the auspices of Sir Walter Raleigh, establishes colony on Roanoke Island off North Carolina coast.
1588—Defeat of Spanish Armada by English fleet.
1589–1610—Reign of Henry IV in France; establishment of Bourbon dynasty.
1598—Edict of Nantes gives rights to Huguenots in France.
1601—Poor Law enacted in England.
1603—The beginning of the Tokugawa period in Japan; strict social hierarchy.
1603–1625—Reign of James I in England; foundation of Stuart dynasty.
1605—Gunpowder Plot and arrest of Guy Fawkes.
1607—Founding of Jamestown in Virginia.
1608—Samuel de Champlain founds the city of Quebec.
1609—Henry Hudson discovers the Hudson River for Dutch.
1609—Expulsion of Moors in Spain.
1613—Foundation of Romanov dynasty in Russia by Michael Romanov.
1613—Dutch establish trading post on Manhattan Island.
1614—Meeting of last French Estates-General before French Revolution of 1789.
1616—William Harvey, Englishman, demonstrates the circulation of the blood.
1618–1648—Thirty Years' War in Europe.
1620—Foundation of Plymouth Colony on Cape Cod under the Mayflower Compact.
1624–1642—Administration of Cardinal Richelieu in France.
1625–1649—Reign of Charles I in England.
1627–1691—Robert Boyle, British physicist and chemist.
1628—Petition of Right in England; important constitutional landmark.
1630—Founding of Massachusetts Bay Colony.
1632–1704—John Locke, English philosopher and political theorist.
1640–1660—Long Parliament in England.
1640–1688—Frederick William of Brandenberg, the great Elector.
1641—Dutch capture Malacca and end Portuguese empire in Far East.
1642—Tasmania and New Zealand discovered.
1642–1649—Civil war in England.
1643–1715—Reign of Louis XIV in France.
1644–1912—Ch'ing Dynasty in China.
1646–1716—Gottfried Wilhelm von Leibniz, German philosopher and mathematician.

1648—Peace of Westphalia ends Thirty Years' War.
1649–1660—Period of Commonwealth in England.
1652—Capetown in Africa founded by the Dutch.
1652–1674—Three Anglo-Dutch wars.
1660–1685—Restoration of Stuarts in England.
1664—English seize New Netherlands from Dutch and rename it New York.
1670—Establishment of the Hudson's Bay Company.
1673—Fathers Louis Joliet and Jacques Marquette reach Mississippi River.
1676—Nathaniel Bacon's Rebellion in Virginia.
1683—Turks turned back at gates of Vienna by army under John III Sobieski, king of Poland.
1685—Revocation of Edict of Nantes in France; emigration of Huguenots.
1687—Sir Isaac Newton's *Philosophiae Naturalis Principia Mathematica* (*The Principia*).
1688—Glorious Revolution in England.
1689–1697—War of the League of Augsburg (in America, King William's War).
1689—English Bill of Rights: basic document in British constitution, and a charter of civil liberties.
1689—Treaty of Nerchinsk opens Chinese trade to Russia.
1689–1725—Reign of Peter the Great in Russia; Westernization in Russia.
1694—Founding of the Bank of England.
1697–1718—Reign of Charles XII in Sweden.
1699—French establish colony in Louisiana.
1701–1713—Reign of Frederick I and establishment of kingdom of Prussia.
1701–1714—War of the Spanish Succession (in America, Queen Anne's War, 1702–1713).
1706–1790—Benjamin Franklin, American statesman, scientist, and writer.
1707—Union of England and Scotland.
1709—Russians defeat Swedes at Poltava.
1711–1776—David Hume, Scottish philosopher and historian.
1712–1778—Jean Jacques Rousseau, French author and reformer.
1713—Treaty of Utrecht practically ends War of the Spanish Succession. Great Britain appears as a great power.
1713–1740—Reign of Frederick William I of Prussia.
1714–1727—Reign of George I of England: establishment of House of Hanover.
1716–1745—Yoshimune is shogun in Japan.
1721—Peace of Nystad ends Russo-Swedish wars.
1721–1742—Ministry of Robert Walpole in England.
1723–1790—Adam Smith, Scottish economist and philosopher.
1724–1804—Immanuel Kant, German philosopher.
1726–1743—Administration of Cardinal André Hercule de Fleury in France.
1729–1797—Edmund Burke, British statesman and political philosopher.
1732–1792—Sir Richard Arkwright, English inventor and founder of the factory system.
1733–1738—War of the Polish Succession.
1738—John Wesley begins Methodist revivals.
1739–1743—War Between Spain and England (in America, War of Jenkins' Ear).
1740–1748—War of Austrian Succession (in America, King George's War, 1743–1748).
1740–1786—Reign of Frederick the Great in Prussia.
1741—Vitus Bering, Danish navigator, explores Alaska for Russians.
1748–1832—Jeremy Bentham, English utilitarian philosopher and social reformer.
1749–1823—Edward Jenner, English physician and discoverer of vaccination.
1749–1832—Johann Wolfgang von Goethe, German poet.
1752—Adoption of the Gregorian calendar by Britain and her colonies.
1756–1763—England defeats France in Seven Years' War under inspiration of William Pitt (the Elder; in America, French and Indian War, 1754–1763).
1757—Robert Clive and the English defeat the French at Plassey in India.
1759—James Wolfe defeats Louis Joseph de Montcalm at Quebec.
1759–1806—William Pitt (the Younger), British statesman and opponent of Napoleon.
1762–1796—Reign of Catherine the Great in Russia.
1763—Treaty of Paris ends Seven Years' War: New France and Mississippi's left bank (part of Louisiana) yielded to England.
c. 1764—James Hargreaves invents the spinning jenny.
1768–1775—Voyages of Captain James Cook to Australia, New Zealand, and the South Seas.
1769—James Watt patents the steam engine.
1770–1831—Georg Wilhelm Friedrich Hegel, German idealist philosopher.
1772—First partition of Poland.
1774—Quebec Act provides for French Canadians and angers English colonists.
1775—Concord and Lexington battles kindle American Revolutionary War (1775–1783).
1780–1790—Joseph II of Austria introduces reforms and religious toleration.
1783–1830—Simón Bolívar, the liberator of Venezuela, Colombia, Peru, and Bolivia.
1784—British Parliament passes the India Act.
1785—Edmund Cartwright invents the power loom.
1787–1789—United States adopts federal form of government under the Constitution.
1788—First British settlements in Australia.
1788–1824—George Gordon Byron, English poet and hero of Romantic Age.
1789—George Washington becomes first president of the United States under the new federal Constitution.
1789—Beginning of the French Revolution.
1791—The Constitutional Act established new government in Upper and Lower Canada.
1792—First French Republic established.
1793–1794—Reign of Terror in France.
1793—Second partition of Poland.
1794—Eli Whitney invents the cotton gin.
1795—Third partition of Poland.
1795–1799—Rule of Directory in France.
1798—Thomas Robert Malthus, *An Essay on the Principle of Population.*
1798–1857—Auguste Comte, French philosopher and the founder of sociology.
1799–1804—Rise of Napoleon Bonaparte in France; overthrow of the Directory and establishment of the Consulate with Napoleon as first consul.
1799–1850—Honoré de Balzac, French novelist.
1801–1809—Presidency of Thomas Jefferson.
1801–1825—Reign of Alexander I in Russia.
1802–1805—Victor Hugo, French poet and novelist.
1803—United States purchases Louisiana from France.
1804–1814—Reign of Napoleon as emperor of the French.
1805—British admiral Horatio Nelson defeats French and Spanish fleets at Trafalgar.
1806—End of the Holy Roman Empire.
1807—Robert Fulton introduces successful steamboat on Hudson River.
1808–1814—Peninsular War; France fights England and Spanish guerrillas in Spain.
1810–1825—Successful revolt of Spanish and Portuguese colonies in Latin America.
1812—Napoleon's disastrous invasion of Russia.
1812–1815—War of 1812 between United States and Great Britain.
1812–1870—Charles Dickens, English novelist.
1813–1814—Capture of Paris in March and the abdication of Napoleon in April.
1814—George Stephenson invents the locomotive.
1814–1848—Dominant influence of Prince Klemens von Metternich of Austria in central Europe.
1815—Napoleon escapes from Elba, but is defeated by the Duke of Wellington at Waterloo.
1818–1883—Karl Marx, German socialist, author of *Das Kapital.*
1820—Missouri Compromise postpones conflict over slavery in the United States.
1820–1903—Herbert Spencer, English evolutionary philosopher and sociologist.
1821—Mexico wins independence from Spain.
1823—Monroe Doctrine proclaimed.
1825—Decembrist uprising in Russia.
1825–1830—Dutch supress Javanese revolt.
1827–1912—Joseph Lister, English surgeon, founder of aseptic surgery.
1829—Independence of Greece from Ottoman domination.
1829–1837—Presidency of Andrew Jackson.
1830—July Revolution in France.
1830–1833—Sir Charles Lyell's *Principles of Geology.*
1830–1848—Reign of Louis Philippe in France.
1831—Giuseppe Mazzini forms Young Italy, a revolutionary republican society.
1832—First Parliamentary Reform Bill in England.
1832–1920—Wilhelm Wundt, German founder of experimental psychology.
1837—Rebellion in Upper and Lower Canada.
1837–1901—Reign of Queen Victoria in Great Britain.
1838–1848—Chartism in England.
1839—Earl of Durham (John George Lambton) issues *Report on the Affairs of British North America.*
1839–1913—John D. Rockefeller, organizer of the American petroleum industry.
1840–1842—First Opium War between Britain and China, leads to British access to Chinese trade and control of Hong Kong.
1843–1910—Robert Koch, German pioneer bacteriologist.
1844—Charles Goodyear of the United States, patents the process of vulcanizing rubber.
1844—Samuel F. B. Morse transmits the first telegraph message.
1845—United States annexes Texas.

1846—Repeal of the Corn Laws in Great Britain.
1846–1847—Irish potato famine causes mass emigration to the United States.
1846–1848—War between United States and Mexico; United States acquires vast territory in the Southwest and California.
1848—Discovery of gold in California at Sutter's Mill.
1848—The *Communist Manifesto* by Karl Marx and Friedrich Engels.
1848—Universal manhood suffrage law in France; first of its kind in Europe.
1848–1851—Second French Republic.
1849–1873—African explorations of David Livingstone from Scotland.
1850–1864—Taiping Rebellion in China.
1851—Louis Napoleon overthrows Second French Republic.
1852–1870—Second French Empire: Louis Napoleon as Emperor Napoleon III.
1852—Count Camillo Benso di Cavour becomes premier of Sardinia.
1852—Publication of Harriet Beecher Stowe's *Uncle Tom's Cabin.*
1853–1854—Commodore Matthew Perry breaches the isolation of Japan.
1853–1856—Crimean War: Russia loses to Turkey, Great Britain, France and Sardinia.
1854—Kansas-Nebraska Bill sharpens conflicting views on slavery in the western territories.
1855—Henry Bessemer patents new method of making steel in England.
1856–1939—Sigmund Freud, Austrian founder of psychoanalysis.
1857—Indian Mutiny, starting with Sepoy revolt.
1858—England assumes government of India.
1859—Edwin Laurentine Drake drills first oil well at Titusville, Pa.
1859—Publication of Charles Darwin's *On the Origin of Species by Means of Natural Selection.*
1861—Emancipation of the serfs in Russia.
1861–1865—Presidency of Abraham Lincoln; the American Civil War.
1862—Otto von Bismarck becomes premier of Prussia.
1862–1867—French invade Mexico and attempt to secure it for Emperor Maximilian.
1863—Lincoln issues Emancipation Proclamation.
1864—International Workingmen's Association (the First International) is founded.
1865—Gregor Johann Mendel, an Austrian, publishes his law of biological inheritance.
1865–1877—Reconstruction period in the United States.
1866—First transatlantic cable connects England and the United States.
1866—Prussia becomes the leading German state as a result of the Austro-Prussian War.
1867—Second Parliamentary Reform Bill in England.
1867—United States Secretary of State W. H. Seward negotiates purchase of Alaska from Russia.
1867—Founding of North German Confederation.
1867—Dominion of Canada established: Confederation.
1867—Austria-Hungary becomes dual monarchy.
1868—Fourteenth Amendment to the United States Constitution ratified.
1868–1894—Benjamin Disraeli (and his Conservative successor, the 3d marquess of Salisbury) alternates as British prime minister with the Liberal, William Gladstone.
1868–1912—Meiji Restoration in Japan: Westernization as Japan becomes great power.
1869—Opening of Suez Canal.
1870—Kingdom of Italy united with capital at Rome.
1870–1871—Franco-Prussian War results in defeat of France and loss of Alsace-Lorraine.
1871—William I crowned emperor of Germany at Versailles.
1871—Uprising of the Commune of Paris suppressed.
1875—English purchase Suez Canal shares from khedive of Egypt.
1876—Alexander Graham Bell invents telephone.
1876—Queen Victoria proclaimed empress of India.
1878—Signing of Treaty of San Stefano ends Russo-Turkish War.
1878—Congress of Berlin modifies Treaty of San Stefano and thwarts Russian aims.
1879—Thomas A. Edison perfects the incandescent electric lamp.
1880–1881—First Boer War.
1881—Assassination of Alexander II of Russia.
1882—Formation of Triple Alliance of Germany, Austria, and Italy.
1882—British take over control of Egypt.
1883–1889—Otto von Bismarck's social insurance laws.
1883–1893—French extend their power in Indochina.
1884—William Ewart Gladstone's Third Reform or Franchise Bill brings almost complete universal manhood suffrage in the United Kingdom.
1885—Louis Pasteur develops treatment for hydrophobia.
1885—Leopold II of Belgium becomes sovereign of Congo Free State.
1886—William Gladstone's first Irish Home Rule bill.
1887—Gottlieb Daimler of Germany builds the first successful automobile powered by internal combustion engine.
1889—Formation of Second (Socialist) International.
1889—Edison invents the Kinetoscope, a pioneer motion picture projector, using film perfected by George Eastman.
1893—William Gladstone's second Irish Home Rule bill.
1894—Franco-Russian alliance.
1894–1895—Japanese demonstrate effective use of modern instruments of warfare in victorious Sino-Japanese War; Korea comes under Japanese control.
1894–1906—Dreyfus affair in France.
1898—Radium discovered by Pierre and Marie Curie.
1898—Spanish-American War resulting in liberation of Cuba and United States acquisition of Philippines, Puerto Rico, and Guam.
1898—Hawaii annexed by the United States.
1898—Fashoda Incident: British and French spheres of influence clash in Africa.
1899—United States secretary of state, John Hay, enunciates Open Door Policy for China.
1899—First Hague Peace Conference defines the laws of war and creates a permanent court of arbitration.
1899–1902—South African (Boer) War.
1900—Quantum theory discovered by Max Planck, German physicist.
1900—Second German naval law expands fleet, establishes basis for naval armaments race with England.
1900—Boxer Rebellion in China; Western military intervention; Russian occupation of Manchuria.
1901—The Commónwealth of Australia organized.
1901—Death of Queen Victoria; accession of Edward VII.
1901–1909—United States presidency of Theodore Roosevelt.
1902—Ernest Rutherford's and Frederick Soddy's disintegration theory of radioactivity.
1902—Anglo-Japanese alliance providing for independence of China and special rights of Japan in Korea.
1902—Tariff law in Germany raises duties on grain, completing alliance of industrialists and agrarians.
1903—United States recognizes three-day-old Republic of Panama: leads to United States building of Panama Canal.
1903—First successful airplane flight by Orville and Wilbur Wright.
1904—Russo-Japanese War opens following Russian failure to evacuate Manchuria.
1904—Northern Securities Case decision by United States Supreme Court legalizes "trust-busting" program of Theodore Roosevelt.
1904—Anglo-French Entente on Egypt and Morocco.
1904—Zemstvo Congress at St. Petersburg demands representative assembly and civil liberties from Russian czar.
1905—Albert Einstein's "special" theory of relativity.
1905—First Moroccan crisis precipitated by Tangier speech of German emperor William II claiming Morocco open to all.
1905—The unsuccessful Revolution of 1905: outbreak of general strike in Russia leading to October Manifesto of Nicholas II granting a constitution; insurrection of Moscow workers.
1905—Separation of Sweden and Norway by treaty.
1905—Law for separation of church and state in France on initiative of Aristide Briand.
1906—British battleship *Dreadnought* is launched, stimulating arms race.
1906—End of Algeciras Conference which affirms Morocco's independence, but France and Spain to share in administration of country.
1907—Triple Alliance (Germany, Austria, Italy) is renewed.
1907—Anglo-Russian Entente divides Persia.
1907—Papal encyclical of Pius X condemns modernism.
1908—Appearance of *Réflexions sur la Violence* by Georges Sorel, leading syndicalist theorist.
1908—Austria announces annexation of Bosnia and Hercegovina; anti-Austrian excitement in Serbia, Turkey, Russia.
1908—Henry Ford introduces the Model T Ford.
1908—Mohandas K. Gandhi begins his campaign for social and political equality in India.
1909—Robert Peary, American explorer, reaches the North Pole.
1910—Constitution for new Union of South Africa goes into effect.
1910—Death of Edward VII; George V becomes king of England.

1910—Portugal becomes a republic.
1910—Russian-Austrian agreement to maintain status quo in Balkans.
1910—Japan annexes Korea.
1910—*Principia Mathematica* by Alfred North Whitehead and Bertrand Russell, a landmark in the development of logic and mathematics.
1911—Second Moroccan Crisis, settled November 4; France is assured free hand in Morocco in return for Congo cessions to Germany.
1911—Roald Amundsen, Norwegian explorer, reaches the South Pole.
1911—Chinese Revolution begins. Dr. Sun Yat-sen elected provisional president of new republic.
1911–1912—Tripolitan War between Italy and Turkey leads to Italian annexation of Tripoli.
1912—Morocco becomes a French protectorate.
1912—Elections in Germany establish socialists as strongest party in Reichstag.
1912–1913—First Balkan War: Bulgaria, Serbia, Montenegro, and Greece defeat Turkey.
1913—Second Balkan War: Serbia, Greece, Rumania, and Turkey defeat Bulgaria.
1913—Federal Reserve Act in the United States.
1913–1921—United States presidency of Woodrow Wilson.
1914—Assassination of Austrian archduke Francis Ferdinand at Sarajevo on June 28, 1914 by a Serbian nationalist, leads to Austrian ultimatum to Serbia.
1914—Austria declares war on Serbia. General mobilization of army in Russia. Germany declares war on Russia. German ambassador in Paris tells French premier state of war exists between Germany and France. Germany begins invasion of Belgium, declares war against France. Great Britain declares war against Germany.
1914—Panama Canal opened.
1914–1918—World War I.
1915—Steamship *Lusitania* is torpedoed and sunk by German submarine; over 100 Americans among 1,198 lost.
1916—Albert Einstein's "general" theory of relativity.
1916—*Democracy and Education*, one of the most influential works of American philosopher John Dewey.
1917—Monarchy is overthrown and provisional government is established in Russia following strikes and army mutiny at St. Petersburg (now Leningrad).
1917—United States declares war on Germany on April 6.
1917—Col. Thomas Edward Lawrence (Lawrence of Arabia) with British support assumes leadership of Arab revolutionary movement against Turkey.
1917—Bolshevik Revolution in Russia under V. I. Lenin and Leon Trotsky on November 6.
1917—United States purchases Virgin Islands from Denmark.
1917—Balfour Declaration states that Britain favors establishing Palestine as a national home for the Jewish people.
1918—Woodrow Wilson presents Fourteen Points to United States Congress.
1918—Russia accepts Treaty of Brest-Litovsk: Russia leaves the war, abandons Poland, Ukraine, Baltic area.
1918—Allied offensive in West, United States troops participating.
1918—Polish Republic proclaimed at Warsaw.
1918—Armistice concluded on November 11 with Germany after abdication of Emperor William II and proclamation of German Republic.
1919—Bauhaus school of architecture stressing modern functional design founded at Weimar by Walter Gropius.
1919—Eighteenth Amendment (prohibition) to the United States Constitution ratified.
1919—Treaty of Versailles signed with Germany.
1919—In Hungary monarchists overthrow Béla Kun, and Bolsheviks.
1919—Treaty of St. Germain with Austrian Republic completes territorial breakup of Habsburg monarchy.
1919—United States Senate refuses to ratify Versailles Treaty.
1919—The Third (Communist) International established.
1920—First commercial radio broadcasts at Pittsburgh, Pa.
1920—Official founding of League of Nations.
1920—Palestine assigned to Britain with authority to establish national homeland for Jews.
1920—Nineteenth Amendment (women's suffrage) to the United States Constitution becomes effective.
1920—Transcontinental airmail service inaugurated in United States.
1920—Treaty of Rapallo: Germany and Soviet Russia mutually renounce reparations.
1920—Northern and Southern Ireland separate.
1921—Little Entente founded by Czech-Yugoslav treaty.
1921—Inauguration of New Economic Policy (NEP) in Russia involving partial return to capitalism in agriculture and industry.
1921—Allies set German reparations at 132 billion gold marks.
1921—Treaty creates Irish Free State as British Dominion, leaves Irish republicans dissatisfied.
1922—*Der Untergang des Abendlandes . . .* (*Decline of the West*) by Oswald Spengler is completed, which sees Western civilization as in a state of decay.
1922—Union of Soviet Socialist Republics established.
1922—Egyptian independence is recognized by Great Britain.
1922—Benito Mussolini becomes premier of Italy.
1922—Irish Free State officially proclaimed with new constitution.
1923—Occupation of Ruhr by France and Belgium over reparations; Germans respond by general strikes; strikers paid by printing new money, causing runaway inflation in Germany.
1923—Spanish military dictatorship established by General Miguel Primo de Rivera y Orbaneja.
1923—Turkish Republic is proclaimed, Mustapha Kemal first president.
1924—British recognition of Soviet government.
1924—Greece becomes a republic.
1924—London Conference adopts Dawes Plan fixing German reparations and offering loans to Germany.
1925—Geneva Protocol for compulsory arbitration of international disputes adopted by League of Nations.
1925—Great Britain rejects Geneva Protocol.
1925—Pact of Locarno: the "spirit of Locarno" represents the attempt to safeguard peace through a system of treaties.
1926—Germany admitted to League of Nations.
1927—Chiang Kai-shek and conservatives in Kuomintang split with left, form new government at Nanking.
1927—Charles Lindbergh makes first continuous solo transatlantic flight from New York to Paris.
1928—Devaluation of French franc by about four fifths of its value.
1928—Kellogg-Briand Pact outlawing war.
1928—First Five-year Plan in Russia; development of heavy industry and collectivization in agriculture.
1929—Leon Trotsky expelled from Soviet Union, marking final victory of Joseph Stalin in struggle to succeed Lenin.
1929—Lateran Treaties create Vatican as an independent state.
1929—"Young Plan" approved, reduces German reparations.
1929—Stock market crash in United States begins depression.
1930—London Naval Conference to regulate naval armaments.
1930—Allied troops are withdrawn from Rhineland.
1931—Isotope of hydrogen is isolated by American, Harold Urey.
1931—Austrian Credit-Anstalt fails; European financial crisis.
1931—Hoover moratorium on intergovernmental debts is accepted.
1931—Japan begins military operations in Manchuria.
1931—Bank of England abandons gold standard; leads to devaluation of currencies by nearly all countries.
1932—Lausanne Conference on reducing reparations ends; United States rejects its proposals.
1932—Reichstag elections in Germany return 230 National Socialists, making this the largest single party.
1932—Albert Einstein's "unified" field theory of relativity.
1933–1945—United States presidency of Franklin D. Roosevelt.
1933—Start of New Deal social and economic legislation involving direct participation of federal government in directing the United States economy.
1933—Adolf Hitler becomes German chancellor; Enabling Act gives German government dictatorial powers, establishing rule of Hitler.
1933—Japan withdraws from League of Nations over issue of Manchuria.
1933—Germany and the Vatican sign a new concordat.
1933—Germany withdraws from League of Nations.
1933—United States goes off the gold standard.
1933—Twenty-first Amendment (repeal of prohibition) in the United States.
1934—Soviet Russia joins League of Nations.

1934—Newfoundland loses dominion status, becomes a crown colony (see *1949*).
1935—Plebiscite returns Saar Basin to Germany.
1935—Franco-Russian alliance against unprovoked aggression.
1935—Nürnberg Laws deprive German Jews of citizenship.
1935—Fifty-one nations in League of Nations Assembly vote economic sanctions against Italy for aggression in Ethiopia.
1935—Death of George V of England on January 20; Edward VIII abdicates December 10; George VI reigns.
1936—Germany reoccupies Rhineland, violating Versailles Treaty.
1936—Italy completes occupation of Ethiopia despite League of Nations.
1936—First Popular Front ministry in France.
1936—Spanish Civil War opened by army revolt against Popular Front government.
1936—New purges in Russian Communist Party.
1936—President Roosevelt attempts unsuccessfully to enlarge United States Supreme Court and secure majority sympathetic to his legislative program.
1937—Japan begins new campaign in China without declaration of war.
1938—German annexation of Austria.
1938—Munich Agreement by Hitler, Mussolini, Neville Chamberlain of Great Britain, and Edouard Daladier of France leads to division, then destruction of Czechoslovakia.
1938—General strike protests French government economy measures.
1939—German occupation of Bohemia and Moravia.
1939—Spanish Civil War is ended by surrender of Madrid to government of Gen. Francisco Franco.
1939—First regular television program service.
1939—Italy invades Albania, violating pact with England.
1939—German-Soviet Pact signed at Moscow.
1939–1945—World War II.
1939—German invasion of Poland on September 1.
1939—England and France declare war on Germany, September 3.
1939—Germany and Russia partition Poland.
1940—Germany invades Low Countries.
1940—Neville Chamberlain resigns, replaced by Winston Churchill and coalition cabinet.
1940—Evacuation of British Army at Dunkerque.
1940—Armistice between defeated France and Germany.
1940—Selective Service Act adopted by United States (first peacetime draft in United States history).
1940—Three-Power Pact between Germany, Italy, Japan.
1941—Roosevelt outlines Lend-Lease Program in a speech before Congress, enumerates Four Freedoms.
1941—Germany invades Russia on June 22.
1941—United States extends $1 billion Lend-Lease credit to Russia.
1941—Japanese air attack on Pearl Harbor, December 7, followed by general assault on United States and British Pacific possessions. United States declares war on Japan December 8.
1942—Battle of Coral Sea halts further Japanese advance in the South Pacific.
1942—United States landings in French North Africa.
1942—Pierre Laval succeeds Henri Pétain, heading French Vichy government.
1943—Penicillin used successfully in treating disease.
1943—Casablanca Conference ended; Roosevelt and Churchill announce plans to force "unconditional surrender" of enemy.
1943—Twenty-two trapped German divisions surrender at Stalingrad, February 2.
1943—Communist Third International is officially dissolved.
1943—Allied landings in Italy.
1943—Pay-as-you-go plan for income tax in the United States adopted.
1943—Jean-Paul Sartre, French philosopher and author, publishes *L'Être et le Néant* (*Being and Nothingness*), a major philosophical work of the existentialist movement.
1944—Anglo-American armies liberate France; Allied troops under Gen. Dwight D. Eisenhower invade Normandy.
1944—United States begins reconquest of Philippines at Leyte.
1945—Yalta Conference; Roosevelt, Churchill, and Stalin plan for ending war and for peace settlement.
1945—President Roosevelt dies, Harry S. Truman becomes United States president.
1945—V-E Day, German surrender is completed.
1945—San Francisco Conference ends, 50 nations having drawn up Charter for United Nations Organization.
1945—British Labour Party defeats Conservatives, begins socialization; Clement Attlee becomes prime minister of Great Britain.
1945—Potsdam Conference (Truman, Churchill, Attlee, and Stalin) continue discussion of postwar plans.
1945—Tito becomes premier of Yugoslavia.
1945—Atomic bomb is dropped on Hiroshima.
1945—Russia declares war on Japan.
1945—Japan accepts terms of surrender; war ends formally on September 2.
1946—First session of United Nations General Assembly.
1946—Nationalization of the Bank of England.
1946—Churchill's "Iron Curtain" speech at Fulton, Mo.
1946—Constitution for Fourth Republic in France adopted.
1947—Communist Information Bureau (Cominform) created.
1947—Truman Doctrine enunciated; aid requested for Greece, Turkey.
1947—Taft-Hartley Act passed over President Truman's veto.
1947—India becomes independent, divided into Dominion of India and the Dominion of Pakistan.
1947—London Conference fails to settle German reparations and control of the Ruhr.
1947—General Agreement on tariffs and trade (GATT) signed at Geneva by 23 nations to establish an international code of fair treatment in foreign trade.
1948—Communists seize control in Czechoslovakia.
1948—United States Congress passes the Marshall Plan for European economic recovery.
1948—Cominform expels Yugoslavia for deviationism.
1948—Christian Democrats defeat Communists in Italian election.
1948—Russian Berlin blockade is completed; Western airlift begins.
1948—The new State of Israel is founded with Chaim Weizmann as first president.
1948—Newfoundland becomes a province of Canada.
1949—Signing of North Atlantic Treaty for military cooperation.
1949—First non-stop flight around the world by United States bomber (94 hours, 1 minute).
1949—End of Berlin blockade.
1949—Federal Republic of Germany, with capital at Bonn, is created.
1949—Peoples Republic is proclaimed by Chinese Communists.
1949—Soviet-controlled German Democratic Republic is established in East Germany.
1949—United States Communist Party leaders convicted of conspiracy.
1949—Independent Indonesian republic established with Dutch approval.
1950—Schuman Plan ratified by French government.
1950—Communist North Korea invades South Korea.
1950—United Nations Command to aid South Korea established.
1950—Intervention of Chinese military forces in Korea.
1951—Winston Churchill again becomes prime minister of Great Britain.
1951—European Coal and Steel Community founded by France, West Germany, Italy, Belgium, the Netherlands, and Luxembourg.
1952—Republican candidate Eisenhower elected United States president.
1952—Twenty-second Amendment to United States Constitution enacted (two term limitation for presidency).
1952—Death of George VI on February 6; Elizabeth II becomes queen.
1952—United States announces successful testing of hydrogen bomb.
1953—Death of Joseph Stalin.
1953—Edmund P. Hillary and Tensing Norkay reach peak of Mt. Everest.
1953—Armistice in Korea signed on July 28.
1953—Russia announces it has hydrogen bomb.
1954—United States Supreme Court bans racial segregation in the public schools.
1954—Truce in Indochina, one half Vietnam to Communists.
1954—West Germany granted sovereignty, right to rearm.
1955—Anthony Eden succeeds Winston Churchill as prime minister of England.
1955—Bandung Conference of African-Asian nations.
1955—Vaccine developed by Dr. Jonas Salk, American medical research scientist, is announced as effective against paralytic poliomyelitis.
1955—"Summit" Conference at Geneva.
1956—Nikita Sergeevich Khrushchev denounces the crimes of Stalin in Russia.
1956—Cominform is officially dissolved.
1956—Egypt seizes Suez Canal.
1956—Soviet troops crush revolt in Hungary.
1956—Israel invades Egypt; French and British troops cross Egyptian border. United Nations negotiates end of fighting.

1957—Harold Macmillan becomes prime minister of Great Britain upon the resignation of Anthony Eden.
1957—Soviet Union produces first space satellite; second satellite carries dog.
1957—Ghana (formerly the Gold Coast Colony) becomes an independent member of the Commonwealth of Nations.
1957—The Federation of Malaya becomes an independent member of the Commonwealth of Nations.
1957—Progressive-Conservatives become largest (but not majority) party in the Canadian House of Commons; John Diefenbaker becomes prime minister, replacing Liberal, Louis St. Laurent.
1957—European Economic Community is established by the six members of the European Coal and Steel Community for a common market and a customs union. The Organization for European Economic Cooperation (composed of the above six plus 11 other nations) then plans for a broader supplementary free trade area. The same six nations form the European Atomic Energy Community (Euratom) for nuclear energy pool.
1957–1958—International Geophysical Year brings worldwide scientific cooperation.

WORLD HISTORIES SINCE HERODOTUS. The remarkable growth of a global perspective in the 1940's and 1950's and the parallel development of world organizations and activities lend special interest to the subject of the gradual rise of a global orientation in the writing of history, taking the form of world history or universal history. Not only has world history become more popular in modern times but the term "world" has come to imply a far more comprehensive geographical and cultural entity. At the beginning, even if an author pretended to be writing world history, his "world" was usually much circumscribed—his own country and its neighbors, with some vague rumors and gossip about the records of peoples on their periphery.

Ancient World Histories.—In a rough and general way, the first world histories are to be found in the myths of creation which appeared in the ancient Orient, such as the Egyptian creation myths, the Gilgamesh Epic of early Mesopotamia, and the Biblical tale of creation in Genesis, all of which told of the origins and development of mankind under divine auspices. The first abandonment of this approach and the rise of a secular treatment of human origins is to be found in the *Genealogies* of Hecataeus of Miletus (born c. 550 B.C.), who ridiculed the creation tales of the Greeks.

The first work that could be regarded, literally, as in any sense a world history was the *History* of Herodotus of Halicarnassus (c. 485–425 B.C.). Although mainly an account of the wars between Persia and Greece, his work broadened into a treatment of the peoples and cultures of the Asiatic and Mediterranean regions in the 6th and 5th centuries B.C., this being virtually all that was known of the world by any classical historian or scholar of the time. In this sense, one can say that world history was born as a by-product of a secular interest in the history of civilization, to which frame of reference world history has returned only during the 20th century. The ancient world produced nothing else which could be regarded as world history save for the rather inferior, if ambitious, compilation called a *Historical Library,* written by Diodorus Siculus (c. 90–21 B.C.).

Early Christian and Medieval World Histories.—With the triumph of Christianity, there was a reversion to the Biblical perspective. Hebrew history became the central fact in the human past, and the doings of the pagans were not regarded as important save as they impinged on the experiences of the Hebrews or taught object lessons about the penalties of wickedness. This limited and highly selective presentation of world history was first thoroughly worked out in the *Chronicle* of Eusebius of Caesarea (c.260–c.340 A.D.). Translated into Latin by St. Jerome in 379 A.D., it served as the general framework for world history throughout the Middle Ages, and writers on national and regional history made it the prelude to their more systematic and detailed historical writing. The theological approach of this work produced a very restricted conception of world history, sacrificing accuracy and all secular perspective.

Another notable work in this pattern was what many regard as the first avowed world history—the famous *Seven Books of History Against the Pagans* by Paulus Orosius (c.380–c.420 A.D.), a protégé of St. Augustine, dealing with the history of world down to 417 A.D. Its aim was to demonstrate that the evils of the past were the product of paganism, while all admirable achievements were the work of the Christians and their Jewish forebears. This viewpoint was reinforced with a broad philosophy by St. Augustine (354–430 A.D.) in his *City of God,* and provided the historical perspective of the medieval annalists and chroniclers.

The nearest approach to a world history among the historians of the Middle Ages was *The Two Cities* by Bishop Otto of Freising (c. 1114–1158), the most notable attempt during this era to force "the whole story of humanity into a system of foreordained causes and effects." Historians during the medieval period knew of only a small portion of the world and cared only about what went on in the limited area with which they were familiar.

It is not surprising that the more successful attempts to produce world histories during the Middle Ages were the works of Byzantine and Muslim historians whose outlook was not so circumscribed by the chronology of Eusebius or the biases of Orosius and Augustine. The best of the Byzantine world histories were the universal chronicle of Joannes Zonaras, and the world history of Michael Glycas, both composed in the 12th century. The Muslims produced no true world histories, the nearest approach to such being the *Experiences of the Nations* by ibn-Miskawaih (d. 1030). But in the works of ibn-Khaldun (1332–1406). *Prolegomena to Universal History* and *Universal History,* we find the ablest statement of the philosophy of history and of the desirable approach to world history that was produced prior to modern times.

Modern World History to 1900.—The coming of the Renaissance and the rise of humanism broadened historical perspective by once more directing attention to the achievements of the Greeks and Romans and the pagan world in general. The chronological tables of Eusebius and Jerome and the antipagan bias of Orosius and Augustine lost some of their prestige and authority and had less effect on the perspective and values of historical writers. The chief world history produced by a humanist historian was the *Enneades* of the Venetian historian Marcantonio Coccio (1436–1506), better known by his classicized name of Sabellicus. While not a remarkable monument to erudition or accuracy, the book was epoch making in concepts and compass and was the nearest approach to a real world history ever

written prior to the work of Voltaire in the 18th century.

The Reformation and Counter Reformation made no contributions to the formulation or writing of world history. The historians were mainly interested in religious controversy or the history of religious movements and figures. The only work which bordered on world history was the *Discourse on Universal History* (1681) by Bishop Jacques Bénigne Bossuet, which revived the approach of Orosius in a somewhat more urbane and sophisticated manner.

The first notable contribution to interest in actual world history and toward preparation for writing it came as a result of the period of geographical discoveries and colonization following the late medieval travels of Marco Polo (1254–1324) and the voyages of Columbus and Vasco da Gama. These events and achievements not only served to increase interest in the history of mankind but greatly broadened the historians' knowledge of the real extent of the world. Those who wished to write world history at last had a considerable world to write about. There were scores of historians who described the discoveries and newly found regions. Perhaps the best of their books were *The History of America* by William Robertson (1721–1793); the *Asia* of João de Barros (1496–1570); and the *History of Japan* by Engelbert Kämpfer (1651–1716). The most notable effort to philosophize about the significance of these momentous developments was embodied in *The Philosophical and Political History of the Settlements and Trade of Europeans in the East and West Indies* (1770) by Guillaume Thomas François Raynal.

The combined influences of the era of discovery and the rise of modern science produced what has been called rationalism and the Enlightenment. The outstanding figure in this movement, Voltaire, also wrote the leading rationalistic world history, his *Essay on the Manners and Spirit of the Nations* (1756), the first extensive history of civilization and a work regarded by many as the first real world history. Rationalism, with its broad concern with humanity as a whole and its espousal of a universal deistic religion, broke through the restricted perspective of a city, nation, or sect.

As the stimulus of rationalism was added to the earlier growth of humanism, a series of world histories and universal histories appeared in the decades following 1750. The first was a cooperative work by English scholars, such as John Campbell and George Sale, brought out between 1736 and 1768 and entitled *Universal History from the Earliest Account of Time.* Among the more important of the books that followed were Johann Christoph Gatterer's *World History* (1785–1787); Karl Rotteck's *Universal History* (1812–1826); and François Laurent's *Studies on the History of Humanity* (1855–1870). World history had finally come into its own.

Also encouraging a world point of view in history were the works on the philosophy of history which grew mainly out of the romanticists' reaction against rationalism. Among the more notable of these were the *Ideas for the Philosophy of the History of Mankind* (1784–1791) by Johann Gottfried von Herder; *The Philosophy of History* (1829) by Friedrich von Schlegel; *The Philosophy of History* (tr. 1857) by Georg W. F. Hegel, and the *Introduction to the Philosophy of the History of Humanity* (1827) by Edgar Quinet.

The intensification of nationalism in the middle third of the 19th century tended to restrain the growth of interest in universal or world history, but the improvements in historical scholarship following the work of Leopold von Ranke (1795–1886) enabled historians to deal more competently with history on the grand scale when the inclination to do so appeared. Indeed, von Ranke himself crowned his historical labors with an ambitious *World History* (1881–1888), which he was able to carry through the Middle Ages.

20th Century World Histories.—Works on world history since von Ranke's time have tended to be cooperative because of the vast amount of material which has to be covered by scholarly methods. Even the worldwide treatment of epochs of history has tended to become a cooperative enterprise, as witnessed, for example, by *The Cambridge Modern History* (12 vols., 1902–1911). Among the more ambitious of the cooperative world histories have been the *Allgemeine Geschichte in Einzeldarstellungen,* edited in 46 volumes by Wilhelm Oncken between 1879 and 1893; *The History of All Nations from the Earliest Times,* edited in 24 volumes by John H. Wright (1902 ff.); *The Universal History of the World,* edited by Sir John A. Hammerton in 8 volumes (1927–1929); the *Histoire générale,* edited by Ernest Lavisse and Alfred Rambaud in 12 volumes from 1893 to 1901; and the *History of Civilization,* edited by Henri Berr, Charles K. Ogden, Georges Renard, and Harry Elmer Barnes in over 100 volumes since 1924.

The appalling destruction and misery produced by World War I brought a temporary reaction in the direction of internationalism, weakly implemented by the League of Nations. This trend inspired what was probably the most widely read world history ever written, *The Outline of History,* 2 volumes (1920) by Herbert George Wells, which was designed to promote peace by providing people with sounder and more universal historical ideas. By the time this book had attained its extensive circulation, the forces that had produced it began to recede, and the world was on its way to another war. The spirit of pessimism engendered by World War I was best reflected in the much discussed *Decline of the West,* 2 volumes (1918, 1922) by Oswald Spengler. More optimistic was Will Durant's ambitious *Story of Civilization,* planned to appear in eight volumes, the first of which was published in 1935.

The chief stimulus to the growth of interest in world history in the present century came from an increasing concern with the history of civilization, which received a great impetus from the work of Karl Lamprecht (1856–1915) in Germany. It was most popular in the United States, where its chief landmarks were a logical succession of epoch-making books, *An Introduction to the History of Western Europe* (1903) by James Harvey Robinson; *A Short History of Civilization* (1926) by Lynn Thorndike; and *History of Western Civilization,* 2 volumes (1935) by Harry Elmer Barnes. The impact of this trend has stimulated a number of textbooks covering the history of world civilization. The disciples of Lamprecht and others promoted a similar trend in European countries, notably in Germany and France.

World War II was followed by a further growth of pessimism and uncertainty in the intellectual field. This accounted for the great popularity of *The Study of History,* 10 volumes (1934–1954), by Arnold J. Toynbee, which seeks to describe and explain the rise and fall of some 22 main civilizations since the dawn of history. Impressive in its vast learning, the work has been correctly described as a "theodicy, vindicating divine justice in permitting evil to exist in the world." Its undercurrent of religious fervor gained for it a wide following among those appalled by the uncertainties of a war-torn and war-threatened world.

The well-intentioned but ill-fated effort of H. G. Wells to promote world history in the cause of world peace after World War I was revised on a much more lavish scale after World War II in the project of the United Nations Educational, Scientific and Cultural Organization (UNESCO) for a 6-volume cooperative history of mankind, edited by Julian S. Huxley and Ralph E. Turner, aided by an international advisory board. It is designed to promote international thinking and support for the United Nations. See also HISTORY, ITS RISE AND DEVELOPMENT.

HARRY ELMER BARNES.

WORLD WAR I (1914–1918). See WAR, EUROPEAN, Vol. 28, p. 259 et seq.

WORLD WAR II. On March 12, 1938, after the German dictator, Adolf Hitler, had forced the Austrian government of Dr. Kurt von Schuschnigg to resign by the threat of immediate aggression and had sponsored the establishment of an Austrian National Socialist puppet government under Dr. Artur von Seyss-Inquart, the German Wehrmacht (army, navy, and air force combined) marched into Austria and occupied that nation within three days without firing a shot.

THE BLOODLESS PHASE

When the annexation of Austria was proclaimed, that country was incorporated into the Reich as a *gau* (district) administered by a *gauleiter,* Josef Bürckel and later Baldur von Schirach. In 1934, Benito Mussolini, Italian Fascist prime minister, had ordered Italian divisions to take up positions to defend Austria when the Germans threatened to occupy it; now he did not attempt to oppose the German move that made Germany and Italy neighbors. Hitler's exultant thanks ("I shall never forget this, Duce!") gave some idea of what Italy's attitude meant to the leader of the Reich. It reassured Germany that Italy would never again interfere with its expansion, that the Reich was now secure from the south, and that France, the potential enemy, would be weakened by a pro-German Italy on her southeastern border.

The occupation of Austria not only substantially strengthened the German potential in manpower and material but also decisively altered the strategic situation on the German-Czechoslovak border in Germany's favor. The northern and western borders of Czechoslovakia were guarded by an elaborate system of fortifications, and the republic's defense plan was based on the assumption that these were the only sectors to be protected in the event of German aggression. The annexation of Austria bared Czechoslovakia's weak, southern border, opening the country's back door to the Germans and outflanking the vital western part of the country. Following the same pattern of preparation as for the invasion of Austria, the Germans set their political machinery in motion to undermine Czechoslovak resistance and to create incidents that might offer an excuse to attack their neighbor.

The Sudetendeutsche Partei (the Sudeten German Party), nominally led by Konrad Henlein, was entirely under German control. Its followers, about 90 per cent of the Czechoslovak citizens of German descent, were organized to stir up trouble. The Sudeten Germans went so far as to offer armed opposition to Czechoslovak authorities. Although the Czechoslovak government showed extreme restraint, the Germans launched a worldwide propaganda campaign. Berlin charged Prague with the persecution of German nationals and asserted that the Reich could not tolerate their alleged sufferings.

The Germans planned a surprise attack for May 21, 1938, the day of the Czechoslovak municipal elections, but it was called off when the republic's rapid military preparation showed that any coup would meet determined resistance. The Czechoslovak government and people relied upon a treaty of alliance with France, which obligated the French to aid the Czechs if they were attacked. They also hoped that the Soviet Union would come to their rescue, in accordance with another pact. Czechoslovak military power alone was no match for a fully mobilized Wehrmacht, but it was strong as was the Czech people's determination to fight for their independence. The Czechoslovak nonaggression pact with Germany was theoretically still in effect, but no one took it seriously.

France's reluctance to stick to the terms of the alliance changed the picture immediately after May 21. The French government's treaty with Great Britain did not automatically require the United Kingdom to come to France's support if France became involved in a war because of her alliances with other countries. The attitude of Poland, also France's ally, was doubtful. Poland had ties with Germany and was hostile to Czechoslovakia because of the problem of Teschen (Cieszyn). Russia was regarded by France with poorly concealed mistrust. The French feared that their lining up with Russia might alienate Britain. The British government of Prime Minister Neville Chamberlain, despite the frantic warnings of Winston Churchill and other observers, believed that Germany could be pacified. These circumstances were well known to the German government. Berlin therefore decided to fight a "war of nerves," threatening war, but blaming everything on alleged Czech provocation and inferring that a peaceful settlement was still possible if the Western powers could induce Prague to accept "justified" German claims.

The German plan was successful. It led to the infamous Munich Pact (Germany, Great Britain, France, Italy) of Sept. 29, 1938, which gave the Reich a substantial slice of Czechoslovak territory. This was followed by the Vienna Agreement on Nov. 2, 1938, whereby Hungary obtained Slovak territory, and Poland occupied the disputed region of Teschen. Chamberlain, returning to London from Munich, produced a document which he said secured "peace for our time." It was actually a rather vague document, in which Great Britain and Germany agreed that all problems that might arise be-

tween the two contracting parties should be resolved without the use of force.

The consequences of Munich were disastrous for any group which opposed further German expansion. The Soviet Union had not been invited to join the Munich parley, although she was prepared to meet her obligations to Czechoslovakia, according to a little-publicized statement by the Czechoslovak propaganda minister, Hugo Vavrečka. Moscow became increasingly distrustful of France and inclined to turn toward isolationism if France were attacked. This largely eliminated the danger that Germany might become involved in a large-scale, two-front war which the Reich General Staff had always dreaded. French public opinion was bitter toward Poland, as the Warsaw government had taken part in the looting of Czechoslovakia, and the chances were that France might abandon her eastern ally if German pressure was brought to bear against Poland. This naturally increased German hope of making Poland a Reich satellite. What remained of Czechoslovakia, shaken by a Slovak feud, undermined by German propagandists, and deprived of defenses, could not be expected to last as an independent state and even less as a bulwark against German expansion. Hitler's reiterated statements that he was prepared to guarantee the independence of the mutilated country could hardly be taken at face value after the Reich's record since March 12, 1938.

On Dec. 6, 1938, German Foreign Minister Joachim von Ribbentrop visited France and signed a pact with French Foreign Minister Georges Bonnet, recognizing Franco-German boundaries and French colonial possessions and including a non-war formula similar to that produced by Chamberlain after Munich. It was considered a bad omen that a general strike in France delayed Ribbentrop's trip for a week. While the German arms industry produced weapons and munitions on an unprecedented scale without labor troubles, absurdly inadequate French industrial preparations for an emergency were hampered by social unrest. The German foreign minister's visit was echoed in Italy by a violent anti-French campaign. Rome claimed Nice, Savoy, Corsica, and Djibouti (Jibuti) for Italy. This campaign aided the Germans by distracting French attention while preparing for further expansion.

The primary objective this time was bound to be Poland. Foreign Minister Bonnet of France felt uneasy about the Polish alliance and also about the pact with the Soviet Union, both of which were somewhat neutralized by the pact with Great Britain. He suggested to the Polish ambassador, Juljusz Lukasiewicz, that his government should talk to Ribbentrop about matters which might lead to eventual controversy. The French government's policy was upheld in the Chamber of Deputies on Jan. 31, 1939, by a vote of confidence for Prime Minister Edouard Daladier, 379 to 234.

Pressure on Poland.—According to a report of Robert Coulondre, French ambassador to Berlin, Hitler received the Polish foreign minister Col. Józef Beck, in his Berchtesgaden mansion on Jan. 5, 1939. The German leader spread out before Beck a map of Europe amended by Hitler himself. It showed Danzig and the region of Pomorze (Pomerania, or usually referred to as the Polish Corridor) again attached to the Reich, while Poland had annexed Lithuania, including Memel. Colonel Beck was not responsive to that proposition. German efforts to enlist Poland as Germany's junior partner in aggression continued, however, until March 21, 1938. During a hunting party in the Polish state forests of Bialowieza, Marshal Hermann Göring suggested on March 18, 1939, that Poland should join the Reich in a war against the USSR, with Finland assisting the two partners. Beck turned down his hunting partner's proposal. He realized that an alliance with Germany meant the end of Polish independence.

The most recent example of German aggression was then only four days old. After a violent campaign which charged the docile Czechoslovak government of President Emil Hácha with anti-German atrocities and an equally violent support of Slovak Separatists led by Monsignor Josef Tiso, the Reich government summoned President Hácha and Foreign Minister Frantisek Karel Chvalkovsky to Berlin on March 14, 1939. There they were blackmailed by Göring's personal threat to have the German Air Force bomb Prague. They were then forced to sign a surrender document which gave the Reich complete control of Czechoslovakia. On the same day, a German-controlled Slovak puppet state was established, and, on March 15, the rest of the republic (except for Ruthenia, which was awarded to Hungary), was made a German protectorate. Prime Minister Chamberlain's indignant reaction in the House of Commons to that act of aggression on March 17, 1939, led the Polish government to assume that the Western powers would come to its aid if Germany went too far.

On March 21, the Germans acted, diplomatically at first. Foreign Minister von Ribbentrop invited the Polish ambassador in Berlin, Joseph Lipski, to an "informal talk." Thinking out loud, von Ribbentrop remarked that German-Polish relations were excellent except for one little flaw that ought to be eliminated: Danzig, retaining its status as a free city, should be returned to the Reich. In addition, the Reich wanted a route through the Corridor, leading from the western part of Germany into East Prussia, including a railway line at Germany's disposal, which would have the same extraterritorial status for Germany as the Corridor had for Poland. In return, von Ribbentrop declared that Germany was prepared to recognize Poland's economic rights in Danzig and to guarantee Poland a free harbor in the Danzig area. Existing boundaries were to be confirmed. In addition, a 25-year nonaggression treaty was to be concluded between the two nations. A German-Polish nonaggression treaty had, in fact, already been signed in 1934 and was supposed to remain in effect until 1944.

On March 26, Mr. Lipski informed von Ribbentrop that his government was willing to discuss the question of a substitute for the Commissioner of the League of Nations in Danzig (Charles J. Burckhardt, a Swiss national), but not the free city's return to the Reich. He added that German transit facilities through the Corridor would be given consideration.

Pattern of Aggression.—While this parley was going on, Germany undertook another aggressive move by invading and occupying Memel, on March 23, 1939, and by forcing the powerless Lithuanian government to recognize the German

acquisition of the city. Memel had been severed from the Reich after World War I.

On March 28, the German- and Italian-sponsored civil war in Spain ended with the capitulation of the defenders of Madrid to Generalissimo Francisco Franco's forces, thus completing the defeat of the Loyalists. France's strategic problems were increased by the presence of a new pro-German and pro-Fascist government on her southwestern border. Germany pressed a policy of encircling France in the hope of frightening that country into inaction on the continent while her remaining partners in the east were eliminated. With the elimination completed, if possible, by the same means employed against Austria, Czechoslovakia, and Lithuania, but by war if necessary, France would be reduced to a second-class power, compelled to accept German political tutelage. With France subdued, Great Britain would cease to be an influential factor in either European or world affairs.

Belatedly and under the most unfavorable conditions, both the British and the French governments tried to create a security system to block further German aggression. As France was already tied by pacts to Poland, Russia, and Rumania, an attempt was made to coordinate French obligations with the Franco-British alliance and to have Great Britain join France's tottering system of alliances.

On March 29, 1939, the Soviet ambassador in London was informed that Great Britain and France were considering joint guarantees to Poland and Rumania. Simultaneously, economic parleys between Britain and the USSR took place. These parleys were narrow in scope, and their slowness was disturbing. The British prime minister, however, answering a question in the House of Commons, stated: "This government has been holding consultations with various powers, naturally including the Soviet Union." He added that he had no hesitation in saying that there would be no ideological clash between Britain and Russia.

A joint Anglo-Polish communiqué, issued on April 6, 1939, announced a preliminary understanding between the two countries as follows: "Pending the completion of a permanent agreement, Polish Foreign Minister Col. Beck"—then visiting London—"gave His Majesty's Government an assurance that the Polish government would consider itself under obligation to render assistance to His Majesty's Government under the same conditions as those contained in the temporary assurance already given by His Majesty's Government to Poland." These arrangements were not to preclude either government from making agreements with other countries in the interest of peace.

While international attention remained focused on Germany, Italy struck a surprise blow with a seaborne invasion of the little kingdom of Albania on Good Friday. Rome previously had emphatically denied any aggressive intention toward that Balkan state. King Ahmed Zogu of Albania had to flee into exile. Albania could offer only token resistance and was quickly incorporated into the Italian Empire. With Albania as a bridgehead, Italy's strategic position for an attack on other Balkan countries was greatly improved. There were no effective foreign objections to the annexation of Albania. The Western European powers were still hoping to use Italy in some way to further their plans to curb the German threat. It was generally believed that, if German aggression were halted, international security could be achieved. Italian restlessness was not taken too seriously.

The latest German conquests and political developments created a strategic situation for Poland which was fatally similar to that of Czechoslovakia after the Munich agreement. By the incorporation of Czechoslovakia into the Reich, a strong arm pressed against Poland from the south, dangerously prolonging the boundary line to be defended in the event of German aggression. After March 15, 1939, Poland was like a nut in a huge cracker. One arm of the nutcracker was the former Czechoslovak border; the other was East Prussia.

The flanking threat from East Prussia had formerly been discounted because the Polish Corridor severed that province from the rest of the Reich, leaving a gap about 60 miles wide. Two thirds of that gap along the Baltic coast was covered by the Free State of Danzig. In 1939, the Danzig Senate had an overwhelming National Socialist majority, and President Arthur Greiser took his orders from Berlin as did Albert Foerster, omnipotent gauleiter of the Danzig Nazi Party. The high commissioner appointed by the League of Nations made no attempt to stem the rising Nazi tide and could not have done so in any case. When the German pressure against Poland began, Danzig was neutral territory in name only. The Germans controlled it completely. As early as March and April of 1939, German storm troopers and elite guards were streaming into the free state to build up a military force ready for instant use against Poland. With Danzig infiltrated by the Germans, the Polish forces in the northern part of Pomorze were sandwiched in an impossible position. Only immediate and effective Russian support and strong pressure from an eventual western front against the Germans could relieve Poland quickly enough to forestall total disaster when war broke out.

In Poland, as in Czechoslovakia before the German aggression, the German minority (only 2.13 per cent of the population) was organized into an effective fifth column, creating countless incidents and provoking the Polish authorities incessantly. The Reich government, exploiting the riots, was quick to denounce the Poles for alleged persecution of German nationals. Eyewitnesses and diplomatic reports disproved the German charges and emphasized Polish self-restraint.

Appeasement.—At this juncture, international efforts were made to appease Germany and Italy. On April 15, 1939, President Franklin D. Roosevelt launched a cabled appeal to both Hitler and Mussolini for a pledge not to attack or invade for the next 10 years (or 25 years, if the recipients of the appeal were willing) the territory or possessions of the European countries, the Middle East, and Egypt. The president promised in return a world conference for disarmament and for opening international trade in raw materials and products.

Although the presidential appeal did not even mention previous German and Italian conquests, thus taking a step toward acknowledging them as *faits accomplis,* there was no immediate or direct reaction from the Axis partners.

Soviet Ambassador Ivan Maisky in London voiced concern and pessimism about the unsatis-

factory progress of negotiations between his country and the Western powers. Reports from Paris and London, however, were hopeful. French Prime Minister Daladier, also acting as war minister, expressed satisfaction with the conclusion of the "reciprocal undertaking between Great Britain and Poland, who decided to give each other mutual support in defense of their independence."

The announcement of an important political speech to be delivered by Hitler on April 28, 1939, created tense international expectation. The day before, a German memorandum, in a completely unilateral action, denounced the Anglo-German naval agreement which dated from April 18, 1935, and fixed the ratio between the two navies at 100 to 35 in Britain's favor. Although the German naval construction program was still substantially behind the 35 per cent permitted by the treaty, the memorandum was supposed to put pressure on Britain.

Hitler's address, broadcast by networks around the world, once more denounced the Treaty of Versailles as the source of most evils. According to the führer, Poland inflicted a severe wound on the Reich by "the strange way in which the Corridor gives Poland access to the sea." Referring to previous parleys with Poland, the chancellor insinuated that Poland had not replied to his "extremely moderate claims." "The intention of an attack on the part of Germany," the speech went on, "was merely invented by the international press. It led to the so-called guarantee offer and to the Polish government's mutual assistance, obligations which would compel Poland, under certain circumstances, to take military action against Germany in the event of a conflict between Germany and any other power, and in which England in her turn is to be involved. I therefore look upon the agreement which Marshal Pilsudski and I at one time concluded," (the 10-year nonaggression pact of 1934) "as having been unilaterally infringed by Poland and therefore no longer in existence."

In another part of the speech, referring to his denunciation of the Anglo-German naval agreement, Hitler declared that he was prepared to conclude another naval pact with Great Britain, provided the United Kingdom would agree to a treaty which gave Germany a 2 to 1 numerical superiority in the air.

International reactions to the speech were mostly unfavorable. Few statesmen doubted that Hitler's claims on Poland were preliminary to final dismemberment of that country or its reduction to the status of a German puppet and that, no matter what attitude Warsaw might take on Danzig and the Corridor, other pressing demands would follow. The British, learning again on April 27 how little Germany's leader respected his obligations, were unwilling to accept another obligation the next day in return for as dangerous a concession as a 2 to 1 German aerial superiority. Considering the necessity of keeping a part of the Royal Air Force overseas, it would have reduced Britain to an air inferiority of perhaps 1 to 4 in a potential European theater of war.

Hitler's address was also labeled a reply to President Roosevelt. It evaded the point completely, however, and concentrated instead on a long enumeration of alleged German grievances.

Although the determination of the Western powers to balk another German aggression seemed to be growing, signs multiplied that the progress of the vital negotiations with the Soviet Union was far from satisfactory. The sudden resignation of Maxim Litvinov as people's commissar for foreign affairs of the USSR and his replacement by the president of the Council of People's Commissars, Vyacheslav Molotov, on May 3, 1939, was decidedly disturbing. Litvinov, who had held that office since 1929, was an advocate of Soviet cooperation with the Western powers. His policy, discredited in the USSR after the Munich Pact, was given the *coup de grâce* by the unsatisfactory course of the latest parleys.

Poland's Stand.—Polish Foreign Minister Beck's reply to Hitler's speech was made on May 5, 1939. It referred to the agreement with Great Britain and emphasized that neither Great Britain nor Poland had any aggressive intentions. The nonaggression pact with Germany did not imply that Poland was bound to remain isolated from other powers. Hitler's assumption that Poland had unilaterally broken the pact with the Reich by concluding the agreement with Great Britain was not valid. Poland would be prepared, nevertheless, to entertain suggestions if the German government wished to regulate relations between the two countries by means of a new treaty.

Discussing other German statements, Beck declared that the Free City of Danzig was not invented at Versailles but had existed for centuries. No pressure had ever been attempted contrary to the interests of the German majority in that city. On March 26, the Polish government had proposed to the Reich government a joint declaration as to the existence and rights of Danzig, but they had received no reply. The word "Corridor," according to Beck, was an artificial invention. He insisted on the term "Province of Pomorze" for that "ancient Polish territory, with an insignificant percentage of German settlers." Coming to the transit question, the foreign minister made it known that Poland had given Germany full railway facilities and allowed its citizens to travel without customs or passports from the Reich to East Prussia. The extension of similar facilities to road traffic had been suggested.

The conciliatory tone of the speech did not soften the German attitude. On the contrary, the controlled press and radio stepped up its campaign against Poland with growing violence, charging that country with warmongering and atrocities against helpless German nationals. The Western powers were accused of supporting Poland's allegedly outrageous attitude and policy of encircling Germany. Investigations by unbiased observers invariably showed that German charges against individual Poles for acts against German nationals were distorted, wildly exaggerated, or pure inventions.

France and Great Britain warned the Polish government against any action that the Germans might interpret as hostile. Polish restraint not only encouraged the Berlin-organized Jungdeutsche Partei (Young German Party) in Poland to increase its acts of provocation and violence against the Poles but also seriously jeopardized urgent defensive preparations. Measures of mobilization, carried out openly within the Reich, were not countered by similar Polish steps, further reducing Poland's slim chances of resisting an onslaught from the west.

Role of Russia.—In May 1939, French-British negotiations with the Soviet Union moved from an unsuccessful to an alarming stage. On May 22, Coulondre, French ambassador in Berlin, reported to Foreign Minister Bonnet that usually well-informed sources were telling a very disturbing story. According to this story, von Ribbentrop, backed by the high command of the Wehrmacht and leading industrialists, was seeking cooperation with Moscow to strike a mortal blow at Great Britain. Hitler was said to be rather reluctant for ideological reasons, but the German trend toward an understanding with the Soviet Union, which had actually begun at the time of the Rapallo parleys in 1922, was undoubtedly strong.

Meanwhile, Foreign Commissar Molotov gave clear hint of the difficulties encountered in the Russian negotiations with the Western powers on May 31, when he told the Supreme Soviet that a mutual assistance and defense pact, such as Great Britain had recently concluded with Poland (and also with Turkey), would not satisfy the USSR unless it included all countries along the Soviet Union's western borders.

The Soviet government sought the approval of the Western powers to take over the defense not only of Poland, but also of all other countries on her western frontier (Lithuania, Latvia, Estonia, Rumania, and Finland). The Russian plan included the establishment of permanent military bases in those countries which would have amounted to subjecting them to Soviet control. The Western powers, united to safeguard the independence of the smaller nations, were in a most difficult position. The Russian demand was a direct violation of existing agreements between the Soviet and other governments of the nations involved and could hardly be justified either from the political or the national viewpoint. On the other hand, the Western powers had to recognize that the Soviet Union had been faithful to its European obligations and that military necessities in 1939 imperiously required an extension of the Russian zone of influence.

The Baltic States were very close to Leningrad, Russia's second city, of vital importance because of its port and the naval base of Kronstadt. They could not possibly resist German aggression for more than a very few days. Rumania, although stronger than the Baltic countries, was by no means a serious opponent for a powerful German army and was also exposed to a Hungarian threat. Finland, less accessible to the Germans than other border countries of the Soviet Union, was correctly considered a soft spot, since the Finnish Army was under strong pro-German influence, and there were many political ties between Finnish extremists of the Lappo-Fascist Party and the National Socialists in Germany. There was good reason to believe that the Germans would not respect neutrality in case of war. By a German drive through the Baltic States and Rumania and by a diversion on the Finnish border, Russian armies fighting far to the west inside of Poland could be outflanked, encircled, and annihilated.

Another grave problem was created by the Polish government's extreme reluctance to allow Red Army units to enter Polish territory. Warsaw was afraid that, once in Poland, the Russians would remain permanently. The Russian General Staff, with incontestable military logic, insisted that the Red Army could not cooperate effectively with Poland unless it was allowed to move at will within Poland's boundaries and to take up battle positions before actual fighting broke out. Yet it was equally clear that such a move by the Russians would give the Germans an excuse to attack Poland immediately. The Western powers did not want to bring pressure upon the Polish government in the sense suggested by the Soviets. The negotiations were therefore deadlocked.

A futile attempt was made to iron out these difficulties by parleys between French and British military missions and Soviet military authorities. French and British staff officers were sent to Moscow. For reasons of prestige, the Soviet government made it clear that it also wanted the highest ranking British statesman to come to Moscow. Although Chamberlain had travelled to Germany to see Hitler three times in the fall of 1938, he did not see fit to visit Stalin. Instead, he dispatched Sir Richard Stafford Cripps, whose mission was a failure. The French government showed no initiative and simply followed the British lead at every step.

Another clear hint about German contacts with Russia was given on May 27, 1939, when Göring answered the statement of Sir Nevile Henderson, British ambassador to Berlin, that Britain, France, and other countries would be involved in a war if Germany attempted to settle Polish Corridor questions by unilateral action. Göring declared that France and Britain *could not* and the Soviet Union *would not* help the Poles. He added that nothing could stop the Germans from acting at once if the Poles attempted to seize Danzig. Poland, according to Göring, was "no united nation," a deadly parallel with the earlier German argument against the national existence of Czechoslovakia.

Poland made no move that could be interpreted as an attempt to seize Danzig, but the activity of the German-controlled Danzig Senate and the National Socialist Party and the rapid militarization of the free state flagrantly violated the statute of Danzig. The Germans obviously intended to construe possible Polish attempts to counter their illegal acts as efforts to seize the free state and city.

War of Nerves.—The month of June 1939 was marked by undisguised German preparations for military war and strenuous activity in a "war of nerves" designed to undermine any spirit of resistance among potential enemies and neutrals. Huge fortifications along the Reich's western border were built with unprecedented speed. The Nazis boasted that the Westwall was completely impregnable. Already German troops began manning the lines in the west, while more and more divisions were massed along the eastern border, including the Czech protectorate and Slovakia. Allied military preparations were made slowly and reluctantly in order not to provoke Germany. It became obvious that, in case of war, the Reich would have an enormous advantage at the outset.

The war of nerves, waged by means of modern propaganda, was very successful in confusing the issues at stake. The mutilation of Germany by the Corridor was emphasized in appeals to other nations. Poland was characterized as a synthetic nation, a constant troublemaker, and a potential aggressor. Germany, by contrast, was depicted as extremely moderate and patient toward its eastern neighbor. Pacifists and isola-

tionists in non-German countries were abetted by German propaganda, whether they asked for it or not. The slogan, "Do you want to die for Danzig?", was successfully launched in France. The German psychological offensive was pushed to the limit, while Allied counter-action was even weaker than in the military field. Many people were thus led to believe that Germany had no aggressive intentions. In reality, of course, the exact opposite was true.

A French note to the effect that France would support Poland if a conflict broke out was answered by von Ribbentrop. The German foreign minister insisted that Germany's relations with its eastern neighbors did not concern France and that the Reich government would not discuss German-Polish relations with the French government or recognize any French right to intervene in Danzig questions.

On July 4, M. Garreau, French consul general in Hamburg, informed the Paris Foreign Office that German-Soviet commercial negotiations were in progress and that, unless some agreement was soon reached between London, Paris, and Moscow, the Soviet government would be prepared to sign a nonaggression pact with the Reich for a period of five years. The possibility of an Anglo-French-Russian agreement, moreover, seemed more remote than ever, with growing mutual distrust between the Western powers and Russia.

The French ambassador to Poland, Léon Noël, reporting on July 10, told his government of new elite guard formations moving into the Danzig area from East Prussia. Three days later, the French embassy in Berlin added that abnormal German Army activities pointed to impending war. The number of German soldiers under arms, 600,000 since the reintroduction of compulsory military service, was expected to rise to at least 2,000,000 by Aug. 15, 1939. The German western fortifications were completely manned by July 20. Huge German military transports arrived at the southern frontier of Poland, the "soft flank" created by the invasion of Czechoslovakia. Troop trains moved through Prague and through Lundenburg, on the Austrian border, in the direction of Moravská Ostrava. The Hamburg armored division went to East Prussia, and recruits for that easternmost province of the Reich embarked frequently at Stettin. Mobilization was carried out in Danzig proper. Civilian production in the Reich was sharply curtailed in favor of all-out war production. Medical services were organized for wartime needs. The fishing boats along the German coasts were converted into minelayers.

The only reaction to this from the west was the reply dispatched by Bonnet to von Ribbentrop, insisting that the German foreign minister had been reminded on Dec. 6, 1938, that France had had a treaty of alliance with Poland since 1921 and a pact with the USSR since 1935. The French foreign minister added that France was determined to maintain these alliances and that the German government must not think that France could ignore events in eastern Europe. There were no conversations between Germany and Poland. No proposals or counterproposals were made. Hitler's speech of April 28 had left no doubt that the Germans considered their claims of March 21 out of date. The Reich seemed determined to alter or add to these claims at will. Poland's government, having no claims to make, waited for German overtures and watched with concern the Reich's unmistakable preparations for attack. Poland still was bound by poorly timed and ill planned political considerations, to refrain from adequate counterpreparations.

While official secrecy veiled competing negotiations with the Soviet Union during the fateful summer of 1939, triumphant publicity was given to parleys at Salzburg and Fuschl, in occupied Austria, and at Berchtesgaden, Germany, between the foreign ministers of Germany and Italy, Joachim von Ribbentrop and Count Galeazzo Ciano, and delegations from the German and Italian General Staffs. Hitler occasionally took part in these discussions personally, and Mussolini was consulted by telephone. Propagandists advertised that a bond of steel had been forged between the Axis partners, Germany and Italy, and military cooperation mapped for all contingencies.

This publicity was part of a scheme to intimidate the Western powers. France was to feel threatened, not only on her southeastern border, but also in Tunisia by a possible Italian thrust from Tripoli and in Djibouti by a thrust from Eritrea and conquered Ethiopia (Abyssinia). Britain was to be harassed by threats of other Italian blows at Egypt, the Sudan, Kenya, and British Somaliland. Meager, unofficial news filtering out of these conferences, however, indicated that Italy was desperately urging a delay in Germany's plans. The Italians contended that their armed forces would need at least two or three more years of preparation before they were able to wage a major war. Germany showed little inclination to postpone aggressive action.

All through the summer of 1939, the German government dictated the trend of political and military events. The Reich propaganda machine, in high gear, flooded the world with fictitious reports of Polish atrocities and border incidents. Meanwhile, the Wehrmacht moved with clocklike precision to its battle stations in east and west, with the groupment of forces in the east clearly pointing to the General Staff's intention to end the war there before the Western powers could create a serious diversion.

Anxious to avoid anything that could be interpreted as a provocative gesture, the Western powers did not react adequately in either the propaganda or the military sphere and urged Poland to follow their example, although the lack of full-scale, preparatory countermeasures threatened to become suicidal.

Russo-German Pact.—On August 20 the announcement came that the Soviet Union and Germany had concluded a commercial treaty. The French and British military missions were still in Moscow at the time. It was obvious that their mission was a failure. Understanding the portent, the British government announced, on August 22, that a Reich-Soviet nonaggression pact would in no way affect British obligations to Poland. On August 23 the dreaded news of that pact and of Ribbentrop's impending visit to Moscow was made public. The full text of the treaty was never disclosed. The official version stated that both parties (Germany and the USSR) bound themselves to refrain from any aggressive action against each other, to give no support to a third power attacking either of the partners, and to abstain mutually from partici-

pation in any grouping of powers directed against the other party. The pact was valid for 10 years.

Also on August 23, the Danzig Senate issued a decree appointing the National Socialist gauleiter of Danzig as chief of state of the free city, thus unilaterally reversing the status of Danzig. The Polish government confined itself to a reminder, addressed to the authorities of the free city, that they had already been warned against a policy of *fait accompli* and that the consequences might be most serious.

The führer told British Ambassador Henderson, in an interview at Berchtesgaden, that he was 50 years old and would rather have war "now" than when he became 55 or 60. He added that he was determined to attack Poland "if another German was ill-treated there." Sir Nevile insisted that England would not abandon Poland to its fate.

The French foreign minister advised the French ambassador at Warsaw to explain to the Polish government, in view of the new conditions resulting from the German-Russian pact, that the French government was more anxious than ever that Poland should at all costs avoid laying herself open to the charge of aggression. The Polish government promised in reply that it would refrain from military action in Danzig, but it also stated that Germany was about to strike.

The German land forces ready for action already numbered 2,400,000 when the pact with Russia was signed. The last details of military preparation were expected to be completed on or before August 25. The French government decided, on August 24, to urge the Polish government to abstain from military action if the Danzig Senate's President Greiser proclaimed the return of the free state to the Reich. Although this French advice was accepted, the Polish government decided at last to take precautionary measures with the aim of bringing a large part of the Polish Army up to war strength. Such measures were bound to take considerable time.

The French ambassador to Berlin warned his government, also on August 24, that the first consequence of the German-Soviet pact would be the partition of Poland. He added that the Reich and the Soviet Union would also revise the frontiers of the Baltic States and Rumania.

Last Efforts to Avert War.—Last frantic appeals for peace were launched after August 23. President Roosevelt requested the king of Italy to intervene for the sake of peace. It was a full week before the reply was received that the presidential message had been transmitted to the Italian government. After urging from the president of the United States, the king of Belgium, acting on behalf of the "Oslo states" (Denmark, Finland, Luxembourg, Norway, Sweden, and Holland), offered his services for mediation and conciliation. The pope called for peace on August 24.

On August 25, a mutual assistance pact between Great Britain and Poland, supplanting the provisional agreement announced on April 6, was made public. Its first article read: "Should one of the contracting parties become engaged in hostilities with a European power in consequence of aggression by the latter against the contracting party, the other contracting party will at once give the contracting party engaged in hostilities all the support and assistance in its power."

The issue of the German-Polish controversy was thoroughly confused. German propagandists made little reference to Danzig and the Corridor, but emphasized alleged Polish outrages against German nationals. This followed the earlier pattern of accusations against Czechoslovakia. On August 25, at 5:30 P.M., Hitler received French Ambassador Coulondre and stated that "Polish provocation has placed the Reich in a position which could not be allowed to continue." Referring to the French-Polish alliance, the führer added that he would not attack France, having renounced all territorial claims against that country, but if France should go to war for Poland, he would see it through to the finish.

French Prime Minister Daladier's eloquent appeal of August 26, urging Hitler to avoid war and emphasizing that France stood by her obligations, was answered by the German leader's charge that the Polish government was no longer master in its own country and that Germany would strike at the first incident.

Although it became increasingly apparent that Germany could not be prevented from attacking Poland, the western governments tried to exhaust every possible avenue of conciliation. On August 28, Ambassador Henderson suggested direct German-Polish negotiations and an international guarantee of any settlement that might be reached.

At 7:15 P.M. on August 29, Hitler replied with a note stating that he would accept direct negotiations, despite his skepticism, solely because of his desire for lasting friendship with Great Britain. In case of any territorial modifications, the German government could not undertake guarantees without consulting the Soviet Union. The German government would expect the arrival of a Polish plenipotentiary on August 30. Orally, Hitler insisted that negotiations were bound to fail. The German government was still trying to induce Britain and France to repudiate their obligations, which would have been a final blow to their prestige.

The Polish government issued strict orders to all officials to refrain from violent reactions to German-engineered incidents. The German national group in Poland engaged in well-planned acts of sabotage.

The British government, wishing to spare Poland humiliation, urged that negotiations be carried out through normal channels without any ultimatum, but its tone was most conciliatory.

The German government wanted a responsible Polish statesman to come to Berlin under the pressure of an ultimatum and to sign a document of surrender, thereby repeating what it had done to Czechoslovakia on March 14, 1939. The Polish government was anxious to avoid action under duress. No Polish plenipotentiary had reached the German capital by the evening of August 30. Foreign Minister von Ribbentrop, reading at top speed from a lengthy document that evening, informed the British ambassador of 16 articles which Poland would have been compelled to sign. When Sir Nevile Henderson asked for the document, Ribbentrop refused to give it to him. The German asserted that it was too late, since the Polish representatives had not arrived within the time specified.

The main points of the German claims were as follows: Danzig was to be returned to the Reich. The territory of the so-called Corridor from the Baltic to the line Marienwerder-Grud-

ziadz (Graudenz)-Kulm (Chelmno)-Bydgoszcz was to decide whether it should belong to Poland or Germany by a plebiscite. Germans who had lived in this territory before Jan. 1, 1918, or were born there by that date, were to be entitled to vote in the plebiscite regardless of their current residence. The plebiscite was not to be held within 12 months. During that 12-month period, roads and railways were to be established to guarantee unrestricted communication between Germany proper and East Prussia. If Poland were to win the plebiscite, Germany was to receive an extraterritorial traffic zone on a line from Butow to Danzig in which to build a superhighway and a four-track railway line. This zone, one kilometer (0.62 miles) in width, was to be under German sovereignty. If Germany were to win the plebiscite, Poland was to get similar extraterritorial communications with Gdynia (Gdingen) and an exchange of populations was to be arranged. Gdynia was to remain Polish. Polish rights in Danzig were to be negotiated against similar German rights in Gdynia. Gdynia, Danzig, and the Hela (Hel) peninsula were to be demilitarized. An international committee of inquiry was to examine complaints regarding economic or physical damage suffered by either side since 1918. Remaining German (or Polish) national minorities were to be guaranteed free development and practical expression of their nationality. According to Ribbentrop's statement, these German claims were already invalid when he read them.

On August 31, the Polish government declared itself ready to establish contact with the German government through its ambassador in Berlin. After having been compelled to wait for some time, Ambassador Lipski saw Ribbentrop at 6:30 P.M. No communiqué of the interview was published, but the German government had the proposals which had been read to Ambassador Henderson broadcast over its radio stations immediately after the meeting ended. Simultaneously, all means of communication between Germany and Poland were severed, making it impossible for Mr. Lipski to get in touch with his government.

Before Lipski's call on the German foreign minister, the Polish government had informed France and Great Briain that it was prepared to discuss a simple *modus vivendi* for Danzig. Its aim was to assure provisionally tolerable conditions of existence for the Poles within the free city without raising any question about the Danzig statute.

Earlier on August 31, at 12:35 P.M., Count Ciano referred to President Roosevelt's appeal to the king of Italy and made it known that if France and Great Britain agreed, Prime Minister Mussolini was willing to invite the German government to a conference "which will take place on September 5, with the objective of examining the clauses of the Treaty of Versailles which are the cause of the present trouble." The Italian foreign minister emphasized the necessity for immediate replies to prevent the outbreak of hostilities. This Italian note made it obvious that Italy intended to press some of her own alleged grievances resulting from the peace of Versailles. Before Britain or France could react to this proposal, the war had begun.

Outbreak of War.—On September 1, speaking before his Reichstag, Hitler put all the blame on Poland. He again repeated the familiar charges of Polish atrocities and went on: "This night, Polish regular soldiers fired on our territory. Since 5:45 A.M. we have been returning the fire. I am determined to solve the Danzig question and the question of the Corridor, and to see to it that a change is made in the relationship between Germany and Poland that shall insure peaceful co-existence." He referred to relations between Germany and the Soviet Union as follows: "Russia and Germany fought against each other in the World War. This shall and will not happen a second time." Speaking of armaments he said: "For six years I have been strengthening German defenses. Over 90 billions of marks" (approximately $37,500,000,000.) "have been spent in that time to build up the defense forces." Finally: "A November 1918 will never be repeated in German history."

Hitler's claim that Polish regular soldiers had fired on German territory was never confirmed. On the contrary, evidence introduced at the Nürnberg (Nuremberg) trial of German war criminals, in November 1945, proved that Hitler had deliberately manufactured the alleged incident.

Also on September 1, Gauleiter Foerster proclaimed the return of Danzig to Germany. High Commissioner Burckhardt, after having been under the surveillance of Gestapo agents in Danzig from midnight, August 30, to midnight, August 31, was informed by Foerster that his functions were terminated and that his immediate departure was required.

On the same day, at 9:30 P.M., Ambassador Henderson handed Foreign Minister Ribbentrop a British note to the effect that, unless the German government suspended all aggressive action against Poland and withdrew its forces from Polish territory, the United Kingdom would fulfill its obligations to Poland without hesitation. The ambassador was told to ask for an immediate reply. Thirty minutes later, the French ambassador joined his British colleague in a similar request on behalf of his government. The Polish foreign minister categorically denied Hitler's claim of Polish aggression.

Prime Minister Chamberlain, speaking in the House of Commons, informed its members that the governments of the United Kingdom and France felt that the German action called for their assistance to Poland. French general mobilization was ordered on September 2.

At 5:30 A.M. on September 3, the British Foreign Office instructed Sir Nevile Henderson to inform the German government that it had until 11:00 A.M. (British summer time) that day to give assurances that it would suspend aggressive action and withdraw its forces from Polish territory. If it failed to do so, a state of war would exist between Great Britain and Germany. Ribbentrop's reply, made to Sir Nevile at 11:20 A.M., stated that the German government rejected the attempt to compel the Reich to recall its forces. Chamberlain, speaking from 10 Downing Street in London, thereupon proclaimed the state of war.

At 12:30 P.M. on September 3, Ribbentrop told the French ambassador, who undertook a *démarche* similar to the British: "If the French government feels itself bound by its commitments to Poland to enter the conflict, I can only regret it. We are only going to fight France if France attacks us." A state of war between France and Germany was declared by France on September 3 at 5:00 P.M.

A state of war between Germany and Poland was never formally declared. Polish accounts put the opening of the German attack at 5:11 (or 5:17) A.M., Sept. 1, 1939. This is considered to be the time when World War II officially began.

POLISH CAMPAIGN

The Polish Army, at full strength, was supposed to number 1,500,000 first-line troops, with almost 2,000,000 trained reserves. This number took no account of substantial deferments for war industries and was supposed to be reached only after full-scale mobilization that could hardly be carried out in less than two or three months. It would have taken at least as long again to bring the mobilized forces into their battle positions. Due to the circumstances which preceded the German attack, the Polish mobilization was still in its early stages when the Wehrmacht crossed the republic's borders. On September 1, the Polish commander-in-chief, Marshal Edward Śmigly-Rydz, had at his disposal about 30 infantry divisions, 13 cavalry brigades, 1 or 2 mechanized brigades, a few tank battalions, about 1,500 pieces of artillery of various calibers up to 210 mm., and between 800 and 1,000 planes. Even a part of these units was not fully ready for war.

The opposing German forces (supreme commander, Colonel General Heinrich von Brauchitsch) were divided into two army groups. The northern group under Colonel General Fedor von Bock consisted of the armies of Generals Gunther von Kluge (Pomorze) and Küchler (East Prussia); the southern, under Colonel General Karl von Rundstedt contained the armies of Infantry General Johann von Blaskowitz (facing Poznań [Posen] province), Artillery General Walther von Reichenau (Silesia) and Colonel General Siegmund List (Czechoslovakia). The Germans had the following units in the first line: 37 infantry divisions, reinforced by 3 Slovak divisions, 5 motorized divisions, 5 heavy armored and 4 light armored divisions with an undisclosed number of additional tank brigades, a cavalry brigade, 7 Luftwaffe divisions (commander-in-chief, Marshal Göring) with about 10,000 aircraft divided into 2 air fleets (Generals Albert Kesselring and Löhr), and an additional tank regiment per corps. The number of infantry reserves was supposed to equal that of the first-line units.

On paper the Germans had only a few more infantry divisions than the Poles, but German superiority in heavy infantry weapons was overwhelming. In the air, Poland was outnumbered 10 or 12 to 1. The quality of German planes was greatly superior, although Polish pilots had a reputation for great courage and skill—which they later thoroughly justified during the Battle of Britain. The camouflaging of vulnerable Polish targets had not even begun. Polish tanks, very few in number and completely inadequate in quality, were no match for the German Panzers, and Polish antitank weapons were completely futile. Polish superiority in cavalry, a weapon almost useless during the Polish campaign, was far more than offset by crushing German superiority in mechanical units. The Polish position was hopeless at the outset from the standpoint of numbers and equipment.

Strategy.—It was even more hopeless from the strategic point of view. The Poles were outflanked from the north and south. Their northern wing was squeezed between East Prussia, including Danzig, and northeastern Germany. They had no cohesive fortified lines; their isolated fortifications could be bypassed. Under these conditions, a defensive battle in the western part of the country was an impossibility. Vast German superiority in most respects, including mobility, ruled out any attempt at a Polish offensive.

A precarious although somewhat better defensive position might have been taken if Marshal Śmigly-Rydz had withdrawn from all of the country west of the Vistula and San and north of the Narew River and made a stand behind these water barriers. Such a retreat, however, would have meant the abandonment not only of vital industries but also of a large recruiting reservoir, thus obliterating any chance of a comeback after consolidation. Furthermore, the Polish Army was not ready for large-scale movements when the Wehrmacht struck.

The incomplete Polish array included one group north of Warsaw, roughly pointing toward East Prussia, which was supposed to support another group in the Corridor up to the Baltic. The strongest concentration of forces was assembled around Poznań. In the south, pitifully inadequate forces were gathered to defend the Upper Silesian and western industrial areas. Although the Polish High Command never had a chance to carry out its plan, it seemed as if its intended strategy was to fight delaying actions all along the extended front, gradually evacuating a territory about 30 to 60 miles in depth while extricating as many troops (including recruits) and as much matériel as possible. It was hoped that this would enable the Polish Army to make a later stand on a shortened north-south line, less exposed to a flanking threat than the boundary. Poor roads, considered a part of the Polish defense system, were supposed to delay the German mechanized advance until heavy rainfalls put them out of action altogether, at which time Polish mounted units were expected to gain control of mobile warfare. Such a plan displayed appalling ignorance of the possibilities of mechanized warfare. One of the most serious of its numerous shortcomings was the insistence on fighting the main battle much farther to the west than the Polish Army could reasonably attempt.

The German over-all strategic plan was probably based upon knowledge of the Polish concept and the assumption that all the advantages of preparation and surprise would rest with the Wehrmacht. It aimed at a battle of annihilation west of the Vistula River, to prevent the Poles from falling back to the eastern regions of their country. The movement of double envelopment was actually dictated by the boundary lines and so was the pincer directed against the Polish forces in the Corridor (Pomorze). The flanking move followed the pattern known since the Battle of Cannae (216 B.C.) between the Romans and the Carthaginians and frequently imitated by later military leaders. Although the Germans could move almost at will, there was a distinct flaw in their plans. The southern wing was surprisingly weak compared to other groups, and its grip did not extend far enough east to prevent effective Polish counter-operations if Marshal Śmigly-Rydz had succeeded in gaining coordinated control of his forces. As he never did gain such control during the short campaign, the German southern wing achieved its objective despite the flaw.

Tactics. — German tactics, frequently referred to as a momentous innovation, were by no means revolutionary. Blitz warfare was based fundamentally upon superior mobility of operating units, which military leaders have tried to achieve since mounted men were first used in battle. Speed accounted for the temporary reputation for invincibility achieved in turn by the Huns, the Magyars, and the Mongols. German mobility was based upon mechanization, a modern asset supposedly possessed by all armies in 1939, although it turned out to have been incredibly neglected by some powers. The details of mechanized action, as adopted by the Wehrmacht, followed the pattern first outlined by the Italian Gen. Giulio Douhet, and the French Colonel, (later General) Charles de Gaulle, neither of whom gained much recognition from their own armies. De Gaulle and Douhet both contended that armored units could operate far ahead of the main infantry forces and that the airplane should team up with advanced tanks in a battering-ram technique, breaching the enemy's lines and smashing resistance in rear areas.

The Germans used their armored divisions to carry out the Douhet-de Gaulle prescription. These divisions had been trained long before the war, and foreign military attachés presumably knew all about them. An armored division consisted of one tank brigade with from three to five hundred armored vehicles, one infantry brigade transported by trucks, and a substantial force of motorized artillery assigned to the tanks. The mass of tanks, concentrated on a front from two to two and a half miles wide, had the heavy and medium vehicles in front, followed by an echelon of light armor. Airplanes, mostly dive bombers of the Stuka (Ju-88) type, flying ahead of the heavy tanks, opened the action with a concentrated bombardment of enemy positions. This bombardment was followed by intense shelling by motorized artillery, paving the way for the tank attack. Armored spearheads then opened a gap through which the lighter and faster units poured, turning the enemy's flanks and smashing rear communications.

German artillery, not overwhelming in numbers, was so skillfully handled that most of the guns were always available for action. The German infantry occasionally fell from five to twenty miles behind the Panzers, but motorized units followed up quickly to occupy the territory already worked over by the air force and the armored units. The bulk of the German infantry saw comparatively little action. Warsaw was first reached exclusively by mechanized forces. When nonmotorized units did fight major actions, they were supported by armor, as one tank regiment was permanently assigned to each army corps. The Germans were well equipped with modern matériel, but nothing resembling a "new weapon" appeared in the Polish campaign.

German tactics sometimes caused thinly screened gaps in the Wehrmacht's own ranks, when some units moved ahead faster and farther than their neighbors, but the Polish High Command could not take advantage of such opportunities. Despite exceptional German mobility, the speed of the Wehrmacht's advance set no records. Nowhere did it average more than 20 miles a day, less than half the distance which the Mongols covered in the same theater of war many centuries ago.

The German High Command believed that the Poles would not only be outmaneuvered and outgeneralled but that the individual German soldier was a braver and better fighter than the individual Pole. Although the Poles suffered a quick and crushing defeat, the second German assumption was not borne out by the facts. Polish soldiers showed great courage and devotion, even with all the odds against them, and usually repulsed frontal attacks which were not supported by the full weight of mechanized superiority.

The Fighting.—The German High Command opened its drive against Poland with a large-scale air bombardment of bases where the weak Polish Air Force, lined up without camouflage, offered an easy target. A large proportion of the Polish planes were destroyed during the September 1 bombardment of Putzig, Grudziadz, Poznań, Plock, Lodz, Tomaszów, Radom, Katowice, Kraków (Cracow), and Lwów (Lemberg). Simultaneously, the first large-scale air raid in history was carried out against a big city when the Luftwaffe hit Warsaw with a tremendous load of explosives.

The German land forces crossed the border in many places. General von Küchler's army, driving south and southwest from East Prussia in the direction of a junction with General von Kluge's Baltic army, gained most of the ground in the early stages. Kluge's attack on the Corridor won initial advantages, and so did General von List's drive on the southern wing through the gentle, wooded hills of the Beskids on the Czechoslovak border. Polish resistance was poorly organized.

On September 2, General von Reichenau's army, adjoining List's forces and striking from Silesia (Schlesien), approached Baila and advanced north of Czestochowa (Czenstochowa), a vital and inadequately protected southwestern Polish town, toward Radom. Reichenau's drive was aimed in the general direction of Warsaw which was also the prize objective of Küchler's main forces. A strategy of envelopment was clearly discernible. General von Blaskowitz' army, operating between von Kluge and von Reichenau, advanced from Pomorze and reached the Vistula River south of Grudziadz. Küchler's right wing already had almost severed the northernmost Polish forces, sandwiched between the armies of General von Bock's group, from the remainder of the Polish Army.

On September 3, the Polish forces in the Corridor made violent attempts to break out of the trap. When Britain and France declared war, German troops stood deep on Polish territory almost everywhere along the front, and the plight of the Polish Army was critical. Only in a single narrow sector, near Treuburg in East Prussia, was Polish cavalry able to cross the Reich border. This sortie was quickly repulsed. In southern Poland, near Czestochowa, other Polish cavalry groups made a gallant but pathetic attempt to stem the German Panzers on September 4 and 5. The fight of unarmored men and horses against armored men and machines inevitably ended in Polish disaster.

The only Polish group still intact, concentrated around Poznań, had not carried out an orderly retreat and was in grave danger of being "kettled" (i.e., encircled) by the armies of von Blaskowitz and von Kluge. Polish forces in the Corridor, in the Poznań area, north of Warsaw, and in Upper Silesia and Galicia were rapidly losing contact with one another. German

armored divisions drove wedges into crucial sectors. Islands of resistance remained behind the German drive and were bravely defended against frontal assault but were soon reduced by ground encirclement and air bombardment.

The German objective of a battle of annihilation west of Warsaw seemed to be secured on the fifth day of the war. The spearheads of Küchler, Kluge, Blaskowitz, and Reichenau all pointed to that area, and List's drive, although lagging somewhat behind the others, barred a general Polish withdrawal toward the southeast. The weather, a major factor in mechanized warfare, was very favorable to the Germans. The poor Polish roads remained stone-dry. The Luftwaffe had full control of the skies although it had lost 625 planes according to Polish reports, most of them in dogfights. German aircraft continuously bombed and strafed Polish military and refugee columns and reported every Polish maneuver to the fast, armored forces. The Polish Army, almost paralyzed by the disruption of its communications, was blinded as well, since it had no air reconnaissance. Cavalry scouts were virtually useless.

On September 5, the Upper Silesian industrial region was in German hands and so was the fortress city of Mlawa. The Polish Army in the Corridor continued to try to break out. In the western regions of Poland, Polish citizens of German nationality acted as a fifth column and helped the Wehrmacht considerably. The Germans reported that Polish civilians were sniping at German columns. These reports were not verified, but they gave the Wehrmacht an excuse for violent persecution of Polish noncombatants. Also on September 5, Kraków in the south was occupied without a fight, and Grudziadz fell in the north.

On September 6, remnants of the Polish Corridor forces finally broke out of the trap and escaped to the east, but their heavy equipment was lost. The German Army from East Prussia (Küchler) reached the Narew River. The Wehrmacht's Supreme Command reported the capture of 25,000 prisoners and 126 guns.

Westerplatte, the Polish foothold outside of Danzig, defended by a handful of infantry against incredible odds, fell on September 7. The next day, the German High Command reported that Warsaw had been invested from the south. The Polish capital was reached by armored spearheads from the German southern army group, but the defenses were not breached, and the garrison held firm. Everywhere else, the Wehrmacht was reported in full pursuit of crumbling Polish forces. In the north, the Poles attempted to regroup behind the Bug River, as the Narew line could no longer be held. German Panzers, however, already had penetrated beyond that river. Other badly mauled Polish divisions, in the region of Radom, were threatened with encirclement by Reichenau's armor on September 9.

On the following day, Reichenau's grip steadily tightened as another huge trap was formed in the region of the Bzura River to seal the fate of the forces originally concentrated around Poznań. In the south, Polish resistance stiffened noticeably. The Germans under General List, after reaching the San River, were unable to make immediate further progress. Warsaw continued to hold out and so did Gdynia, although the latter was isolated far behind the German lines. The big industrial city of Lodz, second to the capital in population, fell to the Germans on September 11.

During September 12 and 13, Polish units encircled near Radom were liquidated with strong Luftwaffe support. The Germans reported 60,000 prisoners and the capture of 143 guns and 38 armored cars. Polish troops in the Bzura River region, 5 infantry divisions and 2 cavalry brigades, counterattacked desperately in all directions in an effort to break through the iron ring. Warsaw was encircled, and the Polish government fled from one city to another. After leaving Warsaw, it went to Lublin, from Lublin to Krzemienece, and from there to Zaleszczyki, on the Rumanian border.

By September 14, the Polish Army had disintegrated into five scattered groups: the Bzura army; the defenders of Warsaw; a group fighting near the Bug River east of the capital; a small force already split up further south; and the southern army group, slowly yielding ground in Galicia in the direction of Lwów. It was very unlikely that these forces could somehow be merged for a last-ditch stand in eastern Poland.

An article in the Moscow newspaper, *Pravda,* printed on September 14, alarmed observers abroad. The paper charged the Poles with alleged atrocities against White Russians and Ukrainians in Poland. An aggressive Russian move seemed in prospect.

The city of Gdynia fell on September 15. Polish counterattacks continued in the Bzura sector; the commander of the Warsaw garrison flatly turned down a German demand to surrender, and the southern Polish armies fought gallantly on. On September 16, the news again

was all in Germany's favor. The citadel of Brest-Litovsk, an old fortress city on the Bug River far to the rear of Warsaw and the Bzura, was invested, and Bialystok, north of Brest-Litovsk, was taken. On September 17, advanced armor from General List's army, operating north of the center of Polish resistance in Galicia, joined hands with General Küchler's men to close a huge ring around all Polish forces except for the group near Lwów.

Russian Intervention. — Before dawn on Sept. 17, 1939, the Polish ambassador in Moscow was handed a note from the Soviet government announcing that, "in order to protect White Russian and Ukrainian minorities in Poland," the USSR would order its army to march into Poland. Simultaneously, the Soviet-Polish nonaggression pact was declared void because "a Polish state no longer exists."

While strong Russian forces marched into Poland, a joint German-Russian declaration stated that "the actions of both armies . . . are not contradictory to the pact of nonaggression. They are intended to restore calm and order, destroyed by the collapse of the Polish state, and to help the population of Poland to reorganize the conditions of their national existence."

On September 18, Marshal Śmigly-Rydz and President Ignacy Moscicki of Poland took refuge in Rumania, and the Germans reported: "The campaign in Poland is drawing to its close." On September 19, the Polish Bzura group began to disintegrate, with 50,000 prisoners falling into German hands. Warsaw and Lwów still fought on. Hitler, riding triumphantly into Danzig, which had been incorporated into the Reich, proclaimed: "This Germany shall never capitulate."

The port of Gdynia, which held out after the city was in German hands, surrendered on September 20. The number of prisoners on all crumbling sectors rose to 105,000. German troops in eastern Poland withdrew to a line of demarcation agreed upon with the Soviet Union. Warsaw's defenses stood firm, and Lwów, too, was still fighting. Scattered islands of resistance also remained in the fortress of Modlin, on the Vistula River north of the capital, and on Hela Peninsula.

With Soviet forces approaching from the east, Lwów surrendered to the Red Army on September 22. Remnants of various Polish divisions, completely disorganized and poorly armed, attempted a stand in the region of Tomaszów on September 24. Hopeless as their action was, it gave the Polish soldiers an opportunity to show that they were second to none in courage. They even succeeded temporarily in pressing the Germans back. But with the Wehrmacht and the Red Army closing in from all sides, with no heavy equipment or air support, they were foredoomed to disaster. The survivors gave up after a three-day struggle.

The actual end of Polish resistance came on September 28. Warsaw, furiously battered by the Luftwaffe, surrendered, as did almost-annihilated Modlin. The last scattered Polish forces gave up on the same day. A few units managed to cross the Rumanian and Lithuanian borders. With the western front along the French border almost dormant, the threat of a two-front war against Germany disappeared.

The End.—On September 28, a German-Russian border and friendship treaty, signed by von Ribbentrop and Molotov, effected the fourth partition in Poland's history. The respective spheres of influence in the "former state of Poland" were divided along a line which began at the southern tip of Lithuania, ran westward north of Augustów to the old German border, followed its line to the Pisa River, then along the Pisa to Ostroleka, then southeast to Nur on the Bug River, westward on a line running north of Rawa Ruska and Lubaczow to the San River, and finally ran upstream to the sources of the San in the Carpathian range. Germany took roughly 71,000 and the Soviet Union 75,000 square miles of Poland. The population density was much greater in the German zone. Germany incorporated 32,000 square miles directly into the Reich, extending its eastern borders well beyond the 1914 line, and gave the rest of German-conquered Poland the status of a "Gouvernement General." The Gouvernement General, including Warsaw, Lublin, and Kraków, had no autonomous rights. Insignificant territorial concessions were made to Slovakia along the puppet country's northern border. The Soviet Union gave the city of Vilnius (formerly Wilno) and the surrounding territory to Lithuania and incorporated the rest of its conquest into the USSR.

The Germans reported their losses during the Polish campaign at 10,572 killed, 30,322 wounded, and 3,404 missing. Polish losses remained undisclosed. The Germans claimed as many as 450,000 prisoners after mopping up operations came to an end. This figure probably included many raw recruits led straight from barracks to prisoner cages. The Soviets reported no losses, and actual Russian casualty figures were undoubtedly very small.

THE DORMANT WESTERN FRONT

During the period between the two world wars, the French Army was widely reputed to be the most powerful in the world. The almost complete inactivity of the French and the British during the Polish disaster created general bewilderment and gave rise to persistent rumors of a "phony war" along the Franco-German border, a nominal state of belligerency to be followed by some sinister agreement satisfying the imperialistic ambitions of the parties involved. These rumors, however, had no more foundation in fact than the alleged superiority of the French Army.

In reality, after having enjoyed military supremacy for a very brief time preceding German rearmament and Russian recovery, France in 1939 was relatively weak. The French continental population figure, basically important for military strength, was roughly half that of Greater Germany as created by the annexation of Austria and the Sudeten territories. French colonies, although surpassing the mother country in population, provided only a relatively small number of soldiers. About 15 per cent of the not too large French army had to be diverted from the main front to guard the Italian frontier and the Spanish border. Strong colonial garrisons had to be maintained to watch the Italian Colonial Army, while demonstrators in Italian cities shouted for the annexation of French Djibouti, and Mussolini was quoted as saying, in that connection, that Italy did not need a French doorman for her African Empire. Still other French divisions were stationed in Syria. Contrary to fantastic publicity figures, hardly more than 85

French divisions were ever available against Germany.

French small arms were of excellent quality but inadequate in quantity. French artillery was traditionally good, but the deficiency of armor and air power was appalling. The French General Staff clung to the theory that fire power, calculated in terms of the weight of projectiles thrown at the enemy per division and per minute, was the decisive element in modern warfare. It concentrated on keeping the artillery strong, with special emphasis on light 75 mm. field pieces and extra heavy rifles. French calculations, however, neglected the mobility of the guns. They assumed that the war would again be fought in trenches, with all the artillery constantly in firing position.

German theory was based on mobile warfare. The Germans figured correctly that the decisive factor would not be the sheer number and caliber of guns, but the capacity to have the greatest volume of artillery in constant action. German artillery was therefore exceptionally mobile, whereas French artillery was deficient in mobility.

In their conception of armored warfare, most French generals thought of tanks as another kind of artillery rather than as an independent weapon. Tanks were mostly grouped into battalion units, attached to the infantry and intended to operate only at low speed in closest coordination with the foot soldiers. As early as 1927, Charles de Gaulle, then a captain on the staff of Marshal Henri Philippe Pétain, advocated far-reaching mechanization in a memorandum to his chief, on the premise that future war would be highly mobile and its outcome decided by rather small, fast, and superlatively trained units. In 1934, de Gaulle, in his book *Vers l'Armée de Métier* (*Toward the Professional Army*), emphasized these theories and urged the creation of fast armored units to operate independently. Three years later, Paul Reynaud, who became prime minister of France in 1940, supported de Gaulle's suggestions in another book, *Le Problême Militaire Français* (*The French Military Problem*). These and other warnings, as well as alarming reports of German mechanization, had little effect on French equipment. There was no basic change in the French concept of mechanized warfare.

In the fall of 1939, France could muster only one heavy and three light armored divisions able to operate independently, against six heavy and five light German armored divisions. By the spring of 1940, the Germans had increased the figure to eight heavy and six light divisions, whereas the French, then boasting of three heavy armored divisions, had actually merely broken up their only armored division into smaller units. The German armored divisions were stronger than the French in numbers of units as well as in performance.

The French Air Force, according to accounts that followed the French disaster, numbered 96 bombers, 580 fighters, and 300 scout planes, to which 500 bombers and 130 fighters of the British Royal Air Force, mostly based around Reims, could be added. Even during the Polish campaign, the Luftwaffe (German Air Force) was able to keep the Allied air arm in check. By the spring of 1940, it reached a crushing superiority with 3,000 bombers and 1,500 fighters, and the number was constantly growing.

The British Expeditionary Force (BEF), under the command of Gen. Viscount John Gort, landed in France at the rate of one division a week, while Polish divisions were being smashed at the rate of two a day. For greater security from possible German air attacks, which were negligible, it was decided to establish landing bases far to the west, extending the shipping lines and slowing the growth of the BEF. Troops were landed at Cherbourg, stores and vehicles at Brest, St. Nazaire, and Nantes. The landings began one week after the declaration of war, and three weeks passed before the First British Corps was assembled in western France. The leading division of the Second British Corps did not take up its position until Oct. 12, 1939. By the end of the year, only five British divisions were in the lines, although 250,000 men and 45,000 vehicles had been landed, a considerable part of them belonging to service units. During the period of the war in the west, the BEF never numbered more than 13 divisions, and not all of these were fully equipped. British equipment, deficient in quantity, was basically conceived according to the same obsolete principles of warfare as the French.

French Generalissimo Maurice Gamelin, tied by political considerations and by plans based on the assumed impregnability of the Maginot Line, lacked the means to take the initiative.

Maginot Line Strategy.—After World War I, the French General Staff felt that a line of strong fortifications in depth would make France almost invulnerable to another German assault. This led to the construction of the Maginot Line under the auspices of French War Minister André Maginot, a staff sergeant in World War I.

The line became the cornerstone of French military thinking, which was sounder originally than it appeared to be later. In the 1920's, France had firm alliances with Czechoslovakia and Poland, which together were considered able to resist a German onslaught. Italy, although unreliable, was likely to be hostile to Germany. Austria was too weak to be taken into serious consideration, and Hungary was expected to be held at bay by her neighbors if she ever attempted to line up with Germany. Russia, still in the extremely difficult process of reconstruction, was expected to side with France. Rumania and Yugoslavia were to guard the approaches to the lower Danube and the Balkans against any German pressure. In case of war, Germany would thus be blockaded more tightly than she ever was during World War I.

If Germany were to attempt to force the blockade, she would run headlong against fortified systems, the strongest of which was the Maginot Line itself. This was supposed to cause terrific losses to the Reich and to hasten its final defeat. In the 1920's, the invasion of Belgium was considered impossible. Belgium and France were allied, and the Belgians were to build a line of their own, extending the French fortifications. Holland, although traditionally neutral, planned extensive defenses against any attack from the east. Moreover, it seemed highly unlikely that cornered Germany would take on another enemy voluntarily. A defensive victory over Germany was actually possible under these conditions.

In 1939, by contrast, no anti-German siege lines existed in central and eastern Europe. Neither Rumania nor Yugoslavia could be expected to make any attempt to keep Germany from the regions they had once guarded. Mussolini had made Italy an ally of Germany. The

Soviet Union's attitude toward the Western powers was close to outright hostility. Germany was not blockaded, nor could any effective blockade be organized. Belgium had decided to fall back upon her precarious neutrality, thus leaving the Allied northern flank in thin air. The fall of Poland relieved Germany from the fading threat of a two-front war. With most of Germany's great power available in the west, there could be no doubt that the Wehrmacht would force its own conception of war on defense-minded Allies.

Although experts understood that there was practically no such thing as impregnability, newspaper reports and movies stressed the impressive features of the Maginot Line. Figures were distributed by propaganda, such as 12 million cubic meters (roughly 12.8 million cubic yards) of terrace-formed escarpments and 1½ million cubic meters of betons used in the fortifications. Large barracks and hospitals were built deep underground, safe from bombs and shells. Huge stores of ammunition and supplies were kept in bombproof shelters. Underground railroads assured safe communications. Light, water, and clean air were provided by ingenious devices.

The Maginot fortifications ranged between 25 and about 100 miles in depth. An involved but well-planned firing system kept every square yard throughout the vast area within range of the guns. Antitank obstacles and ditches were considered strong enough to halt any attempt at an armored breakthrough. But even if one or possibly two or three lines were breached, a fourth, fifth, and even sixth line would bar the aggressor's advance.

The modernized French encampment fortresses of Verdun, Longwy, Metz, Nancy, Toul, Épinal, and Belfort were within the Maginot area, adding to its strength. To the south, the Maginot Line extended well into the Jura Mountains, covering a good deal of the Swiss border. In the north, it ended at Sedan, and its northern section was not as deep as the center. About 20,000 gun emplacements within the Maginot Line absorbed a substantial part of French artillery power. Many billions of francs were invested in the line. If the same amount had been used for tanks and planes, modern French equipment could have been a match for that of all other European powers combined, in 1939.

From Sedan to the Channel, another less formidable line was said to exist as an extension of the Maginot. It was called the Daladier Line, after Premier Édouard Daladier. The Daladier Line actually consisted only of a rather shallow ditch, not completely continuous, which was meant to serve as an antitank obstacle, plus one row of blockhouses which were spaced rather widely but were not really strong. It could never stop and could hardly hope to delay a determined and well-equipped aggressor, but it tied its defenders to its precarious shelter.

The Allied strategic position was extremely awkward. The Maginot Line had to be manned, according to plan, to defend it against a frontal attack which the Allied generals well knew the Germans would not attempt at the outset. The Maginot garrison was neither strong enough to attack the opposing German fortifications, nor was it even supposed to do so.

The bulk of the French Army and the BEF were lined up along the friendly, neutral borders of Belgium and Luxembourg. They were not allowed to move unless Luxembourg or the Low Countries were invaded. If that happened, the initial Allied plan was to hold the main armies in the Daladier Line while small mobile units crossed into the Low Countries to delay the enemy's advance. Immediately after the outbreak of the war, another plan, known as Plan E, was suggested. The idea was to react to a German violation of Belgium's neutrality by advancing into Belgium in full strength to occupy the oblique line of the Schelde (Escaut) River as far as Ghent. On October 13, an alternative Plan D was introduced, suggesting an advance as far as the Belgian Dyle Line from Namur (Namen) to Antwerp in case of a German invasion.

It was obvious that the Allied strategy would leave the initiative exclusively to the Germans. Offensive action was only vaguely discussed. It was supposed to be undertaken much later in the war, after the anticipated collapse of German attacks and when Allied armaments had been built up to the requisite strength. In 1939, Allied equipment was far from adequate, and the traditionally superlative morale of the French army was surprisingly low. French Communists, after the signature of the German-Soviet pact, announced that the war was no concern of theirs. French Rightists, considering Hitler to be a lesser evil than domestic revolutionaries, had no enthusiasm for the struggle. And the German fifth column (political sabotage groups) had done a thorough job of explaining to French moderates that neither Poland nor any other eastern country could justify a French war against a Germany that had no claims against France.

Any chance that the French Army might strike an effective blow while the Germans were engaged in the east was eliminated by politics. Just as the Poles had not mobilized in time, the French delayed their mobilization in a pathetically futile effort to avoid provoking the Reich. The German government, with the enthusiastic approval of its people, had decided to go to war regardless of concessions and had deployed substantial forces along the French border.

Allied Deployment.—When the French mobilization was completed, Poland was already prostrate, and with the BEF gradually taking up its north-south positions, the arrangement of Allied armies was as follows: The French Seventh Army (Gen. Henri Giraud) held the sector adjoining the English Channel. Next came the BEF (Gen. Lord Gort), the French First Army (Gen. Blanchard), the French Ninth Army (Gen. Corap), and the French Second Army (Gen. Charles Huntziger). The latter's front extended as far as the northern section of the Maginot Line. French Divisions 1, 2, 12, 15, and 43, held as a main reserve, were grouped behind the Ninth and the Second. The sector from the sea to the Maginot Line was under the command of French General Georges, who was Lord Gort's superior officer. Georges, in his turn, was under the orders of Generalissimo Maurice Gamelin. The Maginot Line (north to south) was manned by the French Third Army along the Saar, the Fifth around Strasbourg, and the Eighth on the southernmost wing (these latter armies were somewhat below normal strength).

The Allies thus passively awaited the German onslaught, not for lack of belligerent intentions, but because of material deficiencies.

German Strategy.—The Germans had a line, too, the Westwall, occasionally referred to as the Siegfried Line. They also boasted of the

Above: The participation of the United States in World War II began with Japan's surprise attack on Pearl Harbor.

Right: American soldiers taken prisoners by the Japanese at the fall of the fortress of Corregidor in Manila Bay.

(Above) Acme Photo; (right) Wide World Photo

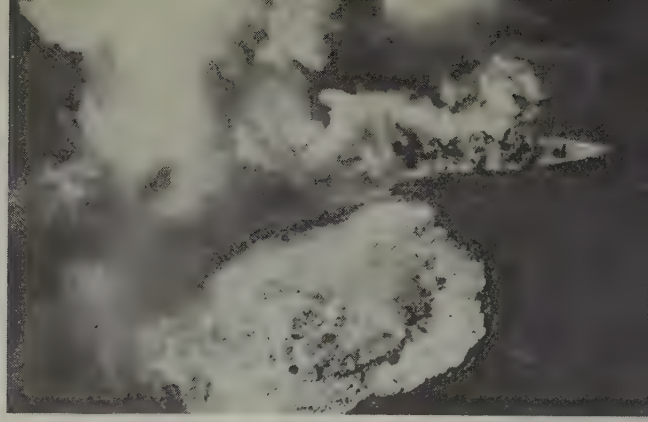
Above: A dominant feature of the war was the invasion and capture of Japanese-held islands in the Pacific.

WORLD WAR II

Below: The initial American assault on Pacific islands was usually marked by heavy and bloody fighting.

Right: The large gun on Bougainville Island in the Solomons was hit twice on the same day by Japanese bombs.

(Below) Official U.S. Marine Corps Photo; (others) Signal Corps Photos



Left: Marines raise the American flag on Mount Suribachi on Iwo Jima, Feb. 23, 1945, after some of the bitterest fighting in United States military history.

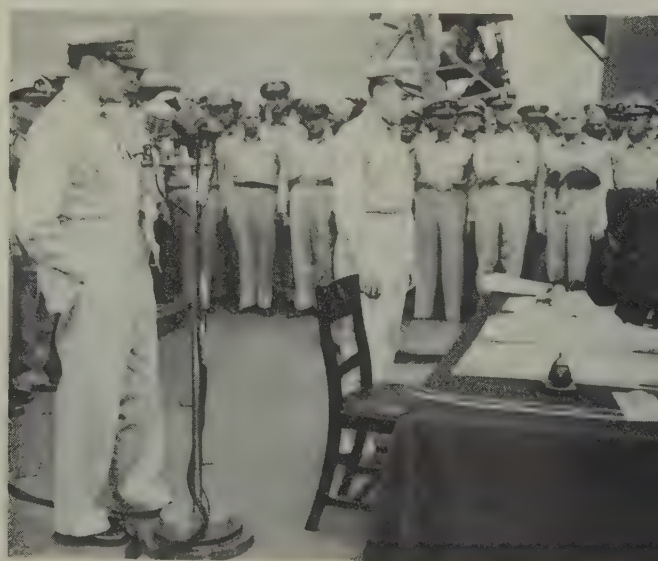
Above: Airpower played an important part in the United States' victory in the Pacific. Here, one American bomb has hit a Japanese transport and another has landed in the water nearby.

Lower left: Transporting hundreds of thousands of men and immense masses of war matériel across the Pacific raised herculean problems in logistics.

Above: The climax of the war in the Pacific came with the dropping of atomic bombs on two Japanese cities. The wrecked plant shown above was a mile from the center of the explosion at Nagasaki.

Below: While General Douglas MacArthur watches, the Japanese foreign minister, Mamoru Shigemitsu, signs the formal terms of surrender.

(Top right) Press Association, Inc.; (lower left) Official Marine Corps Photo; (others) Wide World Photos



impregnability of their line and the six million cubic meters of cement used in its construction. The potential strength of the Westwall was probably less than that of the strongest sections of the Maginot Line. Unlike the French defenses, however, it covered the approaches to Belgium, although the German claim that it reached to the North Sea was not borne out by the facts. The principles of construction were essentially the same as those adopted by the French.

There was one vital difference between the French and German concepts of their respective lines. The Westwall was never the cornerstone of German strategy. It was supposed to be merely a line of defense to be used if the Polish campaign, contrary to German expectations, dragged on beyond the time required by the Allies to complete full mobilization and the Western powers were thus enabled to prepare to attack. Another objective obviously was to create a screen to be manned by small forces while the main German armies were deployed further to the rear, beyond the range of Allied scouting, to take up positions at the springboard of attack immediately before the time set for action in the west.

By the end of August 1939, at least 50 German divisions were deployed in the west, while the Maginot fortification troops numbered 16 divisions. A considerable part of the Luftwaffe and the armored forces did not arrive until somewhat later.

The German General Staff and the Reich government were in full agreement that the main blow should be directed through Belgium and Luxembourg. The question whether Holland should be invaded or by-passed was still being discussed when the war began. The Germans could safely rely upon the threatened countries' determination to preserve their neutrality. Even during the Polish campaign, German reinforcements poured into the west. The Allies never enjoyed numerical superiority at any time. German transportation, carefully planned for the needs of war, functioned to perfection. Three weeks after the campaign in the east was completed, the bulk of the Wehrmacht, complete with the Luftwaffe and armored force, stood ready in the west. Approximately 90 to 100 German divisions (increased to 120 by March and 150 by May of 1940) were mostly massed in rear areas. Their final grouping for attack was well concealed.

The blitzkrieg in the east was considered the supreme test of the armored push, the Panzer-Luftwaffe-Infantry team, and the German doctrine of extreme mobility. As the Polish campaign had been fought under weather conditions which were ideal for the Germans, the Reich's General Staff came to believe that fine weather was essential to "blitz" warfare. The German attack in the west was originally timed for approximately October 15, weather conditions permitting. The forecast was not as good as the experts considered necessary, and the assault was postponed.

There can be little doubt that, had the Wehrmacht attacked regardless of weather predictions, the Allies would have suffered defeat before the end of 1939. With the British government of Chamberlain in office and the United States in no position to give any effective assistance to the United Kingdom, this defeat would have been final. After Oct. 15, 1939, the attack was again postponed at least twice because of weather considerations and finally put off until the following spring. The plan of an attack on Denmark and Norway, prior to the invasion of the Western countries, was taking shape.

Neither the inaction of the Wehrmacht in the west nor Hitler's peace talks should be called "phony war" or real efforts to come to terms. They were merely stop-gaps.

Loudspeakers installed in the German lines transmitted appeals to the French to refuse to fight. They emphasized German peace-mindedness, denounced the war as senseless, and reiterated Hitler's assertion that he had no claims against France. Dissension between the Allies was promoted by telling the French that the British wanted to fight to the last Frenchman. French morale deteriorated under this propaganda. The Allies also used loudspeaker propaganda, trying vainly to appeal to nonexistent German anti-Nazi feelings.

Air activity was restricted to limited scouting. Occasional, weak, British air raids against German coastal strong points, such as Wilhelmshaven, had little effect and were carried out reluctantly in order not to give the Germans a pretext for raiding British cities. The latter were almost unprotected against air attacks. Patrols clashed occasionally along the Maginot Line and the Westwall. Units larger than a company were rarely in action. Artillery activity was limited. Soldiers of General Georges' group were kept busy working on trenches. Their efforts did not substantially improve the Daladier Line, although the British reported that within nine months they had added 40 miles of antitank ditches and 400 pillboxes to the sketchy fortifications.

No major land action occurred in the west during 1939 or in the early months of 1940.

The War at Sea.—The German Navy of the Third Reich, like that of Kaiser Wilhelm, emphasized submarine warfare. At the outbreak of the war, the Germans probably had as many as 130 U-boats ready for action. In September 1939, Allied shipping amounting to 137,084 tons in addition to 42,000 tons of neutral ships, was destroyed without warning. The sinking of the *Athenia,* a large British liner, on the first day of the war, caused the loss of more than 100 lives, including those of 28 Americans. In October 1939, Allied shipping losses amounted to 117,176 tons. They declined in November to 24,759 tons. In December, 33,714 tons were reported sunk by submarines. German submarine losses since the outbreak of the war were reported to number 47, of which 35 were credited to the British and 12 to the French Navy. British and French warships patrolled the main shipping lanes. Convoys were successfully protected.

The threat of another German naval weapon, the "magnetic mine," was reported largely removed by appropriate countermeasures. The British Navy suffered a serious loss in the sinking of its battleship *Royal Oak,* destroyed at anchor by torpedoes launched by a German submarine. Luftwaffe attacks on Allied shipping, although not particularly effective, opened a new threat to Allied sea transportation. By the end of 1939, however, the war at sea had comforting aspects for the Allies.

On Dec. 13, 1939, the German 10,000 ton pocket-battleship, *Graf Spee,* equipped with guns up to 280 mm. caliber, was scouted by three light British cruisers, H.M.S. *Exeter, Ajax,* and *Achilles,* off the mouth of the river Plata in Uruguayan waters. The *Graf Spee,* as a raider, was

able to raise havoc with Allied shipping in South American waters. Two of the British cruisers mounted guns up to 152 mm. caliber, the third up to 203 mm. Their combined fire power was hardly equal to that of the *Graf Spee.* In a sharp engagement, the German ship suffered heavy damage and had to retreat to Montivideo for repairs. The Uruguayan government, after protesting violation of its neutrality to both Great Britain and Germany, informed the *Graf Spee's* commander, Capt. Hans Langsdorff, that his vessel would have to leave on or before December 17, at 8:00 P.M., or face internment. The *Graf Spee,* not fully ready for action, left under the protest of its commander on December 17, at 6:00 P.M., and proceeded down the river Plata to a point three miles offshore. Reinforced British naval units were waiting to attack the German ship. At 7:25 P.M., the captain ordered the crew to abandon ship and to scuttle the vessel. Most of the crew were interned in Argentina at their request. Captain Langsdorff committed suicide.

In the early stages of the war at sea, the Russians gave valuable assistance to the Germans. A naval base, referred to as "base north" and located near Murmansk, was offered to and used by German ships. The sensational escape of the *Bremen,* a 51,731 ton liner, from the United States to Germany, despite the watch of substantial Allied forces, was made possible by the use of base north. After the occupation of Norway by the Germans, base north was no longer of particular importance and was abandoned in September, 1940.

U. S. Neutrality.—Although the majority of American public opinion was in favor of the Allies, there was not much inclination to side with them actively. Experiences after World War I had a sobering effect, and too, it was widely believed that Allied victory was assured anyway. Pro-German elements in the United States, well organized and steadily pursuing their goal, advocated isolationism. Leftist radicals proclaimed that the war was no concern of the American people.

Previous United States neutrality acts were followed by the United States Neutrality Act passed by Congress (the vote in the Senate was 55 to 24, and in the House of Representatives 243 to 173) in a joint resolution on Nov. 3, 1939. It was signed by the president on November 4 and went into effect on that day at 12:04 P.M. This act established the "cash and carry" principle. United States vessels were forbidden to carry passengers, articles, or materials to belligerents. Credits to belligerents were banned. Purchases on behalf of belligerents had to be paid for in cash, and transportation had to be provided by non-United States nationals. The Neutrality Act also established a United States National Munitions Control Board. The cash and carry provisions virtually halted all trade with Germany, as the seas were under Allied control, but Allied advantages from the act were limited. The necessity of payment in cash restricted purchases.

DEVELOPMENTS IN EASTERN EUROPE

Conjectures that the German-Soviet treaty covered a scope much wider than had been disclosed in official reports were soon borne out by events in the Baltic immediately after Poland's collapse.

On Sept. 20, 1939, Estonian ports were blockaded by the USSR. Six days later, the Russian government accused the small Baltic country of a breach of neutrality because the Polish submarine *Orel,* interned at Tallinn (Reval), escaped to Sweden. On September 27, the Estonian foreign minister was summoned to Moscow and presented with Russian demands for naval and air bases and the right to maintain garrisons on Estonian territory. Helpless, Estonia had to grant the USSR naval and air bases on the islands of Saaremaa (Ösel) and Hiiuma (Dagö) as well as close to the township of Paldiski. The enforced pact, signed on September 29, included the establishment of military bases along the Baltic shore and in the capital of Tallinn. Estonia thus came under effective Russian control.

Immediately thereafter, the German government ordered Estonian *Volksdeutsche* (citizens of German nationality) to migrate to the Reich. About 12,000 Germans did so, roughly 80 per cent of the German minority in Estonia. The Tallinn government was compelled to cooperate with Berlin in the liquidation and transfer of the emigrants' property, which severely strained the Estonian economy.

The pattern of the German-Russian agreement became clear. The USSR was to extend its control in the Baltic region to the areas which had been under the czar's rule before World War I, while Germany was to recall its nationals and liquidate their property on the Reich's behalf, thus taxing the economics of the small countries to the limit

Latvia was presented with Russian claims almost simultaneously with Estonia. As a token of resistance, the Latvian government proclaimed a state of emergency and set up a defense council on September 28. On October 5, recognizing the hopelessness of its position, the Latvian government yielded, ceding naval bases at Liepāja (Libau) and Ventspils (Windau) and a number of airdromes and coastal gun emplacements to the USSR. Latvia thus practically ceased to be an independent state. Berlin's action followed Moscow's, and 62,000 Volksdeutsche were shipped to Germany by October 30 and their property disposed of according to the Estonian pattern.

Lithuania suffered a similar fate. Although Russia ceded the town and district of Vilnius, taken from Poland, to Lithuania, Moscow asked for and received the right to maintain land, air, and naval forces in Lithuania. Most of the German nationals of Lithuania had been shifted to the Reich in the previous spring, following the annexation of Memel.

Russian Claims Against Finland.—On October 5, the Finnish government was invited to send a delegation to Moscow. Finland, stronger than Lithuania, Latvia, and Estonia, received greater consideration. The Finns accepted the invitation, but they did not intend to be meekly acquiescent. On October 14, their delegation was presented with Russian claims for a 30-year lease of Hanko (Hangö) Peninsula, key point on the northern coast of the Finnish Gulf. The lease was to include adjoining territories, and a Soviet garrison of 8,000 men was to be maintained at Hanko. The Russians also asked for the cession of the islands of Lavansaari, Suursaari, and Tytärsaari, all in the Finnish Gulf. Furthermore, Moscow demanded the extension of its borders on the Karelian Isthmus and the cession of the Finnish part of the Rybachi (Fish-

ermen's) Peninsula in the extreme north. In compensation, the Soviet Union offered to cede to Finland the Russo-Karelian districts of Repola and Parajärvi, twice the size of all the territories claimed, but of little economic and no strategic value. The Russians stated that, provided their claims were accepted they would raise no objection to the fortification and militarization of the Finnish Åland Islands in the Baltic. Such a move, however, was prohibited by other international agreements. Ultimately, the Moscow government called for the dismantling of Finno-Russian border fortifications.

Finland had its defense line too, the Mannerheim Line. It was supposed to protect the country against invasion from the east on the historic routes. The Finns had as much faith in the impregnability of their line as the French had in theirs. To dismantle the Mannerheim fortifications, or to accept a shift of the Russian border to their key points, would have destroyed Finland's feeling of security.

Russia and Finland were mutually bound by a nonaggression pact, and their borders had been fixed by the Treaty of Dorpat (1920), concluded under the auspices of Vladimir Lenin, founder of the Soviet Republic. The inconclusive justification which the Russians offered for their claims seemed outrageous. The USSR insisted that the proximity of the Finnish border jeopardized the security of Russia's second largest city, Leningrad, whose population almost equalled that of the whole of Finland. The contention that gigantic Russia was threatened by little Finland caused outbursts of indignation in many countries. As it was worded, there was reason for derision.

There were thoroughly realistic reasons behind the Russian claim. Although the overwhelming majority of the Finns adhered to democratic principles and had no use for German or German-sponsored totalitarianism, two small but powerful groups in Finland championed pro-German dictatorship. The average Finn, although traditionally anti-Russian, wanted peace, but a pro-German officers' league urged a German-Finnish alliance directed against the USSR. The domestic Fascist Party, the Lappo, which never held more than 7 per cent of the seats in Parliament but had influential sympathizers in key offices, adopted an annexationist program mostly aimed at Russia. Isolated Finland was no threat to the security of any section of Soviet territory. If Germany should attack Russia, the cession of Finnish bases to Germany would most certainly threaten Leningrad, if not all of Russia. The Moscow government did not disclose this cause for anxiety, while German-Russian friendship was being eloquently advertised.

Stockholm Conference. — In Scandinavia, the Finno-Russian parleys gave impetus to the popular idea that Sweden, Norway, Denmark, and Finland should form a bloc strong enough so that aggressor states would hesitate before violating its members' neutrality. Actually, such an alliance presented difficult military problems.

Neither Denmark nor Norway had armed forces worth mentioning. Only Sweden could take the lead. Sweden was the most populous of the Scandinavian nations, the best equipped, and the only one to possess a fair amount of air and naval power as well as an armament plant. The Bofors factories were among the most renowned in the world. In Sweden, however, small but powerful groups sympathized with Germany. These groups had strongholds in the country's armed forces. The extreme Leftist party, meanwhile, sympathized with Russia and put Soviet interests above Sweden's. Some members of the government meekly awaited a German reaction, although Foreign Minister Rickard J. Sandler was strongly anti-Nazi.

The outlook was not promising when the kings of Sweden, Norway, and Denmark, and the president of the Finnish Republic met at Stockholm, Sweden, on October 18 and 19, 1939. As a result of the conference, an official broadcast proclaimed that the participating countries were determined to maintain their neutrality. A military alliance was not even mentioned. Finland was on her own. Future aggressors understood that they could take on the small, nordic countries one by one.

Finno-Soviet Crisis.—On October 23, the Finns made counter-proposals, refusing to lease Hanko but offering slight territorial adjustments on the Karelian Isthmus, well outside of the Mannerheim Line. The Finnish popular reaction to the Russian demands was almost unequivocally opposed to Moscow's terms despite the possible consequences of their opposition. The government would have needed a good deal more courage to accept the Russian demands than to refuse them. The Finnish proposals were immediately rejected by Moscow.

President Roosevelt wired to Mikhail Kalinin, president of the Supreme Soviet, expressing his hope that friendly relations between USSR and Finland could be maintained. Addressing the Supreme Soviet on Oct. 31, 1939, Molotov termed President Roosevelt's wire "unneutral" and derisively referred to United States relations with the Philippines as well as with Cuba, "which has long demanded her freedom and independence and could not get them." In the same address, the Soviet foreign secretary stated: "It is the fear of the German claim to colonial possessions that is at the bottom of the present war of England and France with Germany, which has grown substantially stronger as the result of the collapse of the Versailles treaty. It is the fear of losing world supremacy that dictates to the ruling circles of Great Britain and France the policy of fomenting war with Germany. Thus, the imperialistic character of the war is obvious . . ."

During the following months, from Molotov's speech until the German attack on Russia, World War II was referred to in the Soviet Union and by Communists abroad as "the imperialistic war."

On November 13, the Finnish delegation left Moscow, still avoiding an official break. A rabid Russian propaganda campaign placed all the blame for the crisis upon Finland.

On November 26, the Russians reported that their troops on the approaches of the Karelian Isthmus, clearly within Soviet territory, had been shelled by Finnish field artillery and had suffered casualties. The Finns, emphatically denying the Soviet report, suggested that, in order to avoid incidents, both armies should withdraw to a distance of approximately 15 miles from the border. This proposal was flatly rejected by the Russians on the basis that such a withdrawal would not affect the Finns but would place the Russian line of defense virtually within the suburbs of Leningrad.

Two days later, Russia denounced her nonaggression pact with Finland, contrary to its stip-

ulations. On November 29, the Finns proposed a settlement by arbitration. Russia replied by breaking off diplomatic relations.

The Finno-Russian War.—On November 30, while Finland was still making attempts to continue negotiations through Swedish channels, a Russian air attack on Helsinki, without a previous declaration of war, opened hostilities. Contrary to some reports, this attack was on a rather limited scale. It was generally believed that Russian superiority would prevail with lightning speed. On December 1, Finnish Prime Minister Aimo Cajander resigned, and Risto Ryti formed a cabinet of National Union. The cabinet pledged itself to an all-out defense of Finnish territorial integrity.

On December 4, with the fighting spreading rapidly, the Soviet government announced that a "new Finnish government" had been formed by Mr. Otto Kuusinen at Terijoki, on the Finnish side of the Karelian Isthmus border. This town had been occupied by Red troops shortly after the initial attack was launched. Mr. Kuusinen, a prominent member of the Comintern and for many years a resident of Russia, was a former Finnish social democrat deputy. During the civil war of 1917–1918, he had sided with the pro-Soviet elements in his country in an effort to have it join the Soviet Union. When the tide turned against the Reds, Kuusinen fled from Finland and had never returned. On Dec. 4, 1939, when the Swedish minister at Moscow tried to intervene on Finland's behalf, he was informed that Kuusinen's government had already granted all Russian demands and that there was no need for further negotiations.

Finland's plight evoked a strong wave of international sympathy but little practical assistance. Its government was advised to appeal to the League of Nations. This appeal was made after some delay. Pro-German elements had been substantially strengthened in the Ryti regime and the general mobilization gave the pan-German officers (36 out of 45 in charge of large bodies of troops) increased power. They did not want the League of Nations, from which Germany had withdrawn, to gain much influence or popularity in Finland. They were convinced that, sooner or later, the Reich would go to war with Russia, and they wanted their country to become Germany's satellite.

At last, on December 14, the Finnish appeal was considered in Geneva. The League of Nations expelled the Soviet Union as an aggressor. The British and French representatives announced the intention of their respective governments to give every possible aid to Finland. Such help would inevitably have led to the presence of British and French troops on Finnish territory, which the pro-Germans were anxious to prevent. Disloyal Finnish officials wanted to postpone Allied aid indefinitely.

Committees were formed in many countries to give the "gallant little Finns" all kinds of help. International volunteers were called upon to join the Finns, but the results were meager. From Sweden, Norway, and Denmark combined, where feelings of solidarity with Finland were strongest, 6,500 were assembled, about two thirds of them being Swedes. Only 800 volunteers from 21 other nations enlisted in the *Osasto Sisu* (the Finnish international brigade). Most of the volunteers were untrained, and only a very few saw action. The little equipment which came from France was scornfully displayed in Finnish army warehouses: cannon dating from 1880 and light machine guns already obsolete at the end of World War I. An Anglo-French survey later listed help to Finland as 285 planes, 590 guns, 100 antitank rifles, and 5,000 machine guns. A few ultramodern Swedish 100 mm. cannon mysteriously never found their way to the front lines. Drives for food and clothing, organized abroad, brought no substantial relief to the Finns, who soon suffered from severe shortages.

The Finnish Army was relatively strong in numbers and superbly trained. There was compulsory military service in Finland in the armed forces as well as in the *Schutzkorps* (protective corps), an auxiliary military formation in which men between the ages of 16 and 60 had to enlist. Finnish ski troops were unmatched. Outdoor life enabled Finnish soldiers to bear extreme hardships. A women's auxiliary corps, the *Lotta Svärd,* released many soldiers for combat duty. The Lotta Svärd, however, was under Nazified leadership, and there were also strong Nazi influences in the Schutzkorps. Finnish mobilization, begun in the early stages of the arguments with Moscow, was completed when the war broke out. Nearly 300,000 men faced the Russian onslaught, with Field Marshal Baron Carl Gustav Mannerheim, a former czarist lieutenant general, as actual commander-in-chief, the nominal commander-in-chief being President Kyösti Kallio. Mannerheim had no Nazi affiliations at the time.

Small arms were abundant in the Finnish Army, although only a small proportion of them was modern. There were only 16 tanks, all of them obsolete, 2 bomber and 6 fighter planes fit for combat duty, and a small number of other aircraft of doubtful value. The Finnish Navy was relatively just as weak, but there was no opportunity for naval activity in the frozen waters of the Finnish Gulf. The lowest temperatures on record, ranging down to about 60 below zero, limited motorized and air action, preventing Russian superiority from becoming immediately decisive. Finnish artillery excelled that of the Red Army in marksmanship, but Russian guns were overwhelmingly superior to Finnish both in quality and numbers. Russian 76 mm. field cannon (model 1936) outranged the corresponding 75 mm. Finnish standard (model 1897) by more than four miles.

The Russians suffered a number of setbacks in the initial stages of the war. It was then widely believed that the Red Army was amazingly weak. Later, it was rumored that the Russians deliberately wanted to give a poor account of themselves to deceive potential aggressors, an extremely far-fetched theory. The Germans subsequently insisted that they had been deceived. This seems highly unlikely in view of the close ties between the Finnish and the German General Staffs.

In reality, the Soviet government expected Finland to capitulate as soon as she realized that Moscow was in earnest about enforcing its claims. In that event, the Red Army would only have had to carry out an occupation instead of waging a serious war. Only the Leningrad military region was mobilized to reinforce peacetime border garrisons. These forces were deployed for a virtually unopposed march through Finland. When it became clear that the Finns were determined to fight an all-out war, the Red

Army, after suffering initial defeats, had to be extensively regrouped and reinforced. This accounted for a period of relative lull on the Finnish front.

The Finno-Russian Winter War.—Of the 12 Finnish divisions, all of them over normal strength when action began, seven were posted in the Karelian Isthmus to defend the Mannerheim Line guarding the main approach to the heart of the country. During the fall of 1939, 100,000 men between the ages of 17 and 70, most of them volunteer workers, had toiled to improve the defenses.

Standard fortifications were supplemented by special features to fit the southern Finnish terrain and the particular type of warfare to be expected. Irregular pieces of rock replaced regular tank obstacles; thick woods provided improvised tank traps; an ingenious system of water traps was developed. Water courses crossing the isthmus were dammed up at the beginning of the freezing season. After their surfaces were frozen sufficiently thick to bear the weight of marching men, the dams were reopened, and a vacuum was formed under the ice. Heavy vehicles attempting to cross the treacherous surface would break through. A large number of cleverly camouflaged blockhouses covered the forefield of the permanent fortifications. Finnish soldiers, superbly trained to find their bearings even in the thickest woods, were prepared to lead Russian attack parties to destruction by patrols armed with light machine guns.

To the north of the isthmus, around Sorta-

vala (Serdobol) in the region of Lake Ladoga, another concentration of Finnish troops was stationed to block Russian efforts to by-pass the left wing of the Mannerheim Line. The line north of Lake Ladoga was not continuous, as there were not enough troops available to man the full length of the Russo-Finnish border which was almost 1,000 miles. The gaps between the groups were left only in roadless, heavily wooded regions, where the Finns knew that Russian units could not penetrate.

The Russian commander in chief, General Kyril A. Meretskov, head of the military district of Leningrad, spread his force of about 250,000 to 350,000 men widely all along the border, with a little less than half of it between the shores of the Finnish Gulf and Sortavala on Lake Ladoga. In the extreme north, a Russian threat developed in the direction of Petsamo, with its rich nickel mines, and toward the Norwegian border to cut Finland off from the Arctic Ocean and to block any possible threat to Murmansk. Farther to the south, Russian divisions concentrated opposite Salla, covering the approaches to the railroad terminal of Kemijärvi and the city of Rovaniemi, terminal of the Finnish Arctic highway, the only land-traffic link between the northern part of the country and the rest of Finland. South of Salla, Russian columns moved toward Kuusamo, in the direction of important Tornio on the Bothnian Gulf, a few miles from the Swedish border. Still farther to the south, the Red Army advanced toward and beyond Suomussalmi in an attempt to cut Finland in two by seizing vital Oulu (Uleåborg), on the east coast of the Bothnian Gulf.

Immediately after the outbreak of hostilities, the Russians triumphantly reported that they had breached the first line of the Mannerheim fortifications by advancing several miles through the Karelian Isthmus and seizing Terijoki. In reality, there were no major fortifications that close to the border. The Finns had left only a thin screen of patrols to delay the Russian advance and to scout the deployment of General Meretskov's forces. Encouraged by the apparent weakness of Finnish defenses, the Red Army, even after making contact with the main Finnish forces in the isthmus and the first line of permanent pillboxes, attempted a breakthrough by frontal assault. The use of planes was hampered by bad weather. The use of armor was handicapped by an improvised antitank weapon, a bottle filled with an inflammable liquid—mostly gasoline—to be thrown at the tank by hand. The Finns called the liquid "Molotov cocktail." It cost only about 10 cents a bottle. Many tanks were lost in Finnish traps Extreme cold hampered mechanized warfare. Deprived of their main elements of superiority, the Russians suffered heavy casualties without making any appreciable progress.

Russian offensive operations were at a standstill by Christmas. The Finns had not yet tested the full strength of the Red Army. Reports of Russian inefficiency and poor equipment were widely circulated and believed.

In January, the Finns won their most spectacular victory in the sector of Suomussalmi. Anxious to remove the threat to Oulu without weakening the Mannerheim garrison, the Finns resorted to harassing operations on an almost unprecedented scale by the use of tactics rarely employed in major warfare. Outnumbered 2 to 1 by the Red Army, they operated in units up to battalion strength, mostly on skis, infiltrating and by-passing the Russian lines and chopping up Red divisions into numerous small groups. The Russians were forced to keep to the roads, of which there were only a few, while the Finns moved through the wildnerness. Red tanks were helpless, and Red artillery was unable to use its full power, but the Finnish skiers ambushed the Russians with their deadly light machine guns.

The battle of Suomussalmi and the adjoining Raate lasted until late i: the month. After a few weeks, the Red forces were cut to pieces. The Russian defeat, however, had no far-reaching consequences. Substantial Red reserves were already on their way to the critical sector, and a half-hearted Finnish push farther north came to a halt after the border was crossed by patrols. The Finns did not have sufficient reserves on hand to exploit their success, and their High Command was most reluctant to operate against the Murmansk railroad, since this might have caused trouble for the Germans using base north.

On January 13, the Russian Air Force began systematic bombings of Finnish cities and communication lines. Its operations, restricted by poor flying conditions, were not particularly effective. The cities of Tampere (Tammerfors) and Oulu suffered the most. Civilian casualties were listed as 563 killed and 1,285 wounded from the outbreak of the war to March 1, 1940.

By the end of January, Russian preparations for the decisive assault were completed. General Meretskov was replaced by General Semyon Budyonny, who was in turn succeeded by Marshal Semyon Timoshenko. On January 31, Soviet War Commissar Marshal Klimenti E. Voroshilov visited Red headquarters on the isthmus. General Grigori A. Stern, of Far Eastern fame, came to Karelia.

At least 12 Russian divisions were massed on a 35 mile line at the isthmus. On February 1, after a six-hour barrage, the Red assault against the Mannerheim Line began. Heavy tanks pulled armored sledges, manned by shock troops, and were followed by regular infantry. A force of 130 low-flying bombers supported the attack, which lasted for five days, and gained ground only by inches against desperate resistance. On February 5, a new barrage paved the way for a crescendo in the attack, with 100 more tanks in operation. The Red Army succeeded in denting the fortifications in some places, and the defenders began to show signs of exhaustion. Although the relative narrowness of the critical sector allowed the Finnish High Command to oppose the Soviet first line with almost equal strength, the Russians had ample reserves available. This fact enabled them to relieve their troops at short intervals, whereas the defenders had to stay in action for 48 hours at a stretch and sometimes longer. The power of the Red artillery began to have a telling effect.

The Finns relied upon the weather to halt the Russian attack. Usually, there are terrific blizzards in Karelia during the month of February. In 1940, however, they came late and were less severe than usual. Lack of heavy matériel in the Finnish Army became alarming.

The failure of the Finnish government to request Franco-British military assistance seemed to be mysterious. This had been suggested after Russia's expulsion from the League of Nations. Finnish Prime Minister Risto Ryti

under the influence of the pro-German elements in his country, sought Berlin's advice. As the Germans were opposed to the presence of any Allied soldiers in Finland (and Norway and Sweden in transit), Ryti sabotaged the appeal to the western democracies. Despite the strange attitude of the Finnish government (neither President Kallio nor Marshal Mannerheim was in the plot, but their hands were tied), the British and French governments proceeded with preparations for sending aid.

On Feb. 22, 1940, in answer to an unofficial inquiry by the British government, Soviet Ambassador Ivan Maisky outlined Russian peace proposals for Finland. The British prime minister, not considering these proposals acceptable to Helsinki, informed the Finnish government of his country's readiness to render armed support. The French prime minister joined the British in this step. The Allied Expeditionary Force was ready to sail. It is supposed to have numbered slightly more than 50,000 men, with little heavy equipment. Such a tiny force could never have so much as delayed the Red advance, but a clash between the regular armies of Great Britain and France on the one hand and Russia on the other would have created a state of war between the USSR and the Western powers.

It was an almost incredible opportunity for Germany. Berlin could have chosen between joining the Allies (who would soon have had to seek support) to destroy the USSR, or joining the Reds against the democracies. In either event, Germany would have been the dominant partner, easily able to conquer her erstwhile allies after the defeat of the common enemy. The German government refused to take advantage of this opening. Plans for the German control of Scandinavia were already drafted. Berlin wanted to keep the Allies out of the northern countries, and especially out of Finland, the potential base for a flanking assault on Russia.

The Scandinavian countries took a negative attitude when they were asked to allow Allied troops to pass through their territories. The Norwegian government looked to Sweden for guidance. The Swedes in turn were anxious not to offend Germany. Berlin was insistent that there must be no Allied transit through Scandinavia.

Meanwhile the Red Seventh Army attacked the crumbling Mannerheim Line with the assistance of the Red Thirteenth Army and kept the Finnish lines on and around Lake Ladoga under constant pressure. A new type of weapon was used by the Thirteenth, a light motor-sledge, armed with a machine gun and able to develop a speed of 100 miles an hour. This fast vehicle did not impress the Finns. Four fresh Russian divisions massed at Suomussalmi and an equal force at Petsamo, where they heavily outnumbered the Finns. Finnish supplies ran low, and the soldiers lived on curtailed rations. Although the army still fought magnificently, its situation deteriorated steadily, and losses mounted rapidly.

Russian losses were also very high. Another main blow at the center of the rear fortifications of the Mannerheim Line began on February 11 and, supported by 1,000 armored vehicles and 300 mobile guns, resulted in slow advances at a cost of more than 1,000 killed a day. The Finns resorted to the tactics of Suomussalmi to cope with the threat of the Red Thirteenth Army. This led to a Russian setback, in which the 18th Red Infantry Division was badly mauled, and the 34th Heavy Tank Brigade was almost destroyed.

The Finnish victories were insignificant compared to the Red successes in Karelia. On February 17, the Finns admitted a withdrawal. A week of blizzards gave the Finns a breathing spell, but the heavily reinforced Red Seventh Army reopened its drive on February 25. Russian 6- and 8-inch guns pulverized Finnish pillboxes. Koivisto, the strongest point in the Mannerheim Line, was still in Finnish hands, and it was believed that it would hold out against frontal assaults. Outflanking moves over the ice of the Finnish Gulf were considered impossible. Rugged, towering cliffs and miniature mountain ranges of ice seemed to be insurmountable obstacles. Under the command of General Stern, however, the Red Army succeeded in getting at least three divisions, complete with heavy artillery and tanks, across the ice. Koivisto, taken from the rear, fell virtually without resistance. With their southern anchor gone, Finnish lines gave way in the Karelian sector.

Two days later, the Russians stood four miles outside of Viipuri (Viborg) with the Finnish Army on the verge of collapse. While the Russians still poured reinforcements into the lines, Finnish losses, now amounting to about 2 per cent per day of the army's remaining forces, could not be replaced. Almost 85 per cent of the Finnish junior officers had been killed or wounded. On March 5, Viipuri was outflanked by Red tanks and virtually encircled. From captured Koivisto, the Russians prepared for another drive over the ice aimed at Kotka, half way between Viipuri and Helsinki. The capture of Kotka would have cut off the Finnish main forces and opened the capital to the Soviet army. A few Finnish diehards advocated a last-ditch stand in the hope that thaws might stop the Reds. The Finnish Army was melting away faster than snow. The fact that Russian losses probably ran almost twice as high could not affect the inevitable outcome.

On March 7, the Finnish Bureau of Information disclosed, for the first time, that peace conditions were under discussion and that Russian demands were "more far-reaching" than those of the previous autumn. The negotiations were due to Swedish mediation. There could be little doubt that Germany had advised the Soviet Union that the Reich was opposed to total Russian control of Finland.

Finnish delegates, including Prime Minister Ryti, arrived in Moscow on March 10. Two days later, a treaty put an end to hostilities, which ceased formally on March 13. This treaty, which made no mention of the puppet government of Otto Kuusinen, gave Russia the lease of Hanko and the adjoining hinterland for 30 years, with the rent fixed at eight million Finnish marks (a little more than $150,000). The Soviet Union annexed the entire Karelian Isthmus, the city of Viipuri, and Viipuri Bay with its islands (more islands in the Finnish Gulf than had been demanded originally), and territory north and west of Lake Ladoga. Finland was to build a railroad to connect Kandalaksha and Kemijärvi in order to enable the Russians to route traffic to Sweden. The Soviets were also granted transit rights through Petsamo.

The population of the regions ceded to Russia, more than 10 per cent of the country's total,

had the choice of remaining in their homes or migrating to what was left of Finland. At least 30 per cent of them (and perhaps substantially more) chose to abandon their homes rather than accept Russian rule. The influx of these refugees greatly increased the general feeling of frustration and the desire for revenge in Finland. Under the influence of government-controlled, distorted news, the Finns felt abandoned by the Western Allies. Even those who disliked and distrusted Germany were inclined to accept an alliance with the Reich if the Germans should attack Russia.

On March 24, Field Marshal Baron Mannerheim, meeting with Parson Kaarlo Riitekki Kares, leader of the Finnish Lappo-Fascists, was persuaded not to oppose the pro-German policy to be carried out by Ryti without consulting Parliament. In May 1940, German specialists were busy establishing bases for the Luftwaffe along Finland's northern coast. Demobilization of the Finnish Army was never completed. Starving, and bled almost white, the country prepared for another war.

SCANDINAVIAN INTERLUDE

Late in 1939, the German General Staff decided as their next move to establish German air and naval bases in Denmark and Norway. These bases were expected to be useful in war against Great Britain, to keep vital German shipping routes open, to make the Reich independent of the precarious base north near Murmansk, and to serve German purposes if the Reich chose to attack the Soviet Union.

The Allies were prepared to respect Norway's neutrality to the limit despite German violations, but they refused to let the Germans ship Allied prisoners through Norwegian waters to camps in the Reich. This refusal precipitated a crisis when 299 British sailors from 7 merchant ships were being taken to the Reich in the German prison ship *Altmark*. Detected by British scouting forces, the *Altmark* slipped into territorial waters in southern Norway, and on February 16 men from the British destroyer *Cossack* boarded the prison ship. The crew resisted and suffered ten casualties. The British prisoners were freed. Germany protested to Norway and threatened reprisals for what was termed a breach of Norwegian neutrality.

The Amalienborg Conference of the Norwegian, Swedish, and Danish foreign ministers appealed to all belligerents to respect the neutrality of the northern countries. German submarines, regardless of appeals, indiscriminately attacked Norwegian shipping. Allied shipping losses still ran low, with 99.8 out of 100 ships on convoy reaching port safely. German shipping in northern waters increased. The Allied Supreme Council, meeting at the end of March, debated how to stop the flow of German iron ore supplies from Sweden.

On April 8, 1940, the governments of Great Britain and France stated that, in reprisal for German actions which flagrantly violated neutral rights, mines had been sown at three points in Norwegian territorial waters. The Norwegian government called this a breach of international law and asked for the immediate removal of the mines. German Foreign Minister von Ribbentrop uttered threats.

Invasion and Occupation of Denmark.—In the darkness of the earliest morning hours of April 9, 1940, the Wehrmacht began its invasion of Denmark and Norway. Some German motorized troops crossed the German-Danish border, while others landed, without interference, at Middelfart, Korsör, Nyborg, and Gedser. Three small German transports, disguised as colliers, after being guided through minefields by a Danish pilot who did not know what was happening, landed two German battalions in Copenhagen. The German raiders immediately set out to seize the key points of the capital.

Hundreds of German planes, flying at low altitude, thundered over the main cities to intimidate the government and the population. The Danish authorities were caught off guard, and no effective preparations for defense were carried out. The armed forces of the country were inadequate in every respect. Although the Danish Parliament had adopted a resolution on January 19 that neutrality must be maintained, little or nothing was done to enforce it if the need for enforcement arose. A nonaggression pact with Germany, only a few months old, could hardly be considered a guarantee of security. In southern Jutland, a few Danish companies of infantrymen made an attempt to resist and were promptly crushed.

After the occupation was already underway, the Danish government was handed a German memorandum. Germany charged the country with having failed to resist earlier transgressions by England and France (which had never actually occurred) and stated that Denmark could not ward off an allegedly impending Allied occupation, which was never attempted. The German troops, according to the memorandum, did not enter Denmark in a hostile spirit, but to safeguard its territory against Allied aggression. It was emphasized that Germany had no intention of interfering with the political independence or the territorial integrity of Denmark.

On April 10, Danish Premier Thorwald Stauning told Parliament that Denmark accepted German assurances and that necessary measures would be carried out accordingly. Seven days later the tiny Danish Army was demobilized. German General Leonhard Kaupisch took charge of all military matters. The German minister in Copenhagen, Dr. Cecil von Rente-Finck, was ordered to supervise Danish economic matters and foreign policy. These were only the initial steps to destroy Denmark's political independence. Danish territorial integrity also suffered when the Germans claimed the return of Schleswig-Holstein to the Reich. These territories had been taken from Denmark in the Prussian-engineered war of 1864 and reincorporated into Denmark following the German defeat in World War I.

War in Norway.—While the Germans strove to create the impression that their attack upon Norway, a peaceful country for 126 years, was a reaction to Allied mining operations, the final preparations for the rape of Norway had been completed two months earlier. In February, a large German whaling ship, a floating factory owned and operated by the soap manufacturer, Dr. Hugo Henkel, of Düsseldorf, made port at Narvik and remained there unmolested by Norwegian authorities. A German mountain brigade was quartered in concealment under its deck. Smaller German boats were at anchor at Trondheim (Trondhjem) for weeks before the German attack. They, too, had soldiers on board.

In January 1940, Norwegian Major Vidkun

Quisling (inactive) whose name was to become synonymous with traitor and who atoned for his crimes by his execution before a firing squad at Oslo on Oct. 23, 1945, received his final instructions from the Germans. Quisling, formerly secretary of war, had influence with a small number of disloyal army officers and was ordered to disrupt the Norwegian defense system through treason and confusion. The overwhelming majority of the officers, as well as of the population of Norway, were opposed to Quisling and his tiny Fascist Party.

Norway was traditionally peaceful. Measures taken by the government to protect its neutrality were completely inadequate. The Neutralitäts-Vakt (neutrality guard) had only a few men and gave them very little training. Of the total of 80,000 men supposed to comprise the Norwegian Army (divided into 9 brigades), hardly 15,000 were under arms on April 9. Some new arms had recently been bought from Sweden. Most of them were stored in warehouses, and the soldiers were not trained to use them. A few anti-aircraft batteries, installed for the protection of the capital, were manned by crews who did not know how to operate the guns. Only the coastal artillery was in reasonably good shape, with some ultra-modern Swedish-built forts located at key points of narrow fjords. Disloyal officers, however, kept some of them out of effective action.

Shortly after midnight, on April 9, 1940, the Germans landed at six key points on the Norwegian coast. At Narvik, the mountain brigade came out of hiding. Meeting no opposition on land, it occupied the town and seized the railroad to Sweden. At the same time, a flotilla of seven German destroyers entered the fjord and sank two obsolete Norwegian cruisers before they could fire a shot. When a squadron of German cruisers escorted by destroyers and some transports moved into Trondheim, the forts guarding the fjord entrance did not open fire. At Bergen and at Stavanger, hopelessly outnumbered infantrymen, armed only with rifles, heroically attempted what could hardly be termed an organized defense. The coastal forts went into action, destroying the light cruiser *Karlsruhe*. In the Oslofjord, confusion reigned, due to the activities of disloyal officers. Even so, one coastal battery at Horten sank the German heavy cruiser *Blücher* (10,000 tons), and a lone minesweeper torpedoed and sank the German light cruiser *Emden*. German landing parties, well informed about the location of the Norwegian Army's stores, succeeded in seizing many weapons before they could be used by the defenders.

Hours after the invasion started, Dr. Curt Brauer, German minister at Oslo, handed Norwegian Foreign Minister Halvdan Koht a memorandum essentially identical with the one presented to Denmark. In addition, the Germans made 13 demands. The most important of these were: that nonresistance to Germany should be proclaimed; that the Norwegian government must cooperate loyally with the Germans; that all military installations must be handed over to the invaders undamaged; that the position of Norwegian minefields must be revealed; that no Norwegian ship should leave port; that all pilots and lighthouses must be put at the German disposal; and that German censorship must be established for mail, press, and radio. The king

and government of Norway indignantly rejected these demands.

When the government ordered full mobilization, Vidkun Quisling, whose fifth column had already seized control of the Oslo radio station, countermanded the order in a broadcast and proclaimed the immediate cessation of defensive measures. Assisted by his accomplice, Col. Konrad Sundlo, he faked telegraphic orders, disrupting what remained of the defenses. Other accomplices disconnected minefield contacts. Bewilderment and confusion spread during the crucial hours, enabling the Germans to consolidate their hold on Norwegian soil.

The Luftwaffe, with a considerable number of its planes in action, seized the vital Oslo airfield of Fornebo without loss. Bombers flying over Oslo, undisturbed by scattered gun fire, dropped a few bombs on the "fortress of Aker," a sightseeing spot rather than a fortification. German air transports poured troops into Oslo. Technicians immediately went to work to prepare additional air bases which were to play an important part in the operations to follow.

With Trondheim, Bergen, Stavanger, and Kristiansand as secure German bridgeheads, Col. Gen. Nikolaus von Falkenhorst moved to establish contact among his scattered troops.

The tiny Norwegian forces, lacking planes and heavy weapons, were split into small groups: one to the north of the capital around Lillehammer; another in the southwest along the Swedish border from Halden to the obsolete fortress of Kongsvinger; some small units on the plateau along the Bergen railway; the remainder of a division north of Trondheim; and some battalions far to the north of the country in and around Tromsö.

The threat of an Allied counterinvasion developed, however. For a few days there was much apprehension at German headquarters in Norway. The invasion forces numbered only 25,000 to 30,000 men. Although they were well supplied with tanks, heavy artillery, and aircraft, the possibility could not be discounted that the Allies would succeed in landing far superior forces, at the same time blockading Norwegian harbors and preventing delivery of seaborne supplies to the Germans.

On April 12, 1940, Winston Churchill promised the British Parliament that the British Navy would keep German transports away from Norway. It was expected that the British Fleet would force the German Navy to give battle, which would lead to the destruction of the German Navy. The German Navy, however, shunned major engagements and relied on the Luftwaffe to deal with the British warships. The first test of land-based planes against naval units was at hand. Although not fully conclusive, it indicated that the air force was to become a major factor in sea warfare. When the Allied fleets arrived in Norwegian coastal waters, many hours too late to interfere with the German landings, a direct hit by a 1,000 lb. bomb badly damaged the British battle cruiser *Rodney*. Constantly harassed by German planes based in Norway, the Allied fleets had to operate cautiously. No effective blockade of the southern shipping routes could be attempted while the Luftwaffe held captured Danish airfields. Only at Narvik did the British score a naval success. When a flotilla of five British destroyers was turned back by German destroyers supported by coastal artillery but not by planes, H. M. battleship *Warspite* entered Narvik, on April 14, and sank all of the German destroyers as well as a whale boat.

On April 13, the Allied counterinvasion got under way. No details were given as to the strength of the landing parties, although rumors mentioned 50,000 to 100,000 men. Actually, they never numbered more than 20,000, most of whom were British. As all major ports were in German hands, disembarkation facilities were poor. This fact, as well as inefficient planning, accounts for the appalling lack of heavy matériel and planes. A few battalions of French chasseurs and some Poles were first-rate troops, but the British sent territorials, by no means a match for picked German mountain units.

The Allied commander in chief, British Maj. Gen. Adrian Carton de Wiart, carried out landings at Narvik on April 13, at Namsos, north of Trondheim, between April 14 and 16, and to the south at Molde and Andalsnes on April 17 and 19. The Allies planned to conquer Narvik and occupy the railroad to the Swedish border, while the group at Molde-Andalsnes was to split. One part was to move north toward Trondheim, and the other through the picturesque Rauma Valley to Dombås and Lillehammer, uniting with Norwegian forces for a push toward the capital. The Namsos troops were to move southward to join with the northern group of the Molde-Andalsnes party, and to squeeze the Germans between pincers at Trondheim, thus preventing them from making contact with the garrison of Oslo.

The Namsos group ran into furious German resistance at Stenkjer. Without air cover, subjected to constant Luftwaffe bombing, harassed by German naval artillery on cruisers in Trondheim fjord, the territorials were forced to retreat on April 22. Three days later, Allied operations toward Lillehammer came to a halt. Dombås was lost to a determined German counterattack, and the Allies were forced to retreat under a hail of German bombs. Allied troops south of Trondheim fared no better. Their retreat, under German air attack, came close to a rout. At Narvik, Allied operations proceeded slowly but successfully with an attack on the city proper.

What the Allies had tried to prevent—a union between the Germans at Trondheim and those at Oslo—materialized on April 30. Instead of driving through the rather flat country north of the capital as expected, General von Falkenhorst chose a lightning push along the Swedish border from Kongsvinger to Röros. Meanwhile, the victorious Germans from Trondheim spread west and southwest to meet the captors of Röros, capturing the weak border fortifications opposite Swedish Storlien, on the way.

No substantial reinforcements in men or armaments came to relieve the situation of the Allied troops. On May 2, a precarious embarkation at Andalsnes began a series of Allied withdrawals. The next day, after suffering disastrous defeat, the remainder of the Namsos forces re-embarked, and the little town of Namsos was obliterated by German dive bombers. Defeat was hastened by the treachery of Quisling supporters. Norwegian forces south of the Arctic Circle were doomed to surrender or destruction.

German air transports were not the only means of reinforcing the Wehrmacht in Norway. Protected by the Luftwaffe, sea transports

reached Oslo with men and matériel, including heavy tanks. Sweden asserted that transit rights were granted to German soldiers only after the cessation of hostilities in Norway and when on leave and without arms. But there was conclusive evidence that, on April 13 and frequently thereafter, with the consent of the Stockholm government, German fighting units passed through Sweden on their way to Norway.

The resignation of Mr. Neville Chamberlain as British prime minister, precipitated by the defeat in Norway, was speeded up by the refusal of the opposition Labor Party leaders, Clement R. Attlee and Arthur Greenwood, to join his cabinet. His replacement by Mr. Winston Churchill on May 11, 1940, gave Britain a strong impetus toward all-out war efforts. On May 13, Churchill told the British House of Commons: "I have nothing to offer but blood, toil, tears, and sweat . . . [Our policy is] to wage war against a monstrous tyranny, never surpassed in the dark, lamentable catalogue of human crime."

On May 30, Narvik fell to the Allies, and the German troops, under the command of General Wilhelm Dietl, were pushed back into the tunnels and galleries of the ore railway. Or June 10, due to the catastrophe in France, the Allies chose to abandon the Narvik venture and to withdraw from Norway altogether. In that operation, the British aircraft carrier *Glorious,* two destroyers, and two transports were lost. Moreover, on June 10, 1940, on orders of King Haakon VII, all that remained of the Norwegian forces in Norway surrendered to the Germans. The king, the crown prince, and the government decided to carry on the fight from London, where they had to flee after being hunted by the Germans.

When King Haakon and Prime Minister Johan Nygaardsvold refused to accept the 13 German demands, Vidkun Quisling professed his readiness to comply, provided he was made the head of the government. King Haakon refused a German request to appoint Quisling, whereupon General Falkenhorst, with his own arrogated power, nominated Quisling, only to replace him immediately thereafter (April 15) by another collaborator, Ingolf Elser Christensen, whom he believed to be more acceptable to the Norwegian people and even to the king. Christensen's prime ministership lasted only four days. Generally despised, he was replaced by a German commissioner, Josef Terboven, from Essen, former publisher of the Göring-owned daily *Nationalzeitung.* The commissioner took orders from Hitler alone, and he was personally responsible for many acts of terror, murder, and large-scale looting committed by the Germans during the five years of their tyrannical rule in Norway. On Sept. 25, 1940, Terboven again renamed Quisling as head of a Norwegian puppet government under German control. Quisling faithfully carried out the most outrageous orders of his German overlords.

The Germans officially gave their losses during the Norwegian campaign as 5,296 killed and wounded. The Allies published no figures of their own casualties.

ACTION IN THE WEST

Early in 1940, the bulk of the German troops was steadily reinforced and drew closer to the Reich's western borders from the North Sea to Switzerland. This move threatened not only France but also the Netherlands, Belgium, and tiny Luxembourg, despite Hitler's insistence that Germany intended to respect the integrity of these countries. Allied Generalissimo Maurice Gustave Gamelin was more than ever convinced that a German attack would follow the pattern worked out by Colonel General Count Schlieffen in 1896—an invasion of France through Belgium, with the German right wing as the center of gravity. The crucial right wing, Gamelin assumed, would be extended through the Netherlands, unlike the German offensive of 1914. The generalissimo felt that the Allied defensive plan, concentrating the strongest forces and most of the meager motorized equipment opposite the German right wing, was the only sensible countermove. Available Allied reserves were drawn up along the Belgian-Luxembourg border, ready to move into the Low Countries if they were invaded.

Belgium and the Netherlands, pledged to mutual assistance in case of attack, had prepared no detailed staff plans for coordinated action. Both countries refused to engage in military parleys with the Allies. Even after ordering mobilization on Jan. 14, 1940, King Leopold III of Belgium refused to sanction any consultations between his General Staff and the Allied High Command.

Although fully aware of aggressive, German intentions, both countries followed an almost suicidal policy of avoiding any action which the Reich might consider hostile. Luxembourg, with a total of 300 soldiers and a handful of gendarmes, was defenseless, but even the tiny Grand Duchy wanted to give Germany no pretext for aggression by asking for Allied protection. Thus the neutral countries had to rely almost entirely upon their own defensive resources when the first German blow fell; they called for Allied assistance only after hostilities had already begun.

The Belgian Army, mobilized after January 14, numbered 700,000 men, increased later to 1,000,000. Not all of them were combat troops. There were 16 combat divisions available. The Belgian Air Force and motorized equipment were inadequate, but their artillery could be considered fair and their small arms excellent. Belgian soldiers had displayed remarkable fighting qualities in World War I. The lack of the basic implements of mobile warfare was due to the mistaken Belgian estimate of what was necessary for total defense. Two permanent lines were expected to ward off invaders from the east; an invasion from the west was never even considered. The first line ran close to the border in a semicircle from Liége to Antwerp along the Albert Canal; the second, in an almost straight line, based upon the Dyle River, from Antwerp to Namur. There was also the Yser Line of World War I memory. It was not permanently fortified, but could be flooded in an emergency to protect France if Belgium should be occupied.

The Netherlands Army numbered 14 divisions, reluctantly mobilized after Belgium carried out its mobilization. It also lacked planes and tanks, and its artillery and small arms equipment were below Belgian standards. Dutch military qualities were untested because the Netherlands had enjoyed peace for generations. Traditionally, the Netherlands relied on a defensive system of flooded areas based on unique conditions. The areas to be flooded surrounded the city of Amsterdam like three colossal ditches: the Ijssel

Line, the Peel Line, and the inner defenses between Utrecht and Amsterdam. The most important of the huge bridges which spanned the "ditches" was the Mordijk, 1,530 yards long, on the approaches to Rotterdam. These bridges were supposed to be blown up if the country were attacked. Only a small section in the southernmost part of the Netherlands would not be protected by floods.

The Netherlands was plagued by an extremely large fifth column. Some 100,000 German nationals, directed as spies and saboteurs by an enormously increased staff at the German legation and augmented by 50,000 Dutch Nazis led by Anton Mussert, undermined the small nation's defenses. German-organized sabotage rings included respected Dutch professional men and government officials. On Feb. 5, 1940, the Commander-in-Chief of the Netherlands Army, Gen. F. E. Rynders, was discharged for disloyalty. He was succeeded by Lt. Gen. Henri Gerard Winkelman, who did not succeed in bringing the country's defenses under full control. Because Anton Mussert had been a high official of the Dutch administration of dykes and dams before his discharge, it was feared that any attempt at flooding would be sabotaged; however, a test flooding of parts of the defensive areas was carried out without interference. The Germans knew very well that the slippery earth beneath the floods would stop the advance of their armor. An Austrian motor car factory, serving as a tool of the German General Staff, had turned out the Dutch caterpillar cars (*geländewagen*) which were supposed to travel even on flooded ground. Much to the relief of the Netherlands, the test flood proved that the cars could not pass through the water.

The Germans knew a great deal, if not everything, about Belgium's defense lines. After denouncing the alliance with France and returning to absolute neutrality in 1936, the king and government of Belgium, in an effort to show no bias, employed German construction firms to complete the country's defenses. These firms acted as informers for the German General Staff. When the Germans had learned all they could about Belgium, and specifically about Eben Emael, supposedly the world's strongest fort, which protected Liège, they built a dummy of Eben Emael on the Luneburg heath and trained special demolition squads, engineers, and parachutists to carry out the destruction of the fortress.

Belgium, too, had a German fifth column assisted by Léon Degrelle's Rexists. These were domestic Nazis, few in number but well organized. Their activity was less spectacular than that of the Netherlands Nazis but hardly less dangerous. There were vital bridges in Belgium, too, spanning the Albert Canal, which were to be blown up as soon as the Germans attacked. Sabotage of planned demolitions would jeopardize Belgium's defenses, but no effective action was taken against the German fifth column either in Belgium or the Netherlands.

The Allied High Command decided on a strategy without consulting the Netherlands. If that country and Belgium were invaded, the French Seventh Army (Gen. Henri Giraud) was to cross Belgium at top speed and enter the Netherlands in the district of Breda to join the Dutch Army. A defense line would then be established in accordance with prevailing conditions. This was called "Operation Breda."

"Operation Dyle," designed to assist Belgium, was to carry Lord Gort's British Army to Antwerp and Ghent, the French First Army (Blanchard) to the line Wavre-Namur, the French Ninth (Corap) along the Meuse River from Namur to Mézières in the Ardennes, while the French Second (Huntzinger) was to safeguard the maneuver pivoting on Sedan. Allied air reconnaissance was not efficient and overlooked the vital fact that the German right wing was not particularly strong and that the German center of gravity was directly opposite the Allied pivot.

The Wehrmacht (Commander in Chief, Gen. Wilhelm Keitel; Chief of the General Staff, Gen. Walter von Brauchitsch) was divided into three army groups. The northern group was commanded by General von Bock, the center by General von Rundstedt, and the southern group by General von Leeb.

Generalissimo Gamelin also divided his command into three groups: (1) from the Channel to Longwy, under General Billotte; (2) from there to Sélestat on the Rhine (Alsace) under General Prételat; and (3) under General Besson, forming the right wing on the Swiss border.

The German Eighteenth Army (Gen. Küchler), only about 7 divisions strong, threatened the Netherlands. The German Sixth (Gen. von Reichenau) and the Fourth (Gen. von Kluge) faced Belgium. Opposite the Sedan gap stood the German Second (Gen. Strauss), the Twelfth (Gen. von List) and, as a rear echelon, the Ninth (Gen. von Weichs). Two other German armies, under Generals von Witzleben and Dollmann, were poised in front of the Maginot Line. The bulk of the German reserves, that Gamelin expected to support the group under Bock, was actually at Rundstedt's disposal.

The Allied High Command stubbornly relied upon its belief that no deviation from the Schlieffen plan was possible, except for the invasion of the Netherlands, and continued to build up its left wing. When the German blow fell, General Gamelin announced almost triumphantly that the expected attack was under way. This mistake proved to be fatal.

In the early morning hours of May 10, 1940, the Wehrmacht crossed the Reich's borders in tremendous strength. More than 150 divisions, at least 10,000 tanks, and some 5,000 planes went into action. The Allies, including the Dutch and the Belgians who applied for assistance immediately after the German attack began, could muster a total of about 125 divisions. This might have been enough for a successful defensive stand if it had not been for the appalling Allied inferiority in planes and tanks.

Battle of the Netherlands.—After the Dutch High Command ordered an alert on May 9, the army took up battle positions, and orders were given to proceed with the flooding and bridge destruction as planned. At 3 A.M., May 10, without previous warning, the German Luftwaffe launched an attack on Rotterdam's airport as well as on the airfield of Bergen, destroying most of the tiny Dutch Air Force. German parachutists descended on Waalhaven and quickly seized control of the air base, while German Rhine barges, docked in Rotterdam's harbor since May 3, followed the pattern set in Norway by disembarking German infantrymen to reinforce the parachutists.

Dutch traitors and German fifth columnists assisted the invaders with the utmost audacity and ruthlessness. Neither the Mordijk bridge

(over which other German troops advanced upon Rotterdam), nor the other vital bridges of Gennep, Roermond, and Dordrecht was blown up, and most of the areas to be flooded remained dry. At Delft and Dordrecht, German soldiers landed from other Rhine barges. German seaplanes, carrying troops, landed in the River Maas. Other parachutists descended over The Hague, where General Winkelman had his headquarters. Street fighting raged right outside the windows of the general's offices. Especially trained German airborne infantrymen attempted to kidnap the queen of the Netherlands, Wilhelmina, and her family and might have succeeded except for the gallant attitude of Prince Bernhard, husband of Crown Princess Juliana.

Wherever the Germans landed, they were awaited and aided by fifth columnists, who sabotaged Netherlands' defensive measures to the point of virtual paralysis. Although they outnumbered the Germans 2 to 1, the Dutch soldiers were helpless. Luftwaffe dive bombers and tanks spread havoc, and Dutch casualties mounted rapidly. German casualties were negligible.

General Küchler's invading army advanced in three columns. One in the north marched on Utrecht; the adjoining column penetrated the dry Ijssel Line and occupied s'Hertogenbosch; the third, crossing the southernmost region at Roermond, rushed toward Breda.

The Dutch Army was cut up into struggling segments before it could make any organized stand. Although the French Seventh Army performed a remarkable feat of endurance, it could not accomplish the long march in time to prevent disaster. The leading division, reaching Breda on May 11, was engulfed in the general rout and lost most of its armor, while the rest of General Giraud's forces fell back frantically to apparent safety in Belgium. The small British landing parties in Zeeland province had no opportunity to join with General Winkelman's disintegrating army.

On May 10, at 6 A.M., the Netherlands' foreign minister, E. N. van Kleffens, received a German memorandum contending that the invasion was made to forestall an Allied attack on the Ruhr from Dutch bases. This explanation was completely untrue. If no resistance were attempted, the German government declared itself ready to guarantee the Netherlands' possessions in Europe as well as overseas. Such a guarantee might have jeopardized German-Japanese relations, because it would have protected the Dutch East Indies against the long-planned Japanese invasion. If the Netherlands should try to resist, the memorandum stated, the country would risk complete annihilation. The government of the Netherlands refused to consider the German memorandum and proclaimed a state of war. The queen and her family were taken to England by a British destroyer on May 13, and the government fled, first to Paris, and then to London.

With the situation out of control, General Winkelman had to consider the surrender of the army. On the morning of May 14, the Dutch could offer only scattered resistance in isolated groups, and the city of Rotterdam, almost completely occupied, was negotiating for capitulation. A German ultimatum threatened that, if the surrender was not made before 4 P.M. the same day, Rotterdam would be bombed indiscriminately. Before the Dutch had a chance to carry out the surrender terms, two hours before the ultimatum expired the Germans made a terror raid on the city after withdrawing their own troops. The Dutch suffered almost 30,000 civilian casualties within one and one half hours. They had no antiaircraft defenses, no shelters, and no fighter protection.

On May 14, at 4 P.M., General Winkelman ordered his troops to march to the key Utrecht-Amsterdam line and lay down their arms. Dutch military casualties numbered approximately 24,000. German casualty figures were not disclosed.

On May 15, Foreign Minister van Kleffens announced from Paris that the state of war continued and that all Dutch overseas resources were placed at the disposal of the Allies. The queen, in two broadcasts from London, proclaimed her own, her government's, and her country's determination to continue the struggle.

On May 30, 1940, Dr. Arthur Seyss-Inquart assumed control of the Netherlands civil administration. Under his rule, large-scale lootings, ruthless terror, and severe oppression plagued the Dutch people. Most of them were not only not responsible for the treason of Mussert's men, but showed remarkable courage by doing everything in their power to contribute to their country's ultimate liberation.

Invasion of Belgium.—The tragic fate of the Netherlands did not necessarily affect too seriously the general situation on the Western Front, including that of Belgium. Overall Allied strategy did not call for the use of the precarious water lines to resist the German onslaught.

Simultaneously with the invasion of the Netherlands, the German Sixth and Fourth Armies crossed the border of Belgium, while the Luftwaffe appeared over the capital of Brussels. The Belgian government, at 4 A.M. on May 10, applied for Allied help. At 7:30 A.M., vanguards of all the Allied armies assigned to assist Belgium were on Belgian territory. Belgian Foreign Minister Paul-Henri Spaak received a German memorandum, after the invasion was under way, which wantonly disregarded Hitler's pledge of Oct. 13, 1937, to respect the inviolability and integrity of Belgium. The memorandum demanded the Belgian government's acceptance of the German occupation. The Germans pretended to have evidence not only that the Allies intended to use Belgium as a base for an impending attack on the Ruhr, but that the Belgian government, despite its official neutrality, had secretly sided with the Allies. The Belgian foreign minister replied that his country would fight to the death. King Leopold assumed supreme command.

Allied intervention was based upon the assumption that the Belgian Army would hold the line of the Albert Canal until the deployment of General Billotte's army group was completed. But the Allies were chiefly concentrated in northern Belgium, whereas the main German blow fell in the south of the country. The arrest of Léon Degrelle and other prominent Belgian Nazis, shortly before the German attack was launched, did not impair the efficiency of the fifth column. Four vital bridges destined for immediate destruction remained intact and were immediately seized by the Germans, who moved armor across the Albert Canal. At Maastricht, the Albert Canal runs very close to the Meuse River, forming part of the second Belgian defense line. A highway linking Maastricht and Liége passes over a vital bridge near Ton-

geren. The invaders seized that bridge intact and, on May 11, crossed the Albert Canal at Tongeren. Discounting the seriousness of a possible flanking threat from the south, the Allied Armies followed the plan of "Operation Dyle."

The disaster of the bridges was followed immediately by the collapse of the defenses of Liége. German squads, trained on Luneburg heath, did their job well. Dropped by parachute and moved in by tanks, they disabled Eben Emael. The garrison was taken completely by surprise. In an effort to intimidate the Allies, German propaganda quoted Belgian prisoners as saying: "Our guns did not fire." The Germans wanted to convey the impression that this was due to the effect of mysterious death rays. Actually, no new weapon was used during the entire fateful campaign in the west. The Wehrmacht followed closely the tactics learned from the Polish campaign and, as in Poland, they relied upon the weather, forecast by meteorologists as "continued fair." The forecast proved true. Dive bombers, tanks, motorized artillery, and infantry bore the brunt of the fight, with the mass of infantry occasionally far behind the shock troops and frequently operating as occupational forces rather than fighting troops.

As soon as the Allies fell back, the Germans used bands of fifth columnists all over the theater of operations to urge the civil population to flee, jamming the roads and hampering troop movements. German air raids on Allied airfields disabled much of the small French Air Force and inflicted substantial damage on the British RAF operating from bases in the Champagne. During most of the operations, the Luftwaffe had uncontested mastery of the skies. German superiority in armor was hardly less decisive. Not only did the panzers outnumber Allied tanks, but they were far superior in firepower and armor. German antitank artillery inflicted heavy losses on Allied tanks, while Allied antitank projectiles were mostly unable to pierce German armor plates.

On May 13, the king of Belgium, the French General Georges, and the British General Henry Pownall met at Casteau Castle outside of Mons. Édouard Daladier, French minister of war, also was present. The king agreed to lead his troops in accordance with instructions to be issued by the Allied commander in chief.

The Breakthrough.—Schlieffen's plan actually was no longer the most important feature of German strategy. It was decided that the northern wing would not insure victory by extensive movement along the Channel coast, later swinging southward to envelop the enemy lines. Instead, new breakthroughs in the direction of Sedan were to pierce the Allied front, and fast German troops, pouring through the gap, would set up a ring of steel around the northern group. The more Allied troops there were in the trap, the better for the Wehrmacht.

The French Ninth and Second Armies sent spearheads and reconnaisance units to meet German troops crossing the Luxembourg border and sweeping through the rugged Ardennes Forest. The Grand Duchy, under protest, suffered a rude German occupation which abolished the small country's independence. Neither the troops in the section of the Meuse River, ahead of General von Rundstedt's group, nor those in the Ardennes offered any serious obstruction to the German armored forces. Advanced French armor proved greatly inferior to the panzers. It was ironic that, in the tank engagements on the Meuse, the Germans used captured Czech armor which proved much better than that of the French.

There might still have been time to reinforce the French armies, but General Gamelin, obsessed by the idea that General von Rundstedt's operations were diversionary, continued to concentrate all available men and materiel in Belgium. German motorized columns moved toward the Sedan gap with all headlights on, but the Allied commander-in-chief discounted this careless action as a ruse to lure him into neglecting the main theater of operations on the northern wing.

The French Ninth and Second, although they had not fought in any major actions, were badly disorganized. Equipment was not completely moved into their poorly prepared positions. Telephone communications were not ready. Gaps appeared in the lines due to sheer confusion among the troops. The German forces, operating with clocklike precision, moved ahead. They crossed water courses in rubber boats, which were not a part of French equipment. On May 13, at 3 P.M., the Wehrmacht took Sedan without firing a shot.

This Sedan gap, 3 miles wide that afternoon, was never to be closed again. On May 14, at dawn, General von Rundstedt opened his all-out attack. French artillery, the best weapon the army had, was not able to show its expected efficiency. Stukas smashed the gun positions, shot at horses (most of the French guns were horse-drawn), and destroyed ammunition dumps before full-scale action began. Dive bombers pulverized the sketchy French trenches and dugouts. The weak extension of the Maginot Line did not even delay the Germans. French infantry, lacking battle experience, became panicky under the assault. There was no Allied air cover. Isolated acts of gallantry could not stem the German avalanche. Tanks followed dive bombers; German mobile artillery smashed up whatever the Stukas and panzers left intact.

Crowds of refugees, urged on by fifth column panic-mongers, joined the retreating armies, blocking the roads, while German planes roared overhead, bombing and strafing. The Germans, accelerating their efforts to widen the critical gap, poured tanks between the French Ninth and Second Armies.

On May 15, while General Huntzinger's forces were attempting to take up positions farther to the rear, General Corap's army was in danger of complete annihilation. Its 11th Corps, 102d Fortress Division, and 53d Infantry Division no longer existed. General Corap, relieved of his command, was succeeded by General Giraud. The new commander was unable to close the breach between his army and the Second, which had widened to a breadth of 31 miles. German armored spearheads, fanning out through the gaping hole, attacked the French First Army in an obvious encirclement move.

Generalissimo Gamelin made a desperate effort to turn the impending German victory into a costly setback. All the motorized forces and armored cavalry that the generalissimo could muster were hurriedly concentrated along the Sambre River for a push southward to cut through the German panzers and join the armies of Generals Corap and Huntzinger. The German

armor pressed ahead and by nightfall reached a point 22 miles from Laon. The French concentration was delayed. Some mechanized forces, after having suffered substantial losses, had to be reorganized. Others were not in the areas where they were supposed to be. Those that attempted to travel on schedule ran into the growing stream of refugee columns which inundated the Belgian roads. The Sixth Army, under the command of General Touchon and formerly kept in reserve, was dispatched to the critical area. A fourth armored division was ordered into action. It was later placed under the command of General Charles de Gaulle and fought a brilliant, isolated action at Montcornet, routing a German armored division. The Third, the Fifth, and the Seventh French Armies were also thrown into the breach on May 16, but the panzers widened it to almost 45 miles.

General Giraud, abandoning some scattered groups of his army to their fate, temporarily succeeded in establishing a precarious but coherent front from the Sambre Valley to Hirson, but a large hole remained between Hirson and the Aisne River. General Touchon's army drew up along the Aisne around Rethel, while General Huntzinger attempted to stem the German advance between the Aisne and Meuse rivers.

The German advance through the gap shaped up into a quadrangle of armor against anchor positions of the French First, Second, Sixth, and Ninth Armies. Although the Allied position was critical, the fact that the bulk of the Wehrmacht's infantry was rather far behind the quadrangle gave some reason to hope that contact between the separated armies might be reestablished.

The German communication lines were stretched precariously, and a tremendous amount of gasoline was needed to continue the push. There was a possibility that the tanks would run dry and be captured by the Allies. The German High Command, relentlessly continuing the armored push, gambled on a blunder which the Allies actually committed. They neglected to remove supplies from the regular gas stations, located in large numbers on the German route. The German armored columns drove up to gas stations, used whatever supplies were on hand, and moved on after filling up.

Allied armies were ordered to hold firm and to advance but retreated again under pressure on May 17. They withdrew from the Dyle to the Dender River and from there, abandoning efforts to hold much Belgian territory, pulled back to a triangle running from Dunkerque to Valenciennes and Brugge. The capital of Brussels and the port of Antwerp were occupied by the Wehrmacht.

On May 18, while a new French Seventh Army drew up along the Oise from Péronne to Coucy, final disaster befell the Ninth. General Giraud and his staff were captured and the army's ranks completely broken. The following day, the German armored columns took Arras. On May 20, they were at Cambrai and, by nightfall of that day, their spearheads reached the sea at Abbeville, at the mouth of the Somme River. The trap had closed.

On May 19, General Gamelin was relieved of his command, and Gen. Maxime Weygand was named as his successor. General Weygand, returning from Syria, took over on May 21. The Chief of the British Imperial General Staff, Sir Edmund Ironside, was replaced on May 26 by General Sir John Greer Dill.

On May 21, at Ypres (Ieper), Belgium, General Weygand met King Leopold, Lord Gort, and General Billotte. Another plan was agreed upon to break the German trap and reunite the First Army Group with the French forces on the left bank of the Somme River, only 25 miles away at some places. The Belgian Army was to hold the Yser Line, facing east, and thus protect the Allied flank to the Lys River. French and British forces between Bapaume and lost Cambrai, facing south, would pierce the screen of panzers and rejoin the forces on the Somme. Only 8 fully intact divisions were available for the southward push, but the German encircling forces were not yet formidable in numbers either.

General Billotte, responsible for the execution of the plan, was fatally injured in an automobile accident immediately after leaving the meeting place. His successor, General Blanchard, was not named until four days later. For those four days, operations were poorly coordinated.

On May 22, the British succeeded in dislodging the Germans from Arras, but their progress toward Cambrai was appallingly slow and soon came to a halt. The French were also unsuccessful. When General Blanchard tried to synchronize their efforts, it was already too late.

The German General Staff reacted quickly. Realizing that the French armies south of the bulge offered no threat, the Wehrmacht's main forces were suddenly switched to the right wing. The Allied offensive, hampered by jammed roads, failed entirely on May 24. For psychological as well as strategic reasons—morale in the Belgian headquarters was very low—the main blow fell upon the Belgian lines. Lesser pressure was applied against the French, and the British had a slight breathing spell.

General Blanchard, abandoning the idea of attack, tried to form a bridgehead on the Channel coast to include the ports of Dunkerque, Calais, and Boulogne. Such a bridgehead was a temporary solution, and could only prevent final disaster if the southern armies were able to ward off German attacks.

The German waves of attack, using the well-tried team method, smashed Belgian and French lines almost at will. On May 26, the French First Army had its banners burned, while the retreating Belgians were reported to be in a state of chaos. King Leopold, supported by Generals Weygand and Blanchard, urged Lord Gort to throw all of his forces into a counteroffensive, but Lord Gort was not responsive. Actually, the few divisions at his disposal would not have been able to provide effective relief, and might have been doomed to final annihilation.

King Leopold warned the Allies on May 27 that he would not be able to carry on. Despite his pledge to lead his troops according to instructions given by the Allied commander in chief, the king, at 5 P.M. on May 27, dispatched officers with a flag of truce through the German lines to offer surrender. The surrender, which took place at 4 A.M. on May 28, exposed the Allied left flank. This move was widely denounced as treasonable, but the king's defenders insisted that the situation could hardly have been saved by continued Belgian resistance. The Belgians suffered losses amounting to about two thirds of their total combat troops before laying down their arms.

Dunkerque.—Of the three ports within the contemplated bridgehead, only Dunkerque was now left under Allied control, while the Germans poured troops into the corridor to the sea from the Meuse to Abbeville. Weygand instructed Blanchard to hold the Dunkerque bridgehead to save what could be saved while the British began to evacuate their remaining troops to England. In this last-ditch stand, with no heavy armor and equipment, with all transportation lanes flooded by crazed refugees, with the Luftwaffe constantly overhead and the German General Staff throwing all its resources into battle, Allied soldiers displayed true heroism. The French 3d Corps, in a brilliant action, was able to escape capture. The Belgian 60th Division, fighting its way through surrendering lines, reached Dunkerque. On a line running from Cassel to the Lys, a wall of poorly armed men held up the attacks of the Wehrmacht's mechanized might; 20,000 British and 50,000 French troops blocked the way to Dunkerque.

The British used an armada of 220 warships and 650 smaller craft to transport the remnants of the Allied northern armies across the Channel. Two hundred French vessels of various types assisted in the operation. Lord Gort had the power to surrender, if need be, and the Germans expected surrender. This was the only one of their expectations which was not fulfilled in the fateful campaign. The RAF from bases in Britain intercepted the Luftwaffe. British Spitfires showed qualitative superiority over German fighters, but their numbers were small. A light haze—not the miraculous fog of occasional legend—interfered slightly with the German bombardment.

By June 4, the embarkation was completed. Those who could not reach a boat were abandoned on shore and many men and practically all of the remaining matériel were captured. A total of 335,000 soldiers, of which 260,000 were British, reached England. The French lost about 26 divisions in the unfortunate campaign and the British casualties amounted to the equivalent of four divisions. The Germans made no attempt to pursue the fugitives on an improvised fleet under cover of the Luftwaffe. Naval operations were alien to the minds of the Wehrmacht generals. The rescued Allied soldiers had to be re-equipped before becoming an army again. Their morale, however, was unexpectedly good.

The German official communiqué of June 4 reported a total of 1,200,000 prisoners taken in the West since May 10 and gave the Wehrmacht's casualties as 61,000, far less than the number of fresh troops sent to the front. This figure may be considered reliable because, as was the case in Poland, the brunt of the fighting in the West was borne mostly by numerically small air and armored forces.

Battle of France.—General Weygand had 43 infantry, 3 cavalry, and 3 armored divisions left to hold the front from the mouth of the Somme to the Maginot Line. Infantry divisions were supposed to defend sectors from seven and a half to ten miles wide. French armored divisions had between 50 and 86 light tanks each. Some infantry divisions were reduced to two undermanned regiments. Seventeen French divisions manned the Maginot Line. They were partly fortress units, partly reservists.

The French forces outside the Maginot Line faced at least 100 full strength German infantry divisions and 10 armored divisions. The odds against the French were 4 to 1 in numbers and 15 to 1 in armor. There was no French Air Force to oppose the Luftwaffe.

What was called the Weygand Line (from Abbeville to the Maginot Line) was even less fortified than the Daladier Line. It ran largely along the precarious obstacles of the rivers Somme and Aisne. The French commander in chief tried to the best of his ability, with inadequate equipment, to ward off a German offensive. Two British divisions which arrived after the encirclement of the northern armies were placed under his command. Appeals for further reinforcements from Britain were met by Winston Churchill's statement that two divisions were available. This Weygand termed: "an attempt to irrigate the Sahara desert with a watering pot." It was planned that French resistance should be based upon defense in depth, with machine gun and field artillery nests to hold the forefield under cross fire, and 75mm. field cannon, in mutually supporting positions, assigned to stop the panzers.

The French Tenth Army, formerly concentrated around Belfort, was drawn up along the lower course of the Somme. The Seventh and the Sixth Armies joined at Neufchatel-sur-Aisne. General Huntzinger's Second and General Freydenberg's Fourth stood between the Aisne and Meuse rivers.

The German Army Group under Colonel General von Bock was poised to attack along the lower Somme, threatening Paris from the west. Rundstedt's groups prepared to break through the French lines at the Aisne River. The purpose was to outflank Paris from the east and then to fan out, penetrating the rear of the Maginot Line, which was to be assaulted frontally by the Army Group led by von Leeb.

On June 5, Bock opened his attack with the full impact of his unchallenged strength of planes and armor. During the first day of the battle, the French Seventh Army succeeded in holding most of its positions, but the Tenth's line was penetrated at night at three points and had to be pulled back. On June 6, the retreat was joined by the battered French Sixth, but French lines remained coherent during the second day of the battle. On June 7, the French met disaster. The battered Tenth Army was completely routed, the Germans invested Rouen and Soissons, the Sixth was thrown back in disorder, and the Seventh, still in a forward area, was outflanked. French and British troops, totalling 20,000, pinned to the coast, had to surrender. In less than three days, the French defense line in depth was penetrated and its defenders put out of action. Bock's army group rolled on unchecked toward Paris.

On June 9, von Rundstedt threw his armies against French positions in the Champagne. Four days of spirited resistance slowed the German advance, but then the front collapsed. The Chemin des Dames ridge fell to the panzers, and, through a gaping hole, German armored divisions under Guderian and Kleist raced toward Troyes and St. Dizier.

On June 11, Weygand's strength along the 270 mile front from the sea to the Maginot Line was reduced to 18 partly intact divisions and 20 others at hardly 30 per cent of their normal strength. Reporting to a Council of Ministers, the generalissimo declared that his

troops were exhausted and demoralized, and most of the scarce matériel was lost. The day before, Italy had entered the war as Germany's ally.

Italy Enters the War.—On March 18, 1940, Hitler and Mussolini met at the Brenner Pass. Only an inconclusive official communiqué was issued, but it was generally believed an agreement had been reached that Italy should finally side with Germany as it had sided with Bismarck's Prussia in 1866. Peace appeals by the Pope, Churchill, Roosevelt, and Reynaud failed to influence Mussolini. On June 10, from the balcony of Palazzo Venezia, he told a deliriously enthusiastic crowd that the die was cast and "our will has burned our ships behind us." Italy, according to the duce, wanted to break the territorial and military chains which confined it. Mussolini called the struggle a conflict between virile, useful peoples and decadent nations. The announcement ended with the solemn statement that Italy did not intend to drag other countries into the war. Switzerland, Yugoslavia, Greece, Turkey, and Egypt were asked especially to note these words.

The Italian declaration of war, denounced by President Roosevelt on June 11 as a stab in the back of France, was not followed by any impressive military action. Thirty-two Italian divisions faced 6 French divisions along the mountainous border (most of the French forces had been withdrawn). Even so, the Italians accomplished nothing of note.

Most of the very limited Italian advances took place after France had collapsed.

On June 11, the French Council of Ministers decided to assemble their remaining armies with all the reserves the country could muster for a final stand and to evacuate Paris, which was declared an open city. The ultimate defense line was supposed to run behind the Loire River. Following a German bombardment of the Citroen automobile factory in Paris, troops of the German Eighteenth Army entered the city, unopposed, on June 14, at 9 A.M.

French Political Collapse.—On their way to Bordeaux, after leaving Paris, the members of the French government held a meeting at Tours on June 12. It was presided over by the president of the republic, Albert Lebrun. Generalissimo Weygand bluntly reported that the military situation was hopeless. Churchill, accompanied by Lord Halifax and Lord Beaverbrook, came to Tours on June 13. Reynaud asked Churchill whether the British government would release the French from their pledge not to make a separate peace if a last minute appeal to President Roosevelt for formal assurance that the United States would support France morally and materially failed to bring a positive reply. Churchill's attitude was sympathetic, but he left Tours without making a final commitment. Roosevelt, answering Reynaud's appeal, emphasized his administration's readiness to supply Allied war needs and declared that efforts in this direction would be redoubled, but insisted that only Congress could make military commitments. The reply added that the United States government would not recognize forcible in-

fringements on the independence and territorial integrity of France.

This was not what Reynaud had hoped for, and the question of a separate French peace was revived. The British reply, while stating that the empire would continue the struggle, professed a willingness to tolerate French armistice negotiations, provided the French fleet would sail to British ports and stay there for the duration of the negotiations. This was immediately followed by a British offer of an indissoluble union of the British and French empires, with joint defenses, a common economic and foreign policy, association of parliaments, a single war cabinet with a Frenchman as its first premier, and common citizenship.

Even had Reynaud wished to accept this unprecedented proposal, he no longer had the power to do so. On June 15, Marshal Pétain, vice premier in the French cabinet, informed Reynaud that he must seek an armistice. Pétain was not interested in British consent. Anti-British forces, sympathizing with German extremists, were about to gain control of the government behind Pétain who was a figurehead rather than a leader.

After a stormy cabinet session on June 17, President Lebrun accepted Reynaud's resignation and appointed Pétain to form a new government. At 12:30 A.M. on June 18, through the mediation of the Spanish ambassador in France, Pétain's government requested an armistice.

Débacle.—With the French roads jammed with refugees and the Wehrmacht advancing at will, the Maginot Line was outflanked, bypassed, and taken in the rear. Some 600,000 French soldiers, of whom only one third were combat troops, were hemmed in on all sides between Verdun and the Swiss frontier and placed in a hopeless position. The panzers, after racing to Dijon and Besançon, pivoted north to Belfort. One spearhead moved east from Neufchâteau to Épinal to pierce to the center of the disorganized French remnants. Verdun, unconquerable in World War I, remained virtually undefended.

On June 14, the German army group under General von Leeb opened a frontal drive against the Maginot Line. General von Witzleben's forces, penetrating the Saarbrücken area, pushed swiftly through to join with Rundstedt's armies at Verdun and Gerbéviller. On June 15, with thick fog limiting vision to 100 yards, the German Seventh Army (General Dollman) crossed the Rhine at Colmar and rolled up the French defenses. The Germans suffered some casualties here, but the conquest of the Maginot Line was not costly.

General Daille, with his 45th Army Corps, attempted to break the German ring of encirclement in the south by a push toward the river Doubs. Polish troops, fighting alongside Spahis in this French Corps, suffered 4,000 casualties. The Germans were temporarily thrown back. After three days of gallant action, the remainder of the corps ran out of ammunition and crossed into Switzerland to be interned. The French Southern Group (Third, Fifth, and Eighth Armies under General Laure), tightly compressed on the western slopes of the Vosges Mountains, its position threatened by almost 2,000 German tanks, surrendered to a German attack on June 22. The Wehrmacht High Command reported 500,000 prisoners. There were hardly any French armies left in the field. According to the armistice terms, fighting was to cease on June 24 at 1:35 A.M. The Germans gave their casualties in the Western campaign as 27,074 killed, 18,384 missing, and 111,034 wounded. They reported 1,900,000 Frenchmen captured, as well as large numbers of Belgians, British, and Dutch. Allied losses were not accurately disclosed by authoritative sources.

Armistice.—The Germans demanded that the armistice with France should be signed in the forest of Compiègne, historical site of the World War I armistice, and in the same railroad car that was the scene of the ceremony in 1918. Col. Gen. Wilhelm Keitel represented the Wehrmacht, and General Huntzinger headed the French delegation. Hitler was present.

There were no negotiations. German conditions, embodying 24 points, had to be accepted without argument. The terms stipulated that French troops already surrounded were to surrender. Most of the other French armed forces were to be demobilized and their arms handed over to the Germans. Only a small security force was to remain in unoccupied France, with its armament and functions subject to German control. All fortifications were to be turned over to the Wehrmacht undamaged.

A zone of France was to be occupied by the Germans. This zone was defined as north and west of a line starting at the French-Swiss frontier near Geneva, marked thereafter by the localities of Dôle, Paray-le-Monial, and Bourg, then running to a point about 12 miles east of Tours, thence 12 miles east of the Tours-Angoulême-Libourne railway line, and finally via Mont-de-Marsan and Orthez as far as the Spanish border. German-occupied territory was larger than the unoccupied zone. It included not only Paris but most of the country's industrial regions and all of its northern and western coastline. Germany was to exercise all the rights of a dominant power within the occupied zone. Local French administrations were to obey and assist the Germans without reservations. The French government was permitted to establish itself either in the unoccupied zone or in Paris. All German prisoners-of-war and internees were to be freed at once, while French prisoners were to be held.

The French Navy, except for a part of it to be termed essential for the protection of French interests overseas, was to be assembled in designated ports for supervised demobilization and disarmament. The Germans declared that they did not intend to make unreasonable claims on the French fleet when a final peace was concluded. All French warships outside of metropolitan France, except for the portion assigned to protect French possessions overseas, were to return to France. Germany was given control of French merchant shipping, aviation, and radio operations.

The French government was to prohibit members of its armed forces from going to England and to prevent the movement of essential war materials to Britain. The French High Command was ordered to forbid French subjects to serve in foreign armies for the purpose of fighting the Reich. French nationals captured in foreign armed forces would be considered "franc-tireurs" (outlaw guerillas), and treated accordingly. France was to guarantee safe transit through her territory between the Reich and Italy. The transfer of securities from occupied to unoccupied territory was forbidden. France was

to pay the costs of the occupation, fixed at 400 million francs a day. The French government was to hand over all Germans living within France and French possessions. The armistice was signed on June 22, 1940, at 6:50 P.M., German summer time.

The Franco-Italian armistice of 26 points was signed in Rome on June 24, at 7:15 P.M., by Marshal Pietro Badoglio and General Huntzinger.

Italian troops were to maintain the positions they held at the time of the surrender. The French were to withdraw 50 kilometers (31 miles) to the rear, and this area was to be demilitarized as well as a zone of 200 kilometers (124 miles) along the borders of Tunisia, Algeria, and French Africa. French Somaliland was to be entirely demilitarized, and Italy was to be granted unlimited rights to use the facilities of the port of Djibouti and the French section of the Djibouti-Addis Ababa railroad. The French naval bases of Toulon in metropolitan France, Bizerte in Tunisia, Oran (Mers-el-Kebir) in Algeria, and Ajaccio in Corsica were to be demilitarized under Italian and German control. Italy was entitled to claim the surrender of all French armaments deployed against its forces. The Italian government declared it had no intention of using the French fleet except for minesweeping operations. Stipulations as to prisoners of war and the control of French aviation and shipping were similar to the conditions of the armistice with Germany.

Demilitarized border regions included the Mareth Line in Tunisia facing Tripolitania, the main French defense against an Italian attack on her African empire. German and Italian declarations concerning French naval forces could hardly be taken at face value. The basic condition for British consent to a separate French armistice was not fulfilled, although the British government, during the period between the French application for an armistice and the publication of armistice conditions, had received various assurances by members of Marshal Pétain's government, including Admiral Darlan, that no terms detrimental to Great Britain's naval interests would be accepted.

The amount to be paid by France for occupational costs far exceeded Germany's actual expenses. It bled the French national economy white and enabled the Germans to acquire controlling shares in France's leading industries with French funds. The Germans were also enabled to transfer any goods they wanted to the Reich. Through the German interpretation of the armistice terms, France became an operational base against Great Britain, and the danger that its overseas possessions might also become springboards against the British Empire was imminent. In four years of occupation, France, Belgium, and the Netherlands experienced an ordeal unparalleled in their history.

Great Britain Stands Alone.—On June 4, 1940, Winston Churchill, reporting on the embarkation from Dunkerque, told the House of Commons: "We shall go on to the end, we shall fight in France, we shall fight on the seas and oceans, we shall fight with growing confidence of strength in the air, we shall defend our Island, whatever the cost may be, we shall fight on the beaches, we shall fight on the landing grounds, we shall fight in the fields and in the streets, we shall fight in the hills; we shall never surrender, and even if, which I do not for a moment believe, this Island or a large part of it were subjugated and starving, then our Empire beyond the seas, armed and guarded by the British Fleet, would carry on the struggle, until, in God's good time, the New World, with all its power and might, steps forth to the rescue and the liberation of the old."

These words became the inspiration of the empire during the ensuing period of unprecedented hardship and emergency.

In the light of events in Denmark, Norway, the Netherlands, Belgium, and France, the British government decided to take drastic measures to restrict subversive activities within its territory. In May 1940, enemy aliens were rounded up for internment. Sir Oswald Mosley, leader of the small British Fascist Party, was arrested, and his newspaper *Action* and the Communist *Daily Worker* could not be sent abroad. In 1940, the British Communists still opposed the country's war effort and looked to Russia for leadership.

The Irish Republican Army, responsible for bomb outrages in Britain, was subjected to strict legal penalties. On June 8, drastic passport restrictions were promulgated for the passage between Great Britain and Eire. No attempt was made to violate Eire's neutral status, although the country became a hotbed of anti-British and pro-German activities for the duration of the war.

BRITISH-FRENCH RELATIONS

On June 20, 1940, a group of former members of the French government, including Édouard Daladier and Georges Mandel, accompanied by 100 members of the French Chamber of Deputies, all of them opposed to giving up the fight, went to Casablanca to consider the possibility of continuing the war from North Africa. The resident general of Morocco, Gen. August Noguès, after at first showing sympathy with this group, quickly changed his mind and accepted Marshal Pétain's policy of total surrender.

The French government's acceptance of demilitarization of parts of its empire, paving the way for German control of its vast territories, presented an alarming prospect to the British War Cabinet. Warfare in Africa, which was always considered a possibility after Italy became closely linked to Germany, had been planned as a joint British-French operation, with France contributing larger land forces than England. After French assistance for Britain was eliminated, and it became potentially available to Germany and Italy instead, the balance of forces was dangerously upset.

Developments in French North Africa.—Italy's declaration of war threatened to make the Mediterranean an Axis lake. French naval aid to Britain's enemies would be bound to have catastrophic consequences for the empire. The British and Dominion forces in Africa were greatly outnumbered by Italian colonial armies, and even if reinforcements had been available in substantial numbers, they could hardly be shipped through the Mediterranean under such conditions. The two British Mediterranean fleets, one based on Gibraltar, the other on Alexandria, without French support, were numerically inferior to the Italian, which included 6 battleships, 7 heavy cruisers, 15 light cruisers, 62 destroyers, 90 submarines, and a considerable number of smaller craft.

On June 30 and July 1, the Germans seized the British Channel islands of Jersey and Guernsey. These islands were only 75 square miles in area with 145,000 inhabitants, but they were the first territories of the empire to suffer occupation.

The British Fleet needed reinforcements to protect vital Atlantic supply lines. Some French units in British ports were taken over on July 1, 1940. On June 23, from London, General Charles de Gaulle had announced the formation of a French National Committee. Britain, having recognized the general on June 28 as the leader of all free Frenchmen, wherever they might be, was able to carry out the necessary negotiations legally. The French ships which joined the British Fleet were of no great importance in size or numbers. Other French units were seized in the Egyptian port of Alexandria, but these ships, in accordance with the wishes of their crews, were interned and not taken over by the British.

A French squadron in the West Indies, consisting of the aircraft carrier *Béarn,* the heavy cruiser *Emile Bertin,* the training ship *Jeanne d'Arc,* two light cruisers, and four destroyers, was considered a threat rather than a potential reinforcement to the British, due to the anti-British attitude of the commanding admiral.

The British could do nothing about the French men-of-war tied up in the naval base of Toulon. There were, however, substantial French naval forces at Oran, Algeria, which, besides a number of light cruisers and destroyers, included the battleship *Bretagne* (22,186 tons), the battle cruisers *Dunkerque* (26,000 tons), *Provence* (26,000 tons), and *Strasbourg* (26,500 tons), and an airplane tender.

On July 3, 1940, British Vice Admiral Sir James F. Somerville, in command of a British squadron off Oran, issued a 6-hour ultimatum. It offered the French the choice of joining the British, accepting internment in British or American ports, scuttling their ships, or having them destroyed by British action. Somerville had at his disposal three battleships, one aircraft carrier, three cruisers, and a number of smaller units. When the time limit expired without a French reply, the British began an attack by air and sea. In a three-hour action, they sank the *Bretagne,* the *Provence,* and the airplane tender, and badly damaged the *Dunkerque.* The *Strasbourg* and some light ships managed to leave Oran and sail for Toulon. More than 1,000 men from the French fleet were killed. Of its major units, only the *Strasbourg* remained fully seaworthy. Another battleship, the *Richelieu* (30,000 tons), still not completed, was at anchor in Dakar, Senegal. Almost 60 per cent of the smaller French warships remained beyond Britain's reach.

An intense, German-directed propaganda, with the slogan "Remember Oran," stirred up strong anti-British sentiments in France. On July 8, backed by popular resentment, the Pétain government severed diplomatic relations with Great Britain. On the same day, French-African based aircraft raided Gibraltar without inflicting noteworthy damage. A state of war between the former Allies seemed likely, but it never materialized.

The Threatened British Empire.—In public, Churchill vigorously asserted that he did not believe for one moment that Great Britain would be subjugated. Almost two years later, the prime minister told a secret session of Parliament that a force of 150,000 men could have successfully invaded Britain in the summer of 1940. The Germans had a great many flat barges available on the Rhine and a number of similar craft captured from the Dutch. They also had available several divisions of trained parachutists and air transport with a substantial carrying capacity. With these assets, there was little doubt that the Wehrmacht could have hurled masses of men and equipment against the British Isles and crushed British resistance, no matter how spirited.

The defenders of Britain were strong in numbers only. The Home Guard, a citizen's army with sketchy military training under the command of Sir Alan Brooke, was increased through a steady stream of volunteers to 1,000,000 men by the end of July 1940, and to 1,500,000 by the end of September. The lessons of previous campaigns made it clear that manpower was far less important than modern equipment which was lacking in the British Home Guard as well as in the regular army during the months following the French disaster.

To meet the most urgent and immediate needs, the United States supplied Britain with 900,000 rifles, 83,000 machine guns, and 2,200 cannon of 75mm. caliber from the military supplies of World War I. These supplies, welcome as they were during the most critical period, could hardly have enabled the British to stop panzer divisions. Despite the cash-and-carry provisions of the United States Neutrality Act, which limited British buying capacity, England was encouraged to place orders in the United States, and deliveries to Britain expanded. British home production, despite German bombings, also increased. By November 1940, the British were able to hold maneuvers involving the use of some armor.

A defense system was hastily improvised, averaging 20 miles in depth. The costly and ineffective pattern of permanent defensive fortifications was abandoned. Barbed wire entanglements, machine gun nests, and concealed gun positions and pill boxes, cleverly camouflaged and widely scattered in towns and villages and across the countryside, were adapted to the tactics of guerilla warfare rather than a full-scale military campaign.

The RAF gradually grew in strength. All of its bases were within range of German airfields along the captured coast. None of the planes used by the defenders of Britain could ever be removed from the danger zone, whereas the Luftwaffe, building up its forces for the onslaught, could keep its reserves in areas virtually inaccessible to British raiders. This gave the Germans another advantage, besides their great superiority of numbers, over the British in the air.

The British Navy could not keep its major units on the Channel coast because of the constant threat of German air attack, and shipping through the Channel became increasingly precarious as the Luftwaffe concentrated in northern France and the Low Countries. Only smaller naval vessels would have been able to go into immediate action if a German invasion had been launched. Capital ships attempting to take part in any such action would have arrived late from their less exposed bases. Moreover, in the light of lessons learned in the Norwegian campaign,

it was hardly wise to use such ships within easy range of land-based aircraft. The British Fleet, for centuries the secure bulwark of the British Isles, could no longer be considered an insurmountable obstacle against a strong and determined invader. If England had fallen to the Germans, there would have been little hope for prolonged and effective resistance from the Dominions and almost no chance that any counteroffensive might recapture what had been lost.

As matters stood in the summer of 1940, the British Navy had difficulty in guarding the empire beyond the seas. Italian warships were not as well armored as their British counterparts, but they were faster. Moreover, Italian capital units in general were more modern than the vessels of the British Mediterranean fleets.

The German Navy had suffered relatively heavy losses during the first nine months of the war, but it was still a formidable opponent. Although extreme secrecy obscured the progress of the German naval construction program, three superbattleships reputed to be of 41,000 tons each (actually 45,000 tons), the *Tirpitz, Bismarck,* and *Deutschland,* were supposed to be almost or entirely completed. Two smaller battleships, the *Scharnhorst* and *Gneisenau,* already had been in action off Norway. Two pocket battleships, the *Lützow* and *Scheer,* were known to be ready for action. Three super-heavy cruisers of 18,000 tons, almost equal in firepower to battleships, the *Hipper, Prinz Eugen,* and *Seydlitz,* were being rushed to completion. With two aircraft carriers expected to be ready in the not too distant future (they never were actually finished), this array of big ships threatened to become a major problem to the British Admiralty. The Germans could keep their ships in safe ports whenever they wished, while the British, guarding the lifelines of the empire, had to patrol the seven seas at the risk of losing invaluable vessels. The ratio of British capital ships to that of the Germans and Italians was no higher than 3 to 2 in the summer of 1940, and strategic conditions were advantageous to the Axis powers.

To maintain close contact with Britain's overseas possessions, routes had to be secured through the Mediterranean and around the Cape of Good Hope. The situation in the Mediterranean had deteriorated so seriously that most of the transports to the Middle East had to be rerouted around the Cape. Gibraltar could still bar the movement of hostile ships into or out of the Mediterranean, but it could no longer guarantee the safe passage of British vessels.

Spain's attitude toward the British was threatening, almost hostile. If Spanish Morocco, on the southern shore of the Straits of Gibraltar, had become a base against Britain, it could have been used to block all British shipping through the Straits. The menace to Gibraltar increased when, in violation of the statute of Tangier (the key city opposite Gibraltar), Spanish troops seized control of this territory on July 14. Although nominally under the suzerainty of the sultan of Morocco, Tangier, according to the treaty of 1906, was actually an international territory, neutral and demobilized. In a boastful and aggressive speech three days later, Generalissimo Franco spoke of Spain's duty and natural mission to control Gibraltar and to expand in Africa. On June 11, President Roosevelt had already proclaimed the Mediterranean a combat zone into which United States ships, planes, and citizens were forbidden to enter.

From the Straits of Gibraltar to the port of Alexandria, a distance of more than 2,000 miles, Britain had only one stronghold, the small but heavily fortified island of Malta. Malta, precariously close to the Italian bases of Pantelleria, Messina, Catania, Castellammare, and Taranto, was the target of constant enemy raids and could no longer be considered of offensive value. Shipping losses were bound to mount rapidly if the British insisted upon using the Mediterranean route to their Middle Eastern bases. By contrast, the Italians had little trouble in maintaining communications with their African Empire and in building up strength to attack the British on land. The Strait of Sicily, only 90 miles wide between Sicily and Tunisia, was no longer a precarious passage after the French surrender placed Tunisia practically under German and Italian control. In addition, the fortress island of Pantelleria, called an unsinkable aircraft carrier by Mussolini, protected even this short route. Italian shipping to Africa, previously travelling by the Catania-Bengasi route, 475 miles long, began to move through the Sicilian strait and along the Tunisian coast to Tripoli.

The rerouting of British transportation to India around the Cape of Good Hope added almost 50 per cent to the normal distance of 7,500 miles. The shipping to the Middle East, diverted around the Cape and through the Red Sea, had to travel four times the distance of the previous route. The number of trips per ship between Britain and its overseas possessions dropped sharply.

Even the route around the Cape became increasingly dangerous. Shipping lanes to India ran close to the great French island of Madagascar, off the southeastern coast of Africa. Madagascar's governor was hostile to Britain and strictly obedient to the government of Pétain. During the summer of 1940, the island became a potential German submarine nest. German armed merchantmen raided British shipping in the vicinity of the Cape. They sneaked along the west coast of Africa and, with obvious French assistance, occasionally made their way back to Europe.

North of Madagascar, British ships bound for India were faced with the uncomfortable proximity of Italian Somaliland. Vessels routed to the Middle East through the Red Sea could no longer count on full protection by the mighty fortress of Aden after Italian control was established over French Djibouti. This port was close to Aden and Italian Eritrea and a base of attack against shipping in the Red Sea.

If the Germans should decide to gamble one or more of their capital ships on extensive raiding voyages, British convoys were certain to suffer unbearable losses. Their escorts were mostly small units, such as destroyers and corvettes, easy prey for the big German warships. British destroyer losses mounted constantly. German U-boats, larger and more heavily armed than ever before, had become strong enough to risk direct engagements with destroyers. Since the Luftwaffe had bases ranging from the North Cape (and even east of it, for the Finns were already allowing the Germans the use of Petsamo) to the French-Spanish border, the sinking of ships by planes increased sharply.

Losses of British tonnage and of neutral

ships in British service in 1940 were as follows:

	Tons		Tons
January	231,000	July	356,000
February	242,000	August	354,000
March	150,000	September	356,000
April	56,000	October	310,000
May	165,000	November	364,000
June	397,000	December	213,000

Although this was far less than the Germans claimed (a Wehrmacht communiqué of August 7, 1940, listed sinkings since the outbreak of the war at 5,000,000 tons), the rate of loss was greater than Britain's shipyards could replace.

With Great Britain in danger of a German invasion, Italy's colonial armies massed in Libya and Ethiopia to threaten the Sudan, British Somaliland, Aden, Kenya, Egypt, and Suez. Repercussions were possible in Palestine and Iraq, where German-sponsored fifth column activities were in full swing. In Syria and Lebanon, the Vichy-French attitude pointed toward impending cooperation with Britain's enemies.

Contribution of British Dominions.—Most of the British Dominions contributed to the empire's defenses. During the first years of the war, Canada mobilized 200,000 soldiers and an additional 19,000 in the RCAF. Two Canadian divisions went overseas. The Canadian Navy of 175 vessels, manned by 15,000 men, helped to guard convoy routes. Canadian domestic industries turned out various military equipment. Newfoundland contributed 11,000 seamen, loggers, and gunners. West Africa dispatched forces to threatened East Africa. The Sudan and East Africa mobilized a number of troops. South Africa, with its industry converted to extensive war production, raised 130,000 men, and South African contingents were sent to East Africa. The South African Air Force raided Ethiopia and Italian Somaliland.

Australia mobilized 200,000 men for the army, 12,000 for the navy, and 19,000 for the air force. Two Australian divisions went overseas, and the Royal Australian Navy was considerably enlarged. New Zealanders gradually arrived in threatened areas, with a total of 80,000 men mobilized, including 5,000 in the air force. The Indian Army grew to 500,000 men. A small number of them had fought in France, and more substantial forces were dispatched to Africa and Malaya. India's war plant was expanded as were its navy and air force. Jewish recruits enlisted in Palestine.

Egypt, which was the primary objective of the expected drive of the Italian African armies, chose to remain neutral, although one Egyptian division was wrongly reported in line on August 23, 1940. British and other commonwealth forces, partly supplied with United States equipment, had to ward off the attack against Egypt. The Dominions did all they could to defend the British Commonwealth, but in the summer and fall of 1940 it seemed to be a case of too little and too late. Britain's enemies prepared for a "war of succession to the British Empire." It was almost a miracle that Britain survived.

U. S. Destroyers Reinforce the Royal Navy.—The critical shortage of escort vessels for the protection of British and Britain-bound convoys was eased by an agreement between Great Britain and the United States. Britain received 50 United States destroyers, veteran four-stackers of World War I, in exchange for bases in the British possessions of Newfoundland, British Guiana, the Bahamas, Jamaica, St. Lucia, Trinidad, and Antigua. The announcement of the agreement on Sept. 3, 1940, was cheered in Britain. It was followed by the renewed British pledge never to surrender and to destroy the fleet rather than let it fall into the enemy's hands. The newly acquired bases were of great value to the United States for the protection of the eastern approaches to the Panama Canal. The destroyers were not up to contemporary standards but were adequate for convoy duty.

Russian Expansion to the West.—While the collapse of France was in progress, it was learned that parleys were being held between representatives of the USSR, Germany, and Italy. No official communiqué announced the result of these parleys, but on June 16 the Soviet government handed similar notes to the governments of Lithuania, Latvia, and Estonia, charging these countries with violation of their pacts of alliance with the Soviet Union. According to the Russian claim, unsupported by factual evidence, Lithuania, Latvia, and Estonia were about to conclude a military treaty for mutual assistance, contrary to the terms of the pacts which Russia had imposed upon the Baltic States in the previous fall.

Since the establishment of Soviet bases, the three small nations had been independent in name only and were certainly unable to make commitments detrimental to the USSR. But the possibility cannot be discounted that German agents had attempted intrigues in the Baltic area, where popular feeling against the Russians was strong. In June 1940, the Germans were not yet openly hostile to the Soviet Union. The Moscow government, at that time, carefully avoided any mention of possible German aggression and was still trying to appease the Reich with economic concessions.

Neither Lithuania, Latvia, nor Estonia had any opportunity to reply to the Russian claims. On June 17, Russian troops marched in and seized all three. After the occupation of the Baltic States, plebiscites were arranged under Russian control. These plebiscites, carried out under conditions resembling those of German-staged referenda, led to the incorporation of all three countries into the Soviet Union as Soviet Socialist Republics. In Lithuania, the Soviet-sponsored "Working People's Bloc" was said to have received 99.9 per cent of the votes; the Communists listed 97.6 per cent in Latvia and 92.9 per cent in Estonia.

Events in Rumania were more spectacular. Although the country had been given a joint Franco-British guarantee of its integrity and independence in 1939, King Carol II, who had previously visited Hitler in Berchtesgaden, decided, in March 1940, to attempt to side with Germany. The leader of the Rumanian Iron Guard, Horia Sima, living as an exile in Germany, was recalled to take an active part in the Rumanian government of Prime Minister Gheorghe Tatarescu. The Iron Guard, a Fascist, terrorist, supernationalist, and rabidly anti-Semitic minority group, created by Corneliu Zelea-Codreanu, acted as Germany's tool.

Rumania was strategically and economically important. The country's oil production, much the greatest of any European nation except the USSR, had reached 6,239,000 tons in 1939. The oilfields were mostly British and American-

owned, with some French interests, but the Rumanian pro-Germans were determined to deliver the oil sources to the Reich. Germany was dependent upon Rumanian oil to feed its panzers and air force. Rumanian wheat was another important product which the Germans were eager to get.

The German cause was aided by the fact that hostile neighbors were threatening Rumania's security. Bulgaria and Hungary were anxious to recover what they had lost to Rumania after World War I and, if these countries had had their way, not much would have been left to Rumania. Germany offered to help Rumania against the extreme demands of its neighbors if the country accepted the Reich demands, one of which was the renunciation of Franco-British guarantees. The Germans made it clear that Rumania would otherwise face complete dismemberment. The Iron Guard acted as the Reich's fifth column. It was obvious that Rumania was about to become another potential base of future German aggression against the Soviet Union, as Finland was already.

Rumania's eastern borders were uncomfortably close to the Russian Black Sea port of Odessa and constituted a flanking threat to the Red Armies in Russian-occupied Poland. In May, Russian forces were reported to be assembling on the eastern bank of the Dniester River (the Russo-Rumanian border). Immediately after the conclusion of the German-Italian-Russian parleys, Russia engineered border clashes, which reached major proportions on June 24. On June 26, the Moscow government presented Bucharest with a 24-hour ultimatum demanding the immediate cession of Bessarabia (which had been Russian territory before the end of World War I) and also the northern part of the province of Bucovina, including the provincial capital of Cernăuti, which had never been Russian, but had previously belonged to Austria. Rumania had to accept these demands. Russian troops occupied the ceded regions within one week, and Rumania lost 19,000 square miles with 3,700,000 inhabitants. The country's revised eastern border ran along the Prut River far from Odessa, and the Red Army's Polish flank seemed secure.

Germany and Italy as Arbitrators.—Untroubled by Britain's continued resistance, the governments of Hitler and Mussolini began to readjust their spheres of influence in central and eastern Europe by drawing new boundaries and forcing national governments in that area into submissive obedience. A new order, planned by the dictators, took shape. The Italian sphere was to include only Greece and a possible share in Yugoslavia, plus conquered Albania. The rest was to go to Germany. Italy had once aspired to control all of the Balkan countries as well as Austria and Hungary, but Germany had grown too strong to recognize Il Duce's ambitions.

On July 4, 1940, Tatarescu resigned, and King Carol appointed Ion P. Gigurtu, who immediately began to reorganize the state along Fascist lines. On July 1, Rumania renounced the Franco-British guarantee, which had ceased to have any practical value under existing conditions. On July 2, Hungarian troops along the Rumanian border staged incidents, while the Budapest government charged mistreatment of Hungarian nationals in Rumania. On July 24, Hitler summoned members of the Rumanian government to a conference at Salzburg, Austria. Hungarian representatives were called in immediately thereafter. It was decided that Foreign Ministers Ribbentrop and Ciano should act as arbitrators in the Hungarian-Rumanian dispute. The arbitration took place in Vienna's Belvedere Castle on August 30, 1940, and satisfied no one. Rumanian territories acquired from Hungary through the peace treaty of Trianon were roughly divided into equal parts. The northern part was to be returned to Hungary and the southern part was to remain in the possession of Rumania. The decision left large national minorities in both countries. Between September 5 and 13, Hungarian troops, theatrically led by Regent Admiral Nicholas Horthy riding on a white charger, occupied the territory which had been ceded to Hungary, 19,300 square miles, with 2,400,000 inhabitants.

Bulgarian claims on the Dobrudja, the land between the right bank of the lower Danube and the Black Sea, were settled by direct negotiations, although the terms of the settlement were actually dictated by Germany and her Italian satellite. Bulgaria gained 3,000 square miles and 380,000 inhabitants.

Rumania thus lost about one fourth of its territory and one third of its inhabitants to Russia, Hungary, and Bulgaria. This was too much even for King Carol, who resigned in favor of his son Michael on Sept. 6, 1940, and left the country. The young king's authority was purely nominal. The real power was in the hands of the newly appointed prime minister, General Ion Antonescu, who was made chief of state. The Iron Guard became the only Rumanian political party. Following the acceptance of the Russian ultimatum, German "specialists," actually air force personnel, moved into Rumania to "protect oil fields against acts of sabotage." On July 4, the British personnel of the oil companies was ordered to leave the country. State monopolies, established for the export of oil and wheat, gave the Germans everything they wanted. General Antonescu prepared frantically to give the Germans full military assistance. The Rumanian Army was greatly strengthened, and German troops, no longer disguised as specialists, moved in. Late in 1940, the number of Germans in Rumania was conservatively estimated at 500,000. By then it had been decided that Germany would attack Russia, regardless of the nonaggression pact, and it was obvious that Antonescu had been promised compensation, at the Soviet Union's expense, for Rumania's territorial losses.

Hungary had to pay for its aggrandizement with its independence. Prime Minister Count Paul Teleki, although pro-German, had hoped that he could prevent German troops from infiltrating the country. The German government had no intention of respecting Hungarian sovereignty. With the Wehrmacht moving into eastern and southeastern Europe and the Reich's zone of domination expanding, German armed forces seized control of Hungary's lines of communication, military bases, and war plants, while German economists directed the reorganization of Hungarian production to fit the Reich's plans. Hungary offered no resistance. The German occupation was not publicized. Count Teleki atoned for his misguided policy by committing suicide in April 1941.

Berlin-Rome-Tokyo Axis.—In August 1940, Germany and Italy urged Franco to join the Axis. As an Axis partner, Spain would presumably

either attack Gibraltar or allow German troops in France to cross Spanish territory for an assault on the British fortress. Franco desired Britain's defeat, but he was reluctant to accept German-Italian suggestions. He was afraid of internal opposition and not too sure of an Axis victory. Although Spain did not join the Axis, she gave Britain's enemies all possible help short of active cobelligerency.

Japan became an Axis partner instead of Spain. The European and African war was about to become a world war.

For a number of years, parleys had been held between Berlin and Tokyo for the purpose of coordinating their ambitions. Italy joined the discussions after she became Germany's dependent junior partner. On Sept. 27, 1940, a German-Japanese-Italian conference, held in Berlin, led to a formal alliance of the three powers. Italy and Germany promised to respect Japanese hegemony in Asia, while Japan was to respect German and Italian authority in Europe. As for the United States, Japanese Prime Minister Prince Fumimaro Konoye declared, on October 4, that Japan was prepared to recognize the leadership of the United States on "their continent." On Dec. 9, 1940, Japanese Foreign Minister Yosuke Matsuoka stated that the Tripartite Pact would dominate Japanese foreign policy. If Germany should go to war with the United States, he added, Japan would fight on Germany's side only in the event that the United States was the aggressor.

United States leadership on "their continent," according to the Japanese interpretation, meant that the United States should be confined to the Western Hemisphere and eliminated from the Pacific. This interpretation meant nothing to Germany. The Reich's fifth column, centered in Argentina, was working frantically to establish Germany as a predominant power in South America by threatening the land approaches to the Panama Canal. Pan-German activities in North America were designed to undermine American resistance to a German war of nerves.

Although Britain was not mentioned in the Berlin communiqué, the division of the three most populous continents into spheres of influence gave further evidence of the Axis partners' intention to become the successors to the British Empire.

The attitude of the tripartite powers toward the Soviet Union was not disclosed. Spheres of influence planned in Berlin, however, gave Russia no share in future world domination. Hungary was compelled to sign the Axis pact on November 20 and Rumania, three days later.

THE BATTLE OF BRITAIN

On July 6, 1940, Adolf Hitler triumphantly rode through the streets of Berlin over a carpet of flowers, deliriously acclaimed by the populace which blasphemously called him their Field Lord and the Leader of Battles. Almost everybody in Germany was convinced that the war was won and that the liquidation of British resistance would be merely a mopping-up operation.

The Supreme Command of the Wehrmacht had previously dictated the course of military action. The prospective victims of aggression had awaited the German onslaught passively. Once the attack was under way, the German plan, based upon the irresistible impetus of the initial blow, set the pattern for each campaign. All German plans were drafted far in advance, and time invariably worked in Germany's favor. In the case of Britain, time worked against Germany after the French disaster. In June 1940, Britain was practically unarmed on land. But the British started to rebuild their armed forces at once, and the Wehrmacht soon lost its opportunity to attack an unarmed defender.

The German General Staff had foreseen two campaigns against Britain: one in France to seal the fate of the home islands and the other in Africa to destroy the British Empire on that continent. When victory in France failed to crush Britain, a new plan had to be formulated. The methodical General Staff was not good at improvisation. Transportation became more important than ever. The Germans were masters of land transportation but lacked experience in amphibious action.

Moreover, the British did not wait passively for the next German move. The RAF, although outnumbered by the Luftwaffe and operating from exposed bases, raided key German transportation centers, like Hamm, and ports, such as Hamburg and Bremen. British planes also systematically attacked German ships and conspicuous flat barges massing in North Sea and Channel ports, obviously the future invasion armada. Even Italy, believed to be beyond British bombing range, was attacked. War industries at Turin and Milan were the principal targets.

For the first time, the Wehrmacht encountered serious enemy interference with its preparations for an offensive. After the invasion of Norway, the Germans had air bases 370 miles away from Edinburgh and 320 from Scapa Flow. In Holland, they were 135 miles from Norwich and 155 miles from London, while only 26 miles separated German positions in the Pas-de-Calais area from the nearest point on the British Channel coast. Despite these advantages, the Luftwaffe was unable to knock out RAF bases. Unlike other opponents of the German Air Force, which had been speedily annihilated, the RAF not only survived but continued to bomb German-occupied French, Belgian, and Dutch harbors, crippling the potential German invasion fleets. As British defenses grew stronger, an increasing number of German soldiers was needed to carry out a successful invasion. The German High Command was surprisingly hesitant at this critical stage of the war.

The great German air assault on Britain finally began on August 15. It was designed to destroy the RAF, to paralyze transportation and war production, and to sever shipping routes leading to the British Isles. After achieving these objectives, the German High Command expected to be able to carry out the invasion with ease and safety, if England did not prefer to capitulate before the invasion was launched.

The ensuing Battle of Britain developed into the first campaign in history that was fought exclusively in the air. On August 15, 500 German bombers and fighters attacked Britain in successive waves. The target was the British coast from Portsmouth along the Channel to the Thames Estuary. Slow-moving British channel shipping was hard hit and suffered extensive losses. German Heinkels, Junkers, Dorniers, and Messerschmitts met spirited opposition from British Hurricane and Spitfire fighters.

The next day, with mounting fury, 1,000 German bombers hit the coast and shipping from

Plymouth to the Tyne, the London docks, the Tilbury docks, and the airdrome of Croydon, inflicting considerable damage. The Germans lost 144 planes in air battles. The British gave their own losses as 18 planes, although the Germans claimed 65. British figures were proven to be reliable, but the Germans accepted the widely exaggerated reports of their pilots. This soon confused the German High Command, which continued to believe in the ultimate destruction of British strength, even though the RAF was showing increasing powers of resistance.

On August 17, the Germans erroneously reported that they had won control of the air over Britain. All neutral countries except the United States and Argentina were notified that the waters around Britain were war areas and that every ship sailing there was in danger of mines or of direct air attack.

It became evident, however, that the Germans were not fully informed about the location of British air bases and that British camouflage was effective. Luftwaffe losses were mostly heavy bombers, while the RAF lost only light fighter planes. Severe damage was inflicted upon Britain and casualties were large, but the people showed amazingly high morale. Predictions that city dwellers would not be able to endure prolonged bombing were proved wrong.

On August 23, the Luftwaffe hit London again—at night. This was the first crucial event in the Battle of Britain. Night bombing was less precise than daylight bombing, but the losses suffered in day attacks were plainly more than the Germans could take. The bombs hit residential areas, inflicting extensive damage and casualties and starting big fires, which were gallantly fought by volunteer and professional fireguards. The indiscriminate bombardment caused only slight damage to military targets.

On August 28, the Germans claimed British losses of 1,055 planes since the beginning of the air battle, against their own losses of 271. Although these figures were fantastic, the Germans were still greatly superior in numbers, and the suffering of the British population was becoming acute. The outnumbered RAF pilots had little rest, but they carried on, raiding Berlin in small numbers, while the Luftwaffe dropped incendiary bombs on London and kindled huge fires.

The Germans turned to systematic attacks on London. They called Britain the heart of the empire and London the heart of Britain. The High Command reasoned that, if London were knocked out, the empire would be knocked out. The Luftwaffe hammered relentlessly at the British capital and its port installations, which handled 70 per cent of the country's peacetime imports. On September 5, Hitler, in a rage about air attacks on Germany, spoke of razing British cities. He charged the British with responsibility for the air war and promised retaliation in the proportion of 100 to 1 for any bombs dropped upon German territory. In reality, the weight of bombs dropped on Berlin during the RAF raids in 1940 was hardly more than 1 per cent of what the Luftwaffe loosed on London. But the spirit of London was not conquered, nor was the claim of German control of the air over Britain ever justified. The invasion bases remained under attack. The Wehrmacht still had more than 100 divisions in the West (10 to 15 might then have been sufficient to overwhelm the British Army and Home Guard after landing in Britain) but not a single one tried to cross the narrow strip of water which separated England from the continent. Hitler, addressing those who were skeptical about a German invasion of England, shouted: "Don't worry! We are coming!" The German führer probably believed his own words, although, on the day of his speech, the Germans lost 54 planes to 11 for the British.

British air defenses gradually improved. Despite lack of sleep, Britishers of all classes worked on shelters and gun emplacements. Factories toiled day and night to produce arms.

On September 6, London suffered a night raid lasting for 7½ hours, and there were 7 alarms during the following night. On September 8, in an unprecedented effort of destruction, 1,500 German raiders dropped 4,400,000 pounds of bombs in the area from the Thames Estuary to the London docks, kindling tremendous fires. Huge clouds of smoke, viewed from the air, created the impression that all shipping facilities were completely destroyed. Herman Göring flew over the stricken region to see for himself what his Luftwaffe had accomplished. The damage was really alarmingly severe, but a considerable proportion of the port installations somehow remained in operation. The RAF retaliated as best it could. The German raids continued without respite, regardless of mounting losses. They temporarily stopped all street traffic in London and inflicted further damage and casualties on large sections of southern England.

On September 12, Churchill announced that the following week might be "very important" and that England was passing through its gravest hours since Sir Francis Drake defeated the Spanish Armada. The RAF noted extreme activity in German invasion ports, and it seemed as if the Wehrmacht was finally about to start its assault. Later reports that an invasion attempt was crushed in a sea of flames were not confirmed. No actual invasion attempt was ever made. During the five days preceding September 13, London listed 1,175 dead and 4,720 injured, and material damage was very extensive. On September 15, while the bombers pounded London, the city's defenses were alerted for invasion.

September 16 was the decisive day in the Battle of Britain. In mass raids on London and southern England, the Luftwaffe lost 185 planes. Thereafter, although the German attacks continued, they steadily declined in strength. By September 19, the score of plane losses stood 1,867 to 621 in Britain's favor, despite the claim of the Wehrmacht that 2,096 British planes had been destroyed.

The ruthless bombing of Britain went on, but it was no longer a preparation for an assault by land, sea, and air. The Battle of Britain developed rather into a siege, with the besieged making increasingly successful sorties. The Germans had suffered their first reverses in World War II, but it was not immediately obvious. RAF pilots still reported the massing of invasion craft opposite Britain. British attacks on invasion ports evoked sharp protests from the Vichy government of France.

After 16 nights of constant air attacks, on September 24 London had a breathing spell at last. From Sept. 7 to Oct. 7, 1940, a daily average of 400 German bombers hit London. After November 15, the Luftwaffe turned its main attention to other targets, although it continued

to attack the capital. Buckingham Palace was hit twice by German raiders. The German air arm, reinforced by a number of Italian bombers, raided British industrial centers, but the performance of the Italians did not match the boastful publicity.

In November, a tremendous attack hit Coventry, site of automotive and aircraft factories. The damage inflicted upon the city seriously delayed badly needed replacements of aircraft. Manchester, Birmingham, Bristol, Southampton, Portsmouth, and Liverpool also felt the impact of the Luftwaffe.

As shipping losses averaged 300,000 tons a month, with British replacement capacity at only 100,000 tons, port facilities were hard hit, and industrial output badly hampered. It was fortunate for the British that only about 2 per cent of their oil stores were destroyed by the raiders.

The need for more planes became pressing because of the losses suffered by the RAF, the rapid enlargement of the scope of military action in Africa, and preparations for an emergency in the Far East. Beginning in November 1940, the United States came to Britain's aid by sending 50 per cent of its plane production to Britain.

According to the most reliable figures, plane losses in combat between Aug. 8, and Dec. 31, 1940, were as follows:

	German (and Italian)	British
August	1,097	295
September	1,088	318
October	239	115
November	288	42
December	9	39

The British reported a total of 200 raids on the Ruhr, 31 on Berlin, and extensive damage to Hamburg. The Germans denied devastation in the latter city and insisted that the effects of the British raids were negligible. In reality, the damage inflicted upon the Reich was very much smaller than that suffered by Britain, where, by Dec. 31, 1940, more than 60,000 persons had been killed or injured by German bombs, and severe shortages of vital supplies had developed.

ITALIAN OFFENSIVE IN AFRICA

The conquest of Ethiopia in 1935 had greatly improved Italy's strategic position. Egypt and the Anglo-Egyptian Sudan were caught between two huge Italian pincers which closed in from Libya in the northwest and from Italian East Africa in the southeast. Long-range Italian strategy aimed at the conquest of these vast territories and the Suez Canal, as well as elimination of the British hold on the west coast of the Red Sea. In addition, Italian pressure against Greece revealed that Italy was planning to gain control of the northeastern Mediterranean shores, simultaneously with a drive against Egypt to deprive the British Navy of its bases in that vital area. The eastern Mediterranean countries were expected to serve as springboards for a later drive into Syria, Palestine, Iraq, Iran, and eventually into India.

Italy's African armies were the strongest ever assembled on the "dark continent." They were massed in Tripoli (or Tripolitania), Libya, and Eritrea (including Ethiopia).

The Libyan Army had almost 250,000 men, at least 500 tanks, many hundreds of airplanes, and huge quantities of artillery and motorized equipment. It was under the command of Marshal Italo Balbo, governor general of Libya. As Balbo was distrusted by the Germans, whom he strongly disliked, Marshal Rodolfo Graziani (Marchese di Neghelli), extolled as the maestro of desert warfare, was assigned as his "adviser." The plan was to have the Italian Northern Army drive straight east toward the Nile Delta and Suez with the help of a fifth column operating inside Egypt. Many Italians who lived in Egypt were strong supporters of the Fascist Party. It was expected that a number of native Egyptians would also assist the Italians, since Mussolini had proclaimed himself "protector of Islam." German agitators were also busy in Egypt as spearheads of a Berlin-controlled fifth column, which spread all the way to India. Cooperation between German and Italian fifth columnists, however, was far from perfect, as their rivalries were stronger than their common aims. Egypt had never in history been conquered from the west, but never before had so formidable an army attempted to force its way into the country of the Pharaohs.

The Italian East African Army, under the command of Prince Amedeo Umberto, the duke of Aosta, was somewhat weaker than the Libyan forces and was cut off for the time being from the homeland. Its numbers were estimated to be between 150,000 and 200,000 men, with some heavy equipment. Most of the troops were colonials.

The duke of Aosta had four objectives: to conquer British Somaliland; to assure Italian control of French Somaliland (Djibouti) by enforcing the terms of the French armistice; to divert British defensive forces with substantial raids on Kenya in the south; and to push northward through Kassala down the Atbara River and into the valley of the Nile, isolating Khartoum. The latter drive was designed to spread eventually to the Red Sea and northward along the Nile to threaten British forces defending Egypt and the Suez Canal.

Of the British dominions and protectorates in Africa, the Union of South Africa, Southwest Africa, and East Africa were military assets. Egypt, as an independent nation, was not at war with either Germany or Italy. The Egyptian government confined itself to breaking off diplomatic relations with the Axis countries. The British were bound by the terms of a treaty to protect Egypt against invasion. The same treaty gave them the right to use Egyptian ports, airdromes, and other military bases for Egypt's protection as well as for the defense of the Suez Canal. The Egyptian Army, 17,500 strong, did not see action. Two under-manned divisions were all the British could muster in June 1940, and their equipment was no match for that of the Italians.

The RAF in Africa had few modern planes, scattered over immense areas, but these tiny forces began to attack enemy installations immediately after the Italian declaration of war. Their boldness misled the Italian commanders, who believed they were faced by substantial forces. All the British could do at first was to confuse the Italians and hamper their movements by daring raids. This could delay but not permanently halt the Italian drive.

The Italian East African Army struck first. Its drive into British Somaliland was carried out by two Celere (speedy) divisions (the Italian counterpart of the German motorized divisions), extremely fast and impressive looking units of limited efficiency. They were strong enough to overcome the resistance of 560 British camel rid-

ers and 500 native gendarmes, all that the empire could muster for the defense of its colony. The capital of Berbera and the port of Zeila soon fell to the attackers and, after two weeks of rear-guard action, the British lost Somaliland on Aug. 19, 1940. The triumphant Italians bragged loudly about their military feat. The British succeeded in evacuating most of their men to Aden, although this fact did not compensate for the military setback.

The Italians also controlled another important point on the Red Sea, Djibouti. Its pro-British Commander, French General Paul Louis le Gentilhomme, anxious to fight the Italians despite the provisions of the armistice, was forced by some of his officers to flee into British territory. The Vichy French then eagerly turned over the Red Sea port to the duke of Aosta and also maintained protective forces to cover the flank of his offensive operations into British Somaliland.

Kassala, on the border between Eritrea and the Sudan, had no garrison capable of resisting the Italian onslaught, which began in July. The duke of Aosta's troops, including another Celere division, although slightly hampered by RAF raids, swept into the Sudan. Gallabat, on the Ethiopian border farther to the south, fell to the Italians. The British also lost the trading posts of Gambela and Moyale (Fort Harrington) in the border regions of Kenya, where the British had half a division to hold a 1,000-mile sector. In the interior of Kenya, General Cunningham's Southwest and East African forces were in the process of assembling. The Italians penetrated as far as Moyale, which was stubbornly though vainly defended by 150 soldiers.

These victories, achieved between June and August 1940, marked the high tide of the duke of Aosta's advance. They were hardly more than a nuisance to the British. After Cunningham's troops were organized, and some reinforcements had arrived from South Africa, the Italians were driven back. Moyale was recaptured. Kassala and Gallabat changed hands several times but were finally regained by the British. The Italians held on in Somaliland and Djibouti. They had not displayed much skill in organizing transportation into advanced areas, and reports of British counteroffensive preparations caused anxiety because supplies were running short. Further offensive action was postponed until Libyan armies were well on their way toward Alexandria and Cairo.

Balbo had six divisions lined up along the western Egyptian border, with more than that number in rear echelons. British advanced forces, scattered over hundreds of miles, were outnumbered at least 10 to 1. A heavy Italian attack would have penetrated deeply into Egypt. The British relied upon bluffing tactics to prevent Marshal Balbo from attacking. Single tanks, followed by a few trucks, dashed at Italian strongholds. Immense clouds of dust swirling up in the desert created the impression of a formidable armored column on the move. British patrols, under cover of such raids, attacked Italian border fortifications and succeeded in temporarily capturing strongholds weakly defended by bewildered garrisons. Italian reports put the British forces at between two and five armored divisions. In reality, less than one armored regiment was in action. The RAF contributed its full share toward bluffing the Italians.

On August 6, Marshal Graziani replaced Balbo, who was soon afterward reported killed in an airplane crash. Under Graziani's command, the Italian border strongholds were recaptured, and the drive into Egypt was believed to be imminent. It did not materialize immediately, however.

Graziani was much concerned about securing his army's supply lines before launching a full-scale offensive. In view of the superior strength of his air force, he was less afraid of air attacks than of the threat from the sea, as only a minor fraction of the Italian Navy was in the eastern Mediterranean. The main highways leading from Tripoli to Libya, and from there to Egypt, ran either directly along the shore or within range of naval artillery. British warships could raise havoc with transport columns. Graziani wanted safer roads built farther inland. According to the Marshal's plan, troops should remain as close to their supply bases as possible.

Graziani also felt that the Italian Army in Africa would be in an extremely precarious position if it was dependent upon a single port at which supplies could be landed and that port was knocked out by the British Fleet. He therefore ordered the use of as many ports as possible and divided his army into groups, each of which was to receive its supplies through a different port. Moreover, the coastal positions were buttressed by lines of fortified and strongly garrisoned posts extending far inland. This system helped to safeguard supply routes, but it also resulted in the wide dispersal of Italian military strength.

Tripoli, the main Italian port of supply, was beyond hostile airplane range, and the British Navy could not easily raid the harbor. Tripoli was too far from the forward areas to supply fighting units, so it became the chief storage base. Bengasi was the westernmost fighting base. From Bengasi, Graziani's supply lines fanned out to Barce, Cirene, Derna, and Tobruk on the coast and Mechili inland. From Tobruk, they stretched to Bardia in the west and Giarabub in the south.

While Graziani methodically carried out his preparations, the British were bringing in some reinforcements and were able to change their tactics. Bluffing was abandoned, and a line of defense was chosen where attackers could be met with a reasonable chance of success. The line had to be short and as close to the Nile Delta as possible without bringing Alexandria and Cairo under constant air attack. The chosen position was anchored at Mersa Matruh in the north and the Qattara Depression in the south. No army could get through the Qattara Depression. In August 1940, the Mersa Matruh line was manned by two divisions, while some screening forces remained in front of the line and a small reserve in the Delta region to the rear.

On Sept. 12, 1940, the long-awaited Italian drive began. In the air, swarms of Italian Savoia-Marchettis and Capronis many times outnumbered the British Blenheims, Gladiators, and Hurricanes. Italian tanks met only a few British armored cars on patrol. The advance was a rather theatrical demonstration of noisy and showy mechanized and air power. The British fought delaying actions and heavily mined the roads. With an apparently irresistible impetus, Graziani's legions drove to Sollum, 55 miles inside the Egyptian border. Leaflets showered over Egyptian cities depicted the country's happy future under the Fascist regime.

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CYPRUS
CASABLANCA
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TUNISIA
TRIPOLI
BENGASI
TOBRUK
SOLLUM
ALEXANDRIA
PALESTINE
IRAQ
EL ALAMEIN
CAIRO
SUEZ
TRANS-JORDAN
SAUDI ARABIA
Qattara
Depression
PERSIAN GULF
RIO DE ORO
ALGERIA
LIBYA
EGYPT
RED SEA
Nile
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FRENCH WEST AFRICA
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SUDAN
KHARTOUM
KASSALA
ERITREA
ADEN
GULF OF ADEN
DAKAR
SENEGAL
GALLABAT
FR. SOMALILAND
DJIBOUTI
BR. SOMALILAND
BERBERA
NIGERIA
GOLD COAST
CAMEROONS
FRENCH EQUATORIAL AFRICA
ETHIOPIA
Lake Rudolf
ITALIAN SOMALILAND
UGANDA
KENYA
Lake Victoria
BELGIAN CONGO

556pp

Graziani advanced as far as Sidi Barrani, a few miles east of Sollum, where he stopped at what was to prove the high water mark of his campaign.

Increasingly worried by the poor showing of the Italian Navy, Graziani realized that he was close to the main British naval bases in the eastern Mediterranean and wanted to safeguard his supply routes before continuing his advance. Sollum was converted into another supply base, and Italian engineers began the construction of a highway 30 miles inland, called *Via della Vittoria* (Victory Road). The Italian commander-in-chief also wanted to await the cool winter season before driving ahead at full speed, and, in addition, the Italian attack on Greece was imminent. Its immediate success could throw the British Navy off balance and even induce the British to divert some of their forces to that theater of war, thus baring the approaches to Egypt.

Expedition to Dakar. — French Senegal, with its important naval base of Dakar, remained under Vichy control. Dakar was only 1,870 miles from Natal, Brazil, and very close to shipping lanes from Britain to the Red Sea, and to India around the Cape of Good Hope. A land link was under construction between Algeria and Senegal through French West Africa, and the possibility could not be overlooked that the Axis might use Dakar to attack British shipping.

In the summer of 1940, General de Gaulle informed the British Cabinet that, according to information from Senegal, the colony was prepared to surrender to his forces. It was expected that Governor General Pierre Boisson would either join de Gaulle or be displaced by his officers. The British decided to organize a Free French expedition to Dakar. Two British battleships, four cruisers and a number of destroyers escorted transports carrying de Gaullist troops but, on September 23, General Boisson's men repulsed a landing attempt of Free French troops near Dakar. The British decided not to force the issue for fear of war with Vichy France. Pétain's government retaliated feebly with another raid on Gibraltar by its North African air force on September 24. Dakar remained under Vichy rule. General de Gaulle finally succeeded in bringing French Equatorial Africa and the Cameroons under his regime. This development slightly improved the British situation in Africa but could not make up for the Dakar fiasco.

Mediterranean Naval War.—The defense of Africa would have been a hopeless task unless the British Navy could prevent the Axis powers from gaining control of the Mediterranean Sea. The attitude of Greece, too, was largely contingent upon the situation in the Mediterranean, for that country could not possibly resist an attack by air, land, and sea.

The Mediterranean is divided into two parts by the Straits of Sicily. West of the straits, except for Gibraltar, not an inch of coastline was under British control. All the British Navy could try to do in the western Mediterranean was to escort vital convoys through an area infested by enemy submarines and aircraft and to inflict as much damage as possible on enemy shipping. It even became necessary to grant the Vichy government safe conduct for shipments from French North Africa to metropolitan France, even though Germany certainly profited from these shipments. It was impossible to interfere effectively with Axis shipping through the Straits of Sicily. The Axis also had many advantages in the eastern Mediterranean. Italy's naval base of Taranto and the Italian-ruled Dodecanese Islands were ideally situated for raids in the middle eastern sector. The Dodecanese Islands, located off the coast of Asia Minor, were built up into naval and air bases with German assistance. From Rhodes and Lero in the Dodecanese, Axis aircraft were within range of Palestine, Suez (235 miles away), Egypt, and the British fortress island of Cyprus, the latter only 30 minutes flying time from Rhodes. The proximity of the Dodecanese Islands reduced the strategic value of Cyprus.

Malta, the other British island stronghold, only about 120 square miles in area, was 60 miles off the southern shore of Sicily and 210 miles from Tripoli. During the first 18 months of the war, Axis planes raided Malta on an average of twice a day. The peak of these attacks was reached during the month of January 1942, when 263 raids rocked the fortress. Despite the heroic and successful defense of Malta, the offensive value of its airfields and the port of Valetta was greatly reduced. The balance of eastern Mediterranean coastlines held by Italy and Britain respectively was changing in Italy's favor, and Syria, under Vichy control, came into the Axis orbit.

Despite these odds and the fact that the Italian Naval Air Force outnumbered his own, Admiral Sir Andrew Cunningham, commander of the British Eastern Mediterranean fleet, decided to take the offensive. His forces steamed out to challenge the Italian Navy immediately after June 10, 1940, but the Italians refused to fight. It was not until July 19 that the Australian cruiser *Sydney* succeeded in sinking the Italian heavy cruiser *Bartolomeo Colleoni* (10,000 tons) off the coast of Greece. On October 13, the British sank an Italian destroyer leader, the *Artigliere,* and a destroyer, the *Francesco Nullo.*

Admiral Domenico Cavagnari, in command of the Italian Fleet, refused to expose his capital ships. The admiral insisted that their crews were not well enough trained. Although much had been said of the efficiency of Italian E-boats, small, extremely fast craft carrying torpedoes, the British were able to blast these vessels from the water before they scored any hits. Italian naval aircraft also failed to inflict losses upon British ships. The Italians usually bombed from high altitudes and with little accuracy. Encouraged by Italian inefficiency, Cunningham decided in November 1940, to strike a daring blow. Greece was already at war. To assist that country, the British Fleet had to penetrate the Adriatic Sea and to intercept convoys bound for Albania. British bases on Crete, established after the Italian attack on Greece, improved the fleet's potentialities. The blow was to strike Italian capital ships in hiding. In late 1940, the theory still persisted that a navy had to fight a war with the battleship quota it possessed at the outbreak of the war. Therefore any Italian battleships that were put out of action would be reckoned as permanent losses.

His Majesty's battleships *Warspite, Valiant,* and *Malaya,* the aircraft carriers *Eagle, Ark Royal,* and the super-modern *Illustrious,* and a number of smaller craft, steamed into the Bay of Otranto. On November 11, three Italian supply ships were sunk and escorting vessels were dam-

aged in Adriatic waters. Italian capital ships in nearby Taranto were trapped in the narrow and crowded port. On November 12, while the British fleet blocked the harbor, carrier-based torpedo planes attacked the ships inside. One of the two Italian 35,000 ton *Vittorio* class battleships and two of the four 26,000 *Cavour* class vessels were severely damaged.

British control of the eastern Mediterranean appeared to be permanently established. British raids in the Adriatic increased and included the shelling of Italian port installations in Albania. Full naval support of the land forces in Egypt was assured. Sea transportation through the Mediterranean, although still extremely precarious in the west, was improved. According to reports issued by the Admiralty, the British Navy, in 1940, lost one 22,500 ton aircraft carrier, two antiaircraft vessels, one 6,000 ton cruiser, 33 destroyers, 21 submarines, and various auxiliary craft. To withhold useful information from the enemy, announcements of losses were usually delayed. Losses by sinking published at the end of the year did not necessarily reflect all losses suffered by December 31.

Italian disasters hastened German intervention in the Mediterranean theater of war. The Wehrmacht took over Italian bases. German dive bombers soon attacked British shipping and British strongholds. They were much more effective than the Italian Air Force and inflicted increasing damage.

On March 28, 1941, the Italians suffered another naval defeat. With the war in the Balkans moving into its decisive stage and the tide of battle turning in North Africa, the Italian Fleet attempted to regain some initiative. After the Taranto disaster, Admiral Cavagnari had been replaced by Admiral Arturo Riccardi. On March 27, Cunningham, with three battleships, one aircraft carrier, and many lesser craft challenged an Italian fleet spotted by scouting planes in the eastern Mediterranean. Light, advanced forces under the command of Vice Admiral Henry D. Pridham-Wippell made contact with one *Vittorio* class battleship, six cruisers, and many destroyers. British torpedo planes attacked and slightly damaged the battleship, but the Italians fled. Another Italian squadron of two *Cavour* class battleships, three cruisers, and four destroyers was discovered 80 miles west of Gavdo Island. The commander of this squadron was also anxious to avoid battle, and the superior speed of the more lightly armored Italian vessels permitted him to gain some distance. On March 28, at 10 P.M., the British at last succeeded in making contact with the Italian cruisers and destroyers. In the engagement that followed, the British units were unscathed, but the three Italian heavy cruisers, *Pola, Zara,* and *Fiume,* all of them 10,000 ton fighting ships, were sunk, as well as two destroyers. The action took place off Cape Matapan. German aircraft arrived too late to assist the Italian squadron, but in time to prevent the British from rescuing a considerable number of survivors from the stricken vessels. With a gesture of chivalry, Admiral Cunningham gave the exact location of the survivors on rafts in a radio message to the Italian commander in chief. They were picked up by an Italian hospital ship.

The Battle of Cape Matapan was followed by a series of Axis victories, compensating for Italian disasters in Egypt and Greece.

Italy Versus Greece.—The aggressor nations carefully appraised the possibilities of states which could be useful to them as strategical bases or potential sources of raw materials and forced labor. The result of their evaluation sealed the doom of the chosen victims, which were to be brought into the Axis orbit by force, corruption, or blackmail. The aggressors tried to place the blame for their own actions upon the victim. If the coveted nation attempted resistance, or some act of provocation failed to bring the desired reaction, the aggressor nation violently denounced the victim for dangerous plotting and the ruthless persecution of minorities.

Italy believed that control of Greece was essential to control of the Mediterranean. In August 1940, Prime Minister General Joannes Metaxas, a dictator himself, was expected to yield to Italian demands, partly for reasons of ideological solidarity and partly for fear of internal troubles in case of a military venture. Placing the interests of Greece above those of his regime, he did not fulfill Mussolini's expectations.

The Italian government invited Metaxas and the Yugoslav prime minister, Dragisha Cvetkovic, to come to Rome for the arbitration of alleged Balkan grievances. The Yugoslavs were supposed to cede parts of the Dalmatian coast to Italy, while Greece was to be induced to cede the district of Ioannina to Italian-dominated Albania and also a strip of the Aegean coast to Bulgaria. The latter concession would have eliminated Greece's common frontier with Turkey. In order to put Metaxas under pressure, the Italians charged his government with a breach of neutrality for granting air bases on islands in the Ionian Sea to the British—which was *not* true—and with persecution of Albanian nationals living in the northwestern part of Greece—which was equally incorrect.

General Metaxas, who had reaffirmed his country's neutrality on August 4, did not come to Rome, much to the dismay of the Italian government. The Germans posed as impartial observers. Their press did not join the Italian chorus of abuse after Metaxas failed to accept the dangerous invitation, and they expressed sympathy for the Greek prime minister who had been in office since 1936. The Reich even concluded an economic agreement with Greece to exchange German coal for Greek ore. The German minister in Athens advised Metaxas to renounce the guarantee obtained from Great Britain. Metaxas did not heed the advice.

On August 15, the obsolete Greek cruiser *Helle,* anchored in the little harbor of St. Nicholas on the island of Tenos, was torpedoed and sunk by a submarine, and a Greek packet boat was destroyed from the air off Crete. In both cases, the attackers were undoubtedly Italians. The Greek government did not retaliate.

The Italian press claimed that the Greek Ioannina district was inhabited by a majority of Albanians, although they actually numbered less than 20 per cent of the population. According to the Fascist newspapers, Albanian patriots, led by Doant Hoggia, were brutally mistreated by Greek authorities. Hoggia was reported by the Greeks to be a fugitive from justice, with convictions for four murders and several cases of rape, robbery, and brigandage on his record. Hoggia's decapitated corpse was discovered on Albanian territory. Although his murderers were unidentified,

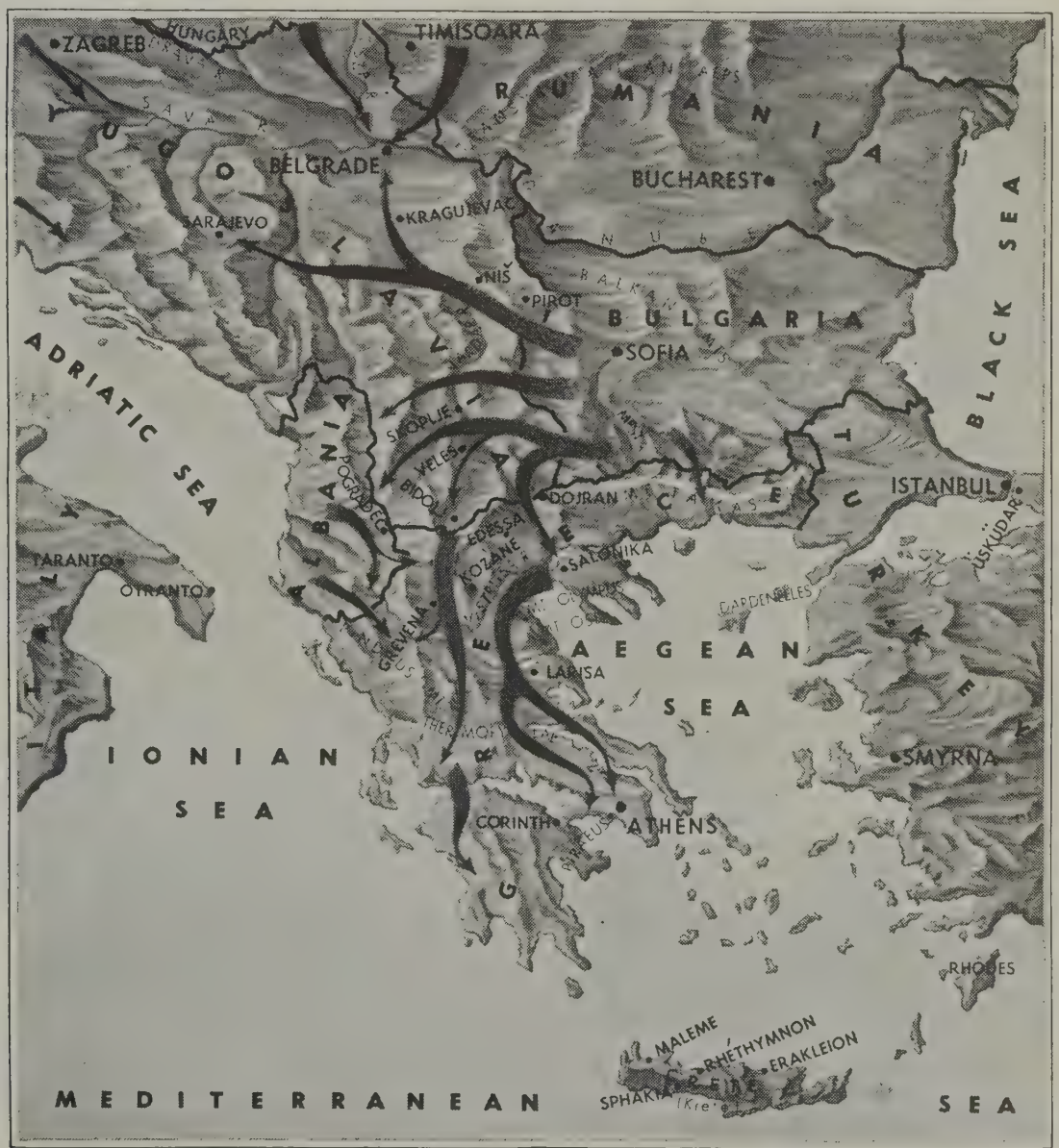
the Italian press and radio fumed with indignation over the "Greek crime."

Whenever Italian shipping was attacked close to the Greek coast, Italian reports charged that the British were using Greek bases. In reality, the Greek government was determined to keep the British out of its territory so as not to give the Italians, and possibly the Germans, a pretext to begin hostilities. The British accepted the Greek viewpoint.

Beginning Oct. 13, 1940, the Athens government received numerous warnings from various European sources that Italy was about to attack. Besides the British guarantee, Greece had two alliances, one with Turkey and the other with Yugoslavia. The Turkish pact called for armed assistance only if Greece went to war with Bulgaria, and Yugoslavia was to help only if the Turks aided the Greeks. Bulgaria was not yet ready for war.

At 3:00 A.M. on October 28, the anniversary of the Fascist march on Rome, the Italian minister in Athens handed an ultimatum to General Metaxas. The note repeated the charges of Greek assistance to Britain, Greek atrocities against Albanian nationals, and especially Greek preparations for an attack on Albania. Guarantees were asked for Italian security and the maintenance of Greek neutrality. Italy was to be permitted to occupy unspecified strategic points on Greek territory. The Italian minister insisted that he had not been informed of the location of the strategic points. General Metaxas refused to surrender to the Italian demands. The ultimatum expired at 6:00 A.M. Thirty minutes before its expiration, the Italians opened the attack.

Greece had less than 8,000,000 inhabitants compared to Italy's 45,000,000. Military odds, however, were less overwhelmingly in Italy's favor. Substantial Italian forces were tied up in the African venture, others were still in France, and some Italian divisions were patrolling the Yugoslav border. Every Italian soldier and all equipment had to be shipped across the narrow and precarious Adriatic Sea to Albania, the springboard of attack, and the topography of the



Albanian coast did not favor the deployment of large forces. The commander of the Italian troops facing Greece, General Visconti Prasca, had 10 divisions of first-rate troops in the line with five inferior divisions in reserve. The main Italian shipping bases for Prasca's army were Brindisi in Italy and the Albanian ports of Vlora (Valona), Durrës (Durazzo), and Santi Quaranta (temporarily named Porto Edda in honor of Mussolini's daughter). Argyrokastron and Koritsa were advanced supply bases in the interior of Albania.

In 1935, Prasca had written a book on a blitzkrieg in the Balkans which advocated a lightning thrust toward Salonika, along the road the Roman conquerors once followed. It was obvious that he would attempt such a drive. Greek army statistics placed the country's forces at 17 divisions, but full equipment was available for only 12 divisions. With Bulgaria about to become an Axis satellite and Yugoslavia's attitude uncertain, both borders had to be guarded. The Italians certainly had numerical superiority. The Greek Army had practically no tanks, while Prasca had several hundreds of them, although they were mostly of the Fiat model which had acquired an unfavorable reputation during the Spanish Civil War. The Italian Air Force numbered 1,200 planes, many of them modern, while Greece had 200 planes of various French, Polish, and German makes, some of them of the vintage of 1926. Nevertheless, Greek pilots gave a magnificent account of themselves, and the Italian Air Force never succeeded in gaining full mastery of the air.

Greece had a permanent line of defense called the Metaxas Line, which adequately protected the Bulgarian border. Small fortifications were scattered along the Yugoslav boundaries but there were no fixed defenses worth noting on the Albanian frontier, as that country, prior to its annexation by Italy, had not been a military power.

General Metaxas, in order to protect himself from charges of having an aggressive attitude, had refused to draw up substantial forces on the Albanian boundary, and the Greek mobilization was far from complete on October 28.

Even with the Italians on the move, Greece did not want large-scale British assistance. The successful defense of Egypt was of the utmost importance to Greece, and Britain could not afford to withdraw either troops or matériel from North Africa. Besides, full British intervention might have induced the Germans to assist Italy, with fatal results for Greece. It was decided, after consultation, that some RAF squadrons should support the Greeks. In return, Britain obtained the right to use the Greek island of Crete as a naval and air base. The British moved into Crete in early November, centering at Suda Bay, 150 miles from Italian-dominated Rhodes and 340 miles from Egypt.

Prince Ehrbach reported to Berlin that the Greek general mobilization, ordered after the Italian attack, was a "farce." The country, according to the German minister, was unable to fight and would soon ask Germany to mediate. The Greeks responded to their call to arms with great enthusiasm and the mobilization was completed with remarkable speed.

Four Italian columns crossed the Greek border on October 28, while the air force bombed Patrai (Patras), the Corinth Canal, Preveza naval base, and the Tatoï airport near Athens. During the early days of the war, the Italian offensive progressed smoothly enough but not too rapidly. One column, advancing in the lowlands along the Adriatic coast, aimed at outflanking Iōannina; the second pushed toward the Kalamas River and Iōannina proper, the third aimed to penetrate the Pindus Mountains in the direction of Metsovon, the capture of which would have isolated Iōannina; while the northernmost, pressing on to Phlorina, marched along the Yugoslav border. From Phlorina a railroad and a highway led to Salonika, 85 miles to the east. Philiatrà, 9 miles inside the border, fell to the Italians on October 31. On November 2, the Kalamas was crossed, and Italian cavalry patrols were reported in the outskirts of Iōannina on November 3.

The primary aim of Gen. Alexander Papagos, Greek commander in chief, was to keep the attackers from gaining vital objectives, with the idea of taking the initiative later. This was a tremendous task with a maximum of nine available divisions, no armor, and no heavy artillery. Despite these odds, local Greek counterattacks started as early as November 1. After repelling the northernmost Italian column, the Greeks crossed into Albania in the Koritza-Phlorina sector, advancing three miles and continuing to advance during the four subsequent days.

The Italian threat lasted for another week. The Julia Division (*Alpini*), the best mountain troops Italy could muster, attempted to cross the Pindus Mountains. On November 9, the Alpini were only 10 miles from Metsovon and the vital pass leading into the Thessalian plain. Three battalions of Greek elite troops (Evzones) defended the mountain crest, and Greek women, old men, and children from neighboring villages volunteered to carry supplies. At nightfall, the Evzones routed the Italians by a violent bayonet charge. The Alpini were almost annihilated.

The Greeks had learned how to deal with the Italians. Italian infantry could not stand bayonet charges, and Italian tanks, confined to narrow valleys, became easy prey to Greek mountain artillery or to infantrymen using antitank rifles flown in by the British. Italian heavy artillery was also greatly handicapped in the rugged terrain. On November 16, no Italian soldiers, except prisoners of war, were on Greek soil. On November 18, Prasca was replaced by Gen. Ubaldo Soddú, and Mussolini threatened to "break the back of Greece."

On November 15, Italian Field Marshal Pietro Badoglio met German Field Marshal General Wilhelm Keitel in Innsbruck, Austria, and appealed for aid. He suggested that the Germans should induce Bulgaria to attack Greece. The suggestion was scornfully rejected and Italy was advised to fight it out alone. Germany wanted to humiliate Italy and make her ally increasingly dependent. Besides, with preparations for the attack on the Soviet Union well under way, the Reich did not want to alarm the Russians prematurely by intervention in the Balkans.

On November 18, the Greek mobilization was completed. The amazing incompetence of the Italian Air Force accounted for the lack of effective interference with Greek troop movements. General Papagos concentrated the 1st, 2d, 3d, and 4th Greek divisions on the left wing in the Epirus sector, while the 9th, 10th, 11th, 16th, and 17th attacked on the right wing (western Macedonia). After hard fighting, the Albanian town

of Koritsa, an Italian supply base, fell to the Greeks, who thus captured substantial supplies. Five Italian divisions, reinforced by *Bersaglieri* and Blackshirts, were defeated on November 22. Six days later, the victorious Greek right wing reached Pogradec on the shore of Lake Ohrid and attempted an impressive turn to the west toward the Albanian inland strongpoint of Elbasan. From Elbasan, a road led to Tiranë (Tirana), which was linked by railroad with Durrës.

Marshal Badoglio, who had once advised against the Greek venture and later failed to secure German assistance, was the next victim of Mussolini's wrath. On December 6, he was succeeded as Chief of Staff of the army by Gen. Ugo Cavallero. Some lesser commanders were also changed. Neither these changes nor the Italian attempts to stabilize their defenses could stop the Greek offensive, which, on December 4, spread to the Epirus sector.

The Italians tried to hold a line running from the Adriatic coast to the high ridges between Elbasan and Lake Ohrid. The Italian Ninth Army was deployed in the southern sector and the Eleventh in the northern sector. The Greeks had three immediate goals: Vlora on the left, Berat in the center, and Elbasan on the right. If these objectives were reached, the way would be open to Tiranë and Durrës, and the Italian armies could be driven into the Adriatic Sea. Before the end of the year, the Greeks hoped to establish a front along the Shkumbi River, which crosses Albania from east to west. Greek vanguards succeeded in reaching the Shkumbi only in the north. In spite of their gains and a glorious defense of their country, the Greeks fell short of their objectives.

It was rumored that Metaxas had deliberately delayed Papagos' advance in accordance with a German request. Fascist sympathies were attributed to the Greek dictator, although there was no confirmatory evidence. General Metaxas adhered to his pledge to defend Greece against every aggressor to his last breath.

Weather conditions were severe. Snow, sleet, and floods made every step arduous, and communication lines were extremely precarious. The Greeks suffered from material shortages and physical exhaustion, while the Italians were being constantly reinforced. British support from air and sea could not alleviate the increasing difficulties of the Greeks to any noticeable extent. Under such circumstances, it was miraculous that the Greeks carried on as well as they did. On January 10, Klisura was wrested from the Italians. Three days later, General Soddú was succeeded by General Cavallero, and Mussolini went to Berchtesgaden to see Hitler. The subject of the discussions was not disclosed, but obviously the Germans were not yet prepared to assist the Italians in Greece. From Brindisi and also from Bari, despite some losses suffered by British action, additional reinforcements poured into Albania. Cavallero ordered a general attack immediately after taking command. For ten days, the Italians attempted to penetrate the Greek positions. The Greeks once again displayed superior fighting qualities, and the Italians suffered heavy losses without gaining any ground. The Tuscany division was completely routed, but the Greeks were too exhausted to pursue the beaten enemy. Despite their losses, the Italians still had 20 divisions. The Greek threat to Vlora and Elbasan did not develop, although small Greek territorial gains were reported on February 5. The Greek High Command reported a total of 20,000 Italian prisoners and the capture of 230 guns and 1,500 mortars since October 28. The British had given some help by air raids and naval attacks, but misfortune befell the RAF on February 28, when its base at Larisa was destroyed by an earthquake.

On March 2, Mussolini landed at Tiranë. With German intervention in the Balkans imminent, the duce wanted *his* troops to defeat Greece. Seven Italian divisions, some of them reformed (the 3d, 5th, 24th, 38th, 47th, 51st, and 59th), battered a 20-mile sector in an effort to recapture Klisura, to pierce the Greek lines, and to drive on as far as Metsovon, the initial objective of the campaign. The main attack opened on March 9. On March 19, the Italians, having suffered 40,000 more casualties and gained no ground, were once more on the defensive.

This battle really ended the Italian phase of the Greek campaign. New deployments became necessary. The Germans were on the move, and their will once more dictated the rules of action. Not only did the Greeks see the fruits of victory fade away, but the glorious British North African campaign was soon to be replaced by a venture doomed to failure.

Italian Rout in North Africa.—Late in 1940, according to a statement by Mussolini, Marshal Graziani could muster 290,000 men, 1,900 cannon, 770 tanks, 15,000 machine guns, and 10,000 trucks. In accordance with Graziani's principle of keeping troops close to their ports of supply and dividing them accordingly, the first line was manned by only 100,000 men. He had placed two divisions at Sidi Barrani, where they adjoined one Celere division to the south. These were followed by two divisions, with another at hand to support an attack. The first line troops held springboard positions behind a protecting line of improvised stone-walled fortified camps. Intervals between the camps were said to be heavily mined and otherwise safeguarded by obstacles of all kinds. Behind the first line, many desert forts were strongly manned. Each of the supply ports of Bardia, Tobruk, Derna, and Bengasi was garrisoned by forces numbering a division or more. The echelon of Italian troops extended hundreds of miles to the rear and scores of miles inland.

Despite the German invasion threat, the British government, well aware of the vital importance of a successful defense of Egypt, diverted some of its scanty armored equipment to the Middle East. The number of British tanks was by no means equal to that of the Italians and, despite the influx of reinforcements, the British remained far outnumbered in men. The holding British force in the Mersa Matruh Line and in its forward areas consisted of one armored division, an Indian division (including British units), and one division of New Zealanders. Two Australian divisions and some units of fighting Poles formed the reserve, the greater part of which was deployed as far to the rear as the Nile Delta.

With such a small force, it seemed that only a strictly defensive strategy was possible. By mid-November, however, British patrols probing the Italian springboard line reported that a gap relatively far inland had been opened in the minefields and tank traps. Italian positions formed an arc running from the northeast on the Mediterranean shore to the southwest in the

desert and, therefore, forces driving through the gap straight north would reach the coast well behind the eastern Italian lines. These reports, soon confirmed, changed the outlook of the campaign. If a strong raiding force could actually penetrate the gap and take the Italians in the rear, it might be possible to try a coordinated frontal attack to chop up the scattered Italian forces and to hinder Graziani's army to such an extent that he would not be able to make a major attack for a long time.

If the raid should fail, which was still possible, the raiding forces would be in an awkward spot, and it might be hard to extricate them from a trap. As the British could not afford heavy losses, these raiding forces had to be limited in strength. Not even the most optimistic members of the British staff thought of an advance beyond the Libyan border.

Gen. Sir Archibald Wavell ordered preparations to be made with utmost care, so that Italian air reconnaissance would not detect the troop movements. The Italian Air Force was inefficient once again. Besides, Graziani believed that a British attack was impossible.

The raid was to start on December 9. Two days before, the RAF and the Royal Navy swung into action. Air Commodore Raymond Collishaw's squadrons battered Italian airfields and strafed Italian ground forces, meeting only light opposition. The navy shelled Mechili and then turned its guns on Sidi Barrani. The warships of Cunningham's fleet were aided by two monitors (small, slow, but heavily armored ships) mounting 15 inch guns, floating batteries rather than warships. The British shells wrought devastation, but no Italian vessel challenged the fleet, and the Italian Air Force did not score a single hit.

On December 9, while the Italian High Command was still wondering about British intentions, the British Fourth Armored Division (Maj. Gen. Sir Michael O'Moore Creagh) and the Indian Division (Maj. Gen. Sir Noel Beresford-Peirse) poured through the Sofafi gap. No anchor line was encountered. Whirling north, the two divisions attacked and overwhelmed Italian camps one by one. The British had at least as many men on the spot as the Italians in every individual action, and British fighting qualities and tactics were far superior. The first British communiqué announced the capture of 900 prisoners in an attack, the scope of which was not disclosed. On December 12, the raiding forces reached the coast and their right wing invested the southern approaches to Sidi Barrani. The success of the turning maneuver far exceeded expectations.

General Wavell thereupon ordered the attack from Mersa Matruh to the west. Mechili, heavily pounded by the fleet, had been evacuated when imperial troops reached there. Sidi Barrani, under attack from two sides, was taken at nightfall of December 12. The total of prisoners rose to 20,000, including General Gallina.

General Creagh's armored division had already advanced 10 miles to the west when Sidi Barrani fell. One Italian division surrendered after a feeble tank charge failed to stop the British armor. British infiltration tactics disorganized Italian communications. The *Via della Vittoria,* severed on the second day of the offensive, witnessed a complete Italian rout. Huge quantities of stores and equipment were abandoned by fleeing soldiers. The RAF, constantly overhead, saw to it that the Italians had no breathing spell.

After a week of one-sided fighting, the British held Sollum, Halfaya Pass, Fort Capuzzo, Sidi Omar, and Musaid. There were 30,000 Italians reported captured, with British losses totaling 72 killed and 732 wounded. What remained of the six defeated Italian divisions fled to Bardia. Graziani's dispersal of Italian forces proved disastrous.

General Wavell pressed on. The British husbanded their forces carefully and did not use more than two divisions in simultaneous action. The New Zealanders were temporarily replaced by Australians. Bardia was encircled on Jan. 1, 1941, and captured five days later. Before Bardia surrendered, British vanguards were already racing toward Tobruk to block the retreat of its garrison of 20,000. Tobruk was by far the strongest Italian fortress in the path of the attackers. Two rings of forts protected city and harbor. The outer ring was 30 miles in perimeter, the inner was 19. The old, heavily damaged Italian cruiser *San Giorgio* was unable to defend the harbor. The Italian Air Force in Tobruk was wiped out by the RAF. Tobruk fell on January 22, after the British main forces had moved up from Bardia. On January 24, Derna, 100 miles to the west by road, was in British hands. The speed of the British advance exceeded German accomplishments in previous blitz campaigns. The utmost speed was necessary, for German preparations were progressing in the Balkans, and the Afrika Korps groupment, far to the west, was developing methodically.

The next British objectives were Cirene, Barce, and Bengasi, which fell the first week of February, with most of the members of the Italian garrisons captured. On February 9, the British reached El Agheila after a total advance of 500 miles. British, Australian, New Zealand, and Indian troops shared the honor of the victory that brought more than 150,000 prisoners and tremendous booty at a cost of 1,744 casualties. Total losses suffered by Graziani's forces were estimated at 200,000 men.

General Wavell's men needed rest, and their mechanized equipment needed overhauling. Supplies had to be moved up, and lines of communication had to be secured before the advance could be resumed. German dive bombers were beginning to appear over the British lines. Convoys badly needed for the continuation of the offensive were increasingly battered by the Luftwaffe. The 9,000 ton cruiser *Southampton* was lost, and the aircraft carrier *Illustrious* was put out of action for a long time. Malta was bombed constantly. It was obviously impossible for the British to reach Tripoli before the Germans opened their expected drive in the Balkans.

Free French forces from Equatorial Africa, assisting the British offensive, reached Italian territory early in March 1941, after a long march through arid regions and captured Kufra Oasis. The British took Giarabub, outflanked from the north on March 25. These two victories were the last in that phase of the campaign.

A Greek call for help was heeded by the British government. Only screening forces were left around El Agheila, while most of the troops were withdrawn to aid the Greeks. The British hoped that the Africa Korps together with the reformed remnants of the Italian Army, would

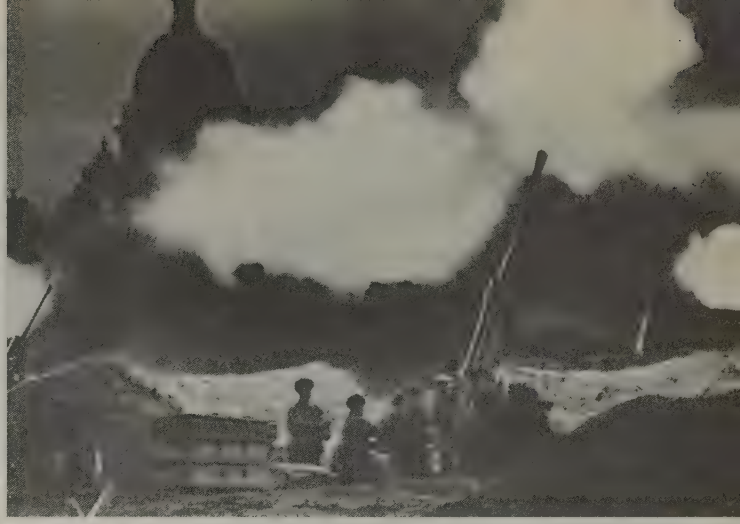
Above: World War II began with the invasion of Poland. In the picture, a German motorized unit moves through a badly battered Polish town.

WORLD WAR II

Below: In the Battle of Britain, the Germans tried to defeat the English by crushing air raids on their cities and industrial plants.

Below right: In the last two years of the war, Allied air raids leveled to the ground large parts of many German cities. Saarbrücken, shown below, was almost entirely destroyed.

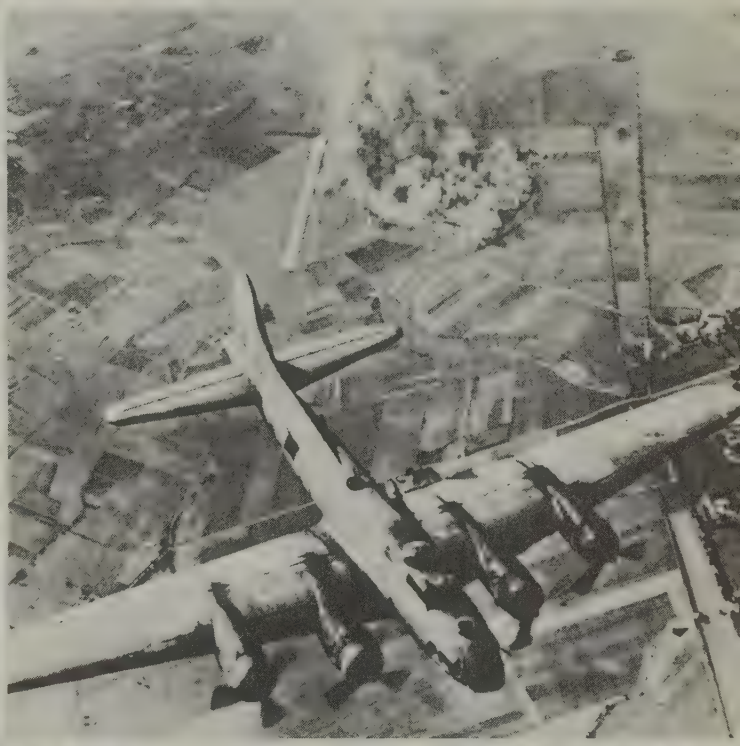
(Above) Acme Photo; (below) British Information Services; (below right) United Press Photo



Above: The long, unsuccessful siege of Leningrad was one of the major events of the German invasion of Russia.

Below: By the end of the war, United States Air Force precision bombing raids had destroyed much of German industry.

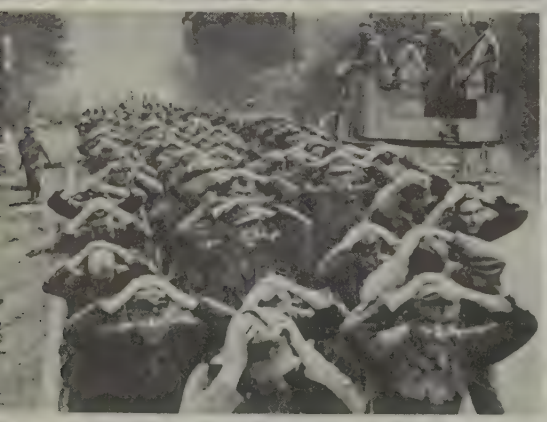
(Above) Sovfoto; (below) United Press Photo



Left: Over 5,000 merchant vessels were built in the United States to transport men and materials to the various theaters of war.

Above: Allied soldiers in the invasion of Normandy were supplied by means of artificial harbors, one of which is shown in the picture.

Below: American troops march down the Champs-Elysées in Paris after France was liberated from German occupation.



Left: In the last months of the war in 1945, German resistance weakened and many German soldiers were taken prisoners of war.

Below: The war in Europe ended on May 7, 1945, when the Germans signed surrender terms at Reims.

(Top left) U.S. Maritime Commission Photo; (top right) British Combine Photos, Ltd.; (left) United Press Photo; (above and below) Acme Photos

not be able to attack before late May 1941. Until then, the thin holding line was to be reinforced to an extent which would permit a successful defense and later the renewal of offensive action. These expectations did not materialize

NEW MOVES BY U.S.

Early in the war it became obvious that Germany could be defeated only if its enemies were able to secure aid to enable them to offset the Reich's superiority in modern equipment. Britain's original disadvantage, due to Germany's head start in armaments, was compounded by the exploitation of industries in German-occupied countries and the drafting of their manpower by the conquerors. Besides, the Reich's industry and that of its satellites suffered comparatively little from air raids, as a considerable part of it was located beyond bombing range, whereas Britain's plants were exposed to constant hammering from the air. Under such conditions, only large supplies of the tools of war from the United States could prevent Britain from falling hopelessly behind in the armament race. If Britain's resistance had collapsed, the United States in turn would have been directly threatened by German aggression. Not even the most liberal interpretation of the cash and carry provisions of the Neutrality Act enabled the British to obtain urgently needed weapons and goods from America. By the end of 1940, British funds in United States dollars were near exhaustion, and German propaganda claimed that American deliveries to the empire would soon terminate.

Lend-Lease.—In this emergency, the president of the United States proposed a measure to help Britain. It provided for the lending or leasing of military equipment to certain countries, the defense of which was considered by the president to be vital to the United States. By the end of 1940, as Gallup polls revealed, United States public opinion favored aid to Britain even at the risk of war. Although such help during the climax of the battle for France had had the support of only approximately 35 per cent of the population of the United States, this percentage had almost doubled by the end of 1940.

The original lend-lease bill was passed in the House of Representatives on Feb. 8, 1941, by a vote of 260 to 165. It was amended and passed by the Senate on March 8. The amended bill went to the House again on March 11 and was adopted and signed by the president on the same day. The carry provisions of the Neutrality Act were not altered at first by the lend-lease bill. American shipping was still barred from war zones.

The United States Chiefs of Staff of the Army and Navy were to be consulted with respect to the transfer of materials, and reports to Congress were to be made every 90 days. On Oct. 28, 1941, by executive order a Lend-Lease Administration was established to handle the growing task. The initial limit on the amount of deliveries under the new bill was $1,300,000,000, but in March 27, 1941, the president signed an act of Congress increasing the appropriation to $7,000,000,000. Later authorizations allowed the total of lend-lease supplies actually delivered to reach an amount of $11,000,000,000 by Jan. 15, 1942, with the flow of supplies steadily mounting. Britain and the Dominions were the principal beneficiaries of lend-lease, but goods were also sent to Russia, China, the Dutch East Indies, and Latin America.

Under the terms of lend-lease, articles essential for defense were shipped, such as weapons, ammunition, aircraft, ships and boats, machinery for the manufacture, processing, and repair or service of any such article, and component parts of equipment for agriculture and industry. This list was later substantially enlarged. Ship repairs and food supplies became important lend-lease items. Practically everything except luxury goods was rated as essential for the defense of a country.

In the fall of 1941, the British were already using United States lend-lease tanks (13- and 28-ton) in North Africa.

U.S. Protection of Greenland.—Greenland, under Danish rule, was a coveted objective of the German war planners as a weather observation post and an important German foothold in the Western Hemisphere. Since the fall of Denmark, German planes had been seen in the vicinity of Greenland, and German expeditions were said to have reached Greenland. Later evidence showed that a small, German-armed group was already established there before the United States took over.

On April 10, 1941, President Roosevelt announced an agreement with the Danish envoy in Washington whereby the United States, acting under the terms of the Havana Pan-American accord, undertook to protect Greenland from aggression and to build military and naval bases there, available to all nations of the Western Hemisphere. United States protection of Greenland was violently denounced by the angered Germans, who questioned the Danish envoy's authority to sign the agreement. Actually it served the interests of occupied Denmark no less than the interests of the nations of the Western Hemisphere.

THE BALKANS AND GREECE

Foreign Commissar Molotov's visit to Berlin early in 1941 created the impression that the Soviet Union was determined to continue to cooperate with Germany. Five new Russo-German agreements were signed on January 10. One of them provided for the delivery of $400,000,000 worth of important raw materials by Russia in exchange for German-manufactured industrial equipment. Almost simultaneously, British intelligence agents reported that huge German forces, including several panzer divisions, were lined up along the lower Danube ready to cross the river, and that German technicians, disguised as tourists, had established themselves on Bulgarian airfields and in the important Black Sea port of Varna with the obvious consent of the Bulgarian government.

Although relations between Britain and Russia were far from friendly, the British government, through appropriate channels, transmitted this information to the Kremlin. The building up of great German strength in the Balkans was equally dangerous to the Soviet Union and to the British Empire. It threatened the British lifeline to the Middle and Far East, and it exposed southern European Russia and the Black Sea area to German aggression. The similarity of British and Russian interests in the Balkans was far greater than it had been in Poland in 1939. The Moscow government, however, was unresponsive. Russia considered the British as

rivals for the favor of southeastern European countries and as protectors of the Turks who controlled the coveted Dardanelles. The Soviet Union was averse to German infiltration in the Balkans, but its government wanted to act independently of Great Britain.

Britain alone could not forge an effective anti-German front from the Danube to Asia Minor. Even pro-British governments were frightened by German strength and were convinced that for the time being England was unable to prevent their countries from being overrun by the Wehrmacht. The Soviet government by itself was equally unable to protect the Balkans. Its military strength was still untested, its political trends were viewed with distrust, and Turkey, despite a nonaggression pact with Russia, was determined to keep the Red Army as far from its territory as possible.

Politics in the Balkans.—On Jan. 13, 1941, Wavell visited Metaxas in Athens. The head of the Greek government was in poor health. Wavell informed Metaxas that no less than 43 German divisions were deployed from the Yugoslav border through Hungary and Rumania. Metaxas had been reassured by Prince Ehrbach, on Dec. 20, 1940, that the German government had no hostile intentions toward Greece, but the German minister's insistence that the British should not be allowed to help Greece with any real strength was alarming. In conferences lasting four days, it was agreed that the British should continue their African drive and wait for a call from Greece before dispatching forces to that country.

On January 31, General Metaxas died, and King George II of Greece named Alexandros Korizis, governor of the National Bank, as his successor. Korizis lacked his predecessor's energy and military education, but he confirmed Metaxas' political policy on Feb. 8, 1941, by declaring: "We remain steadfast in our firm resolve to resist a possible German attack."

The Bulgarian people were traditionally pro-Russian, in the national rather than the communist sense, and had a strong dislike for Germany, based upon bitter experience, since World War I. In 1940 and 1941, the Reich resorted to bribing the Bulgarian government as it had done in 1914 and 1915. On February 9, Churchill solemnly warned Bulgaria of the consequences of aiding German aggression.

The Moscow government summoned its Balkan ministers to a conference. On February 10, a messenger from the USSR foreign commissariat was sent to Sofia in an unsuccessful attempt to promote a military alliance between Russia and Bulgaria.

In the meantime, British military experts, Gen. Sir James Marshall-Cornwall and Air Vice Marshal Thomas Elmhirst, conferred with the Turkish General Staff at Ankara on questions of strategy and armament. The soldierly tradition of the Turks was far more impressive than their equipment. Much of their matériel came from Germany, and the Germans had seen to it that it was not adequate. Britain had little to offer her reluctant ally, and it was not expected that Turkey would join Britain actively.

Germany was well aware of Turkish weakness. The Wehrmacht's High Command, however, preferred to bypass Turkey for the time being instead of wasting time on its conquest. Once the Middle East was in German hands, Turkey was bound to come into the Reich's orbit. As the Turks had a pact with Greece obligating them to come to that country's assistance if Greece were attacked by Bulgaria, and as the prospect of Bulgarian intervention as an Axis satellite became more imminent, Berlin sponsored a Turko-Bulgarian nonaggression pact which in effect voided the treaty with Greece.

British Foreign Secretary Anthony Eden went to Cairo, accompanied by Chief of the Imperial General Staff Sir John Dill, in an effort to offset German penetration of the Balkans. He was particularly concerned about Yugoslavia. Serbia had suffered a German occupation during World War I, and its population was strongly anti-German, while the Slovenian and Croatian parts of the country were expected at least not to be anti-British. Following the assassination of King Alexander, Yugoslav governments had increasingly followed a pro-German course, disregarding popular feelings and strong sentiments in the army. British hints that Eden would welcome an invitation to Belgrade met with no response. Instead, on February 13, Yugoslav Prime Minister Cvetkovic and Foreign Minister Aleksander Cincar-Markovic went to Berchtesgaden to confer with Hitler. Both knew that their unpopular regime could be maintained only by German bayonets. At the German führer's request, a Yugoslav-Hungarian "pact of eternal friendship and permanent peace" was concluded on February 27, bringing Yugoslavia into the camp of German satellites. Closer ties with the Axis were to follow.

The day before the signing of the pact, Eden and Dill visited Ankara, Turkey, where they learned that only a strict neutrality and an assurance that Turkey would not give the Germans transit rights could be expected from the Turkish government. The British delegates had broader ambitions. They felt that Russia would realize at last that Germany could be held at bay only in cooperation with Britain. The possibility of an invitation to Moscow was hinted, but Moscow remained noncommittal.

On March 1, twenty German divisions crossed the Danube over newly built bridges into Bulgaria, to line up along its southern and western borders. On March 2, Bulgaria signed the Tripartite Pact.

On March 4, Eden, Dill, and Wavell conferred with the government in Athens. Greece had only two divisions available to face the threat from Bulgaria. British assistance was now urgently needed and called for.

Yugoslavia's attitude was not definitely established, although its government was committed to full cooperation with Germany. There was still a possibility that the government might be overthrown. Cvetkovic and Cincar-Markovic understood that it was a case of now or never. On March 13, they revisited Berchtesgaden. On March 16, the Soviet government, still going its own way, advised Yugoslavia not to sign the Tripartite Pact. Cvetkovic and Cincar-Markovic, returning to Belgrade on March 20, informed the Council of Ministers that they had promised to sign the pact and to allow the passage of German war matériel and medical supplies through Yugoslavia. The passage of troops was not mentioned, although it is safe to assume that it was also agreed upon. Four ministers resigned in protest, but Prince Regent Paul backed the pro-German elements. On March 24, while Eden was meeting with the Turkish Foreign Minister

Şükrü Saracoglu at Cypress, the Yugoslav prime minister and foreign minister left for Vienna to sign the pact.

The ink was hardly dry on the agreement when, in the early morning hours of March 27, 40 officers of the Yugoslav Air Force inaugurated a coup d'état. Prince Regent Paul was deposed and fled; King Peter II was declared to be of age; Cincar-Markovic and Cvetkovic were placed under arrest; and Yugoslavia's signature of the Tripartite Pact was voided. The chief of the air force, Gen. Dusan Simović, formed a government which included representatives of all political parties. Churchill praised the Yugoslav people for having found their soul.

On March 30, Dill visited Simović, who was anxious to gain time to carry out Yugoslavia's mobilization and to man the country's borders before the expected German attack. General Simović hoped that this attack would not start before April 20. Moscow, still acting independently, urged the conclusion of a five-year Russo-Yugoslav pact of friendship and nonaggression. The pact was signed on April 5, 1941. On May 15, 1941, after Yugoslavia was overrun, and its government had been established on British territory, the Soviet government denounced the pact and withdrew its recognition from the Yugoslav government in exile. On April 5, however, there was still hope that Yugoslavia might resist the Germans effectively and that British, Greek, and Yugoslav forces could create a formidable obstacle to German aggression in the Balkans, provided the German drive did not start too soon.

Greek and British Preparations Against Germany.—When Greece called for aid, Britain hurriedly shipped all the forces that could be mustered by baring the North African front to a dangerous degree. The commander in chief of the British Expeditionary Force, General Sir Henry Maitland Wilson, had 24,000 Britishers, 17,125 Australians, and 16,532 New Zealanders under his command, well-equipped with 60- and 25-pound guns, but he had only one armored brigade. Futhermore, Britain could spare only a hundred fighters and a few bombers to reinforce the small and already depleted RAF in Greece. Approximately 35,000 of the soldiers belonged to ground combat units. Lack of matériel and shipping space, as well as inadequate Greek port facilities, accounted for the weakness in armor. The previous Greek campaign had given a misleading picture of mechanized warfare in a rugged country because Italian incompetence had made it appear ineffectual. German efficiency soon revealed its paramount importance.

By scraping the very bottom of the manpower barrel, and by using not only every weapon in their own arsenals, regardless of condition, but also reconditioned Italian booty, the Greeks increased their army to twenty and one half divisions. Of these divisions, 14 remained in the Epirus sector, facing 28 Italian divisions. The 19th Greece, Thrace, and eastern Macedonia, including Its armor consisted chiefly of salvaged Italian tanks. Its automobiles were obsolete trucks, taxicabs from Athens, and similar inadequate vehicles.

Plans drafted early in March by Greek General Papagos and British Generals Wavell and Dill envisaged a drastic shortening of the Greek front in case of a German attack. Yugoslavia was then considered a German operational base, and its border was to be closely guarded against a breakthrough that would have split the defenders of eastern and western Greece. Eastern Greece, Thrace, and eastern Macedonia, including Salonika (Thessalonike), were to be evacuated by the main forces. Only small garrisons were to be left behind to delay a German advance from Bulgaria. The Metaxas Line could not be held with a hostile army in Yugoslavia on its left flank. But small garrisons, deliberately sacrificed to give the main forces a breathing spell, were to be established in forts on the Metaxas Line. In the rear line, the BEF was to hold the easternmost sector along the Vistritsa (Haliakmon) River, with three Greek divisions remaining in positions to the northwest. Three and one half other Greek divisions were to support the British and to man the sacrifice positions. The victorious Greek Army of the Epirus right flank was to swing by Pogradec to join the Greek and British Armies. A solid front would thus have been established which, although giving up valuable Greek and Greek-occupied Albanian territory, would offer a consistent line of opposition to the attackers.

The plan was based on the idea of total defense. Total defense, as repeatedly shown in previous campaigns, was at best a temporary expedient and offered no solution of military problems. But the odds were too strongly against the defenders to permit any other strategic concept. No more than the equivalent of 10 divisions could be mustered to meet the onslaught of 43 German divisions, supported by Hungarians and Bulgarians. The British Armored Brigade and the pathetic Greek 19th Division were no match for 6 German panzer divisions, just as the 100 RAF fighters could hardly contest mastery of the skies with 1,200 Luftwaffe aircraft poised to strike.

Role of Yugoslavia.—The Yugoslav coup seemed to change the situation. No longer was Yugoslavia a potential German base, but its army was to support Greece in the event of a German attack. Although no common strategy was agreed upon, due to Yugoslav reluctance and lack of preparations, the Greeks and the British presumed that their center along the Yugoslav border was safe. Even if forced to abandon much territory in the north and west of the country, the Yugoslav Army should be able to hold Yugoslav Macedonia from the point where two vital invasion routes led into Greece: one through the valley of the Vardar River, the other through the Bitolj (Monastir) Gap. It was further expected that an offensive drive from southwestern Yugoslavia would penetrate the rear of the Italian armies in Albania. The surrender of the Italian forces there (a logical consequence of such a drive) should free the Greek Epirus Army to give substantial help to the rest of the forces fighting Germany and its satellites.

In reality, the theoretical assistance of Yugoslavia to the Allies tended to hasten the German victory in Greece. The defensive plans drafted in Athens were not fully carried out. Confusion spread when the Yugoslav Army gave way and the disaster which was to have been avoided at all costs, the baring of the Bidolj Gap and the Vardar River valley, materialized almost immediately.

The Yugoslav Army consisted of 30 infantry divisions, 10 reinforced brigades of almost division strength, and 3 cavalry divisions. With compulsory military service, the number of able-bodied men subject to draft ran to more than a

million. The Serbian soldiers rightfully enjoyed a reputation for being second to none in bravery and stamina. The next strongest national group, the Croats, were remembered as the flower of the former Austro-Hungarian Army, but their loyalty was doubted because of fifth column activities and controversies with the Serbs. The Slovenes, the third largest faction in Yugoslavia, were good soldiers, too, and not anti-Serb. If the Yugoslav Army had been mobilized in time and reasonably deployed, it might have been a formidable fighting force, despite its appalling lack of modern equipment. Pro-German governments established after 1934 had sorely neglected the country's armaments, and the Cvetkovic and Cincar-Markovic government completed the sabotage of Yugoslavia's defenses by an order of partial mobilization which doomed the army to total impotence. According to that order, the bulk of the Yugoslav Army faced the northern border, while the main German armies were massed along the southeastern border, thus pointing toward the right flank and rear of the Yugoslav forces. The German deployment was undoubtedly well known to the regime in control.

General Dušan Simović had to reverse these treacherous dispositions and to switch all his available forces to the south and east, a tremendous task because of the extremely primitive condition of Yugoslav transportation. It would have been easier to start mobilization from the beginning. Even had the Germans waited until April 20 before opening their drive, as the general hoped, the first days would have been extremely critical. Marked inferiority in equipment gave the Yugoslavs little hope of holding out in open territory in the north of the country, which was ideally suited for mechanized warfare. A retreat to the mountainous regions could hardly be avoided. The High Command of the Wehrmacht did not plan to give Yugoslavia any chance at all. Its preparations were completed before April 20.

The British War Office, in a report on the ill-fated Greek campaign, made the following statement about the situation of the Yugoslav Army after the German attack:

"The Yugoslav Army was not fully mobilized when the Germans attacked. Its forces were not disposed in the parts of the country best suited for defense. It was not mechanized. It was not mobile by modern standards. It had no effective antiaircraft defenses, no antitank weapons, and no tanks. The greater part of the Yugoslav Army was in the north, and the new Simović government had not had time to do more than dispatch large reinforcements to the south. Thousands of men were marching, carrying packs and rifles, with their baggage in ox wagons which regulated the pace of the column. The German Air Force caught them like that. The dive bombers swooped out of the low clouds and the long winding columns—150 miles jammed with marching men and beasts crawling at a foot pace—were bombed and strafed and blasted. The German aircraft flew along, emptying their machine guns when they had used up their bombs, on what must have seemed an almost stationary target. This was the end of the Yugoslav reinforcements which should have held the southern passes from Bulgaria."

German Preparations in the Balkans.— More than half of the total of German power assembled for the Balkan campaign (23 infantry and 3 panzer divisions, with Bulgarian forces echeloned to the rear), were massed in Bulgaria as the Twelfth Army under the command of Field Marshal General von List. List's army was divided into three groups. The left wing faced southward along the southwestern Bulgarian border toward the Aegean Sea. The center faced Skoplje in Yugoslav Macedonia, gateway to the vital Bidolj Gap. The right wing, deployed east of Sofia, was poised to strike toward Pirot and Niš, then northward through the Morava Valley in the direction of Belgrade, Yugoslavia's capital.

North of the Danube, on Rumanian territory in the vicinity of the city of Timisoara, the German Ninth Army Corps also faced southward in the direction of Belgrade. On its right, between the Tisza (Theiss) and Danube rivers, a Hungarian army corps was ready to enter northern Yugoslavia. In southwestern Hungary, on a line along the left bank of the Drava River, the German Second Army was deployed to capture the Croatian provincial capital of Zagreb, where a puppet government was to be set up in an attempt to separate Croatia from Yugoslavia. Thereafter, this army was to fan out toward Bosnia Province to the south and Belgrade to the east, to join the Twelfth Army. Small German detachments on Austrian soil prepared to invade Slovenia. East of Trieste, with the Adriatic harbor of Sušak as its primary objective, the Italian Second Army was ordered to drive along the system of coastal roads into Dalmatia Province.

The Germans considered the elimination of Yugoslavia to be more urgent than the conquest of Greece. This was bound to break the backbone of a possible Balkan defense. The attack on Greece, however, concentrating on the easternmost wing, started simultaneously with the drive against Yugoslavia. The first action fought by General List's army was a "battle for the passes." The Germans did not intend to engage in costly drives against mountain ridges, where armor was of little use because of the total absence of roads and where defenders found better protection against air attack than in territory easier to observe from the air. The Wehrmacht planned to capture the narrow passes and pour into the valleys behind, fanning out and cutting off the defenders on the ridges. The assault tactic was that of a battering ram, a massive array of the most formidable armor, with swift patrols on motorcycles spearheading the drive. German armor was not only heavier and much more numerous than the British, but it was also considerably faster. This allowed List to switch his divisions from one place to another in a short time, and to have the greatest strength available wherever it was needed. Four motorized divisions carried the German attack with the dreaded lightning speed which characterized their operations. The slowness of the retreating columns, falling back from bypassed ridges, made them an easy target for Luftwaffe dive bombers.

Conquest of Yugoslavia. — In the early dawn of April 6, 1941, without a declaration of war or previous warning, waves of German bombers carried out a shattering raid on Belgrade, leaving a substantial part of the city in ruins and killing about 10,000 persons. Belgrade had neither antiaircraft defenses nor adequate shelters.

In the morning hours of April 6, preceded by dive bombers, a German column broke through

and raced toward vital Skoplje in Yugoslavia, which was reached in the afternoon of April 7. Skoplje was the key to the Vardar River valley. Another column farther to the south penetrated into Veles and then joined the northern group. Three days later they reached the Bidolj Gap, threatening the flank of the Greek forces between Phlorina and Katerina.

The Yugoslav Army never actually attained fighting strength, although some reports claimed that, after the initial shock, the Yugoslavs were furiously opposing the invaders. Broken up into scattered units, armed with nothing but what they could carry, even the most heroic men were unable to cope with German planes and tanks. The Balkan campaign was actually decided within less than one week. The Yugoslavs made no attempt to drive into Albania.

Gen. Paul Kleist's group battered its way into the Morava Valley. Niš fell on April 9, and the Germans drove on to Belgrade from the south. On April 13, they met the Ninth Army Corps coming from the opposite direction, and entered the smoldering city unopposed. The Second Army captured Zagreb on April 11. From Zagreb, one column marched along the Sava River toward Belgrade. Another, entering Bosnia, aimed for the provincial capital of Sarajevo, where it was met by a column of Kleist's group marching from Kragujevac (between Niš and Belgrade) toward the Bosnian capital. The Germans met no resistance in Slovenia. Unarmed recruits, gathered in barrack courtyards, were led away as prisoners of war. Even the Italian Second Army swept forward and was far in the south of Dalmatia Province on April 17, when the last Yugoslav forces surrendered.

The conquest of Yugoslavia was a matter of marching rather than fighting. The Yugoslav Army, being in the process of mobilizing and regrouping, was not a fighting force. Former pro-German elements, frightened into silence during the brief days of patriotic Yugoslavian enthusiasm following the coup, raised their heads again when the Germans marched into the country. They defied the government, which was compelled to flee from Belgrade to Sarajevo, then to Athens, to Cairo, and finally to London. Sabotage hastened the breakdown. The appointed representatives of the Yugoslav government did not negotiate a surrender, but generals, lacking official powers, offered capitulation of their forces on April 15, 1941. It was accepted by the Germans on April 17. The capitulation did not end the state of war, however, and did not bind the Yugoslav forces which wanted to carry on the struggle in loyalty to the government of King Peter.

The Germans, collecting every Yugoslav soldier or draftee they could find, reported a total of 6,000 officers and 337,000 enlisted men as prisoners. As the German armies had made contact with the Italian forces in Albania, a force of more than 70 divisions stood ready to inflict the death blow upon Greece.

Conquest of Greece.—Germany handed a declaration of war to the Greek government at 5:30 A.M. on April 6, 1941. At that time, seven German divisions opened the assault from southwestern Bulgaria with two columns: one along the Mesta River toward the Aegean Sea; the other on a detour toward the Vardar Valley and Salonika.

The Greek High Command hastened to divide its forces into three groups, the largest of which was the Epirus Army. The second group had been almost continuously on the march since the Yugoslav coup, without a definite destination. The third was with the British Expeditionary Force.

The Vardar Valley's defense was not yet organized when a German motorized division reached Dojran (Doiran) on April 7, 1941. Wheeling south from that city, it drove through the flat pass east of the Vardar River and pushed southward toward Salonika. The defense of Fort Rupel and smaller fortifications of the former Metaxas Line was one of the unsung epics of World War II. The garrisons were decimated by superior armaments, but they stood firm and inflicted as many casualties upon the Germans as they could.

The BEF and their Greek supporters, abandoning the Vardar Valley, had to fall back to high ground west of that river. An attempt to delay the advance of German armor at Salonika, attempted by the Greek 19th Division, was swept aside. 1928 trucks were no match for 1941 panzers.

A temporary stabilization allowed the defenders to form a line running from the mouth of the Vistritsa River to below Mount Olympus, to Larisa, and beyond Edessa to the Yugoslav frontier. Between the border and the Epirus Army was an open breach. The Bitolj Gap was defended by 2,000 frontier guards armed with rifles. Two German panzer divisions and the Adolf Hitler Elite Guard Division attacked the riflemen. The hope that overcast weather would permit troop movements to be carried out without heavy Luftwaffe interference did not materialize. Reinforcements to help the frontier guards were delayed. There were not many reinforcements available, and disembarkations had come almost to a standstill because the only port able to handle heavy equipment, Piraeus, was under constant Luftwaffe attack.

On April 9, the Germans reached the eastern shore of Ohrid Lake, with the unsuccessful Italian armies established on the western shore. On April 10, a raid carried out by British light mechanized units, mostly armed with machine guns, drove 30 miles to the north from Phlorina. The Germans were taken by surprise and suffered casualties, but they soon recovered and drove the raiders back toward Phlorina, which was now the crucial hinge of defense. Greek cavalry, with sabers and carbines, charged the Adolf Hitler Division in a gallant attempt to give the other defenders time to rally and recover. Heroism was of no avail against armor, and Phlorina fell.

Another defensive position was hurriedly improvised. Its right wing was still anchored at the southernmost curve of the Vistritsa River. The British Armored Brigade, after a short retreat, held on at Grevenà. The Greek 12th and 20th Divisions stood on rising ground west of Kozànē. The Anzacs held Servia Pass on the Kozànē plateau. The regroupment was completed on April 14. The German assault followed immediately. The Anzacs were attacked by one prong of a Wehrmacht pincers, while another German prong, driving from Salonika along the coast and constantly reinforced from Bulgaria, pushed on against the New Zealanders on the Haliakmon and at Servia. The Greek 12th and 20th came under attack by superior forces, and the British

Armored Brigade, already badly mauled, had to come to their assistance to prevent total annihilation. The new position proved as untenable as the previous ones. The Wehrmacht again followed the pattern of the battle for the passes by a drive toward the plain.

The Greek Epirus Army was still intact. Its 14 divisions had not seen much action since the German declaration of war. It was the only effective force left available for the defense of Greece and did not move until April 14, when the Germans, moving toward Koritza, were already penetrating its rear. The commander of the Epirus Army, Gen. George Tsolakoglou, who had been given almost unlimited powers by his commander in chief, Gen. Alexander Papagos, made no effort to maintain contact with other groups while this was still feasible.

King George II of Greece knew that Greek capitulation threatened to trap the BEF, and he really wanted to fight on to the last. But the solid national unity that had existed in Greece during the Italian campaign no longer survived in the days of extreme emergency. German propaganda had had its effect, and there were Greeks who really believed that an honorable peace, permitting the country's survival, could be negotiated with the Reich. Others had personal interests in dealing with Germany. They were a small minority, but they undermined Greek resistance.

Prime Minister Korizis was no less determined to fight than the king, but he was exhausted physically and mentally and faced with the problem of surrender. He made it clear that he would not stand for capitulation, but cabinet members were divided. The prime minister died on April 18, the cause of death being undisclosed, although suicide was openly rumored. King George II named as new prime minister, Emmanuel Tsouderos, a man with strong pro-British inclinations.

General Tsolakoglou urged the Greek government to capitulate. Tsouderos appealed to General Papagos to relieve Tsolakoglou and have the Epirus Army fight on, regardless of its strategic position. It was too late. Tsolakoglou was already negotiating surrender with the commander of the German Twelfth Army. The surrender was signed on April 20 before Papagos could interfere. Its strange terms provided that the Germans would recognize a Greek victory over the Italians and prevent the Italians from crossing the Greek border. Despite this provision, which was later violated by the victors, Mussolini saw fit to congratulate the Italian troops: "The victory has lighted up your colors with fresh glory." The Italians suffered more than 125,000 casualties in the Greek campaign.

The BEF and the remnants of six and one half Greek divisions remained to face the invaders. The Greek divisions were almost without armor or air support, and, harassed by the German panzers, they were retreating under a rain of Luftwaffe bombs.

Defeated, but still in reasonably good order, Australian troops marched south from Larisa, joining with other Australians and New Zealanders who had been fighting rear-guard actions down the sea coast from Mount Olympus to Ossa.

There was no longer any doubt that the campaign was lost, and the best hope the British had left was to salvage a part of their forces in an evacuation. Any attempt to save Greece from complete occupation was abandoned. Conditions for an evacuation were worse than Dunkerque the year before. There, the RAF could at least support the ground troops in some strength; the British coast was nearby, and many boats were on hand for the evacuation. In Greece, a friendly shore was much farther away; practically no air cover was available; and shipping space was scarce. A delaying action was fought to permit the embarkation of the main forces. This action took place along a line roughly 30 miles long, centered on the historic Pass of Thermopylae.

On April 23, the Greek king and government left for Crete. It was officially requested that the British forces be withdrawn from the Greek mainland. This request was not a hostile act, but the logical consequence of the collapse of the country's defenses and a gesture of consent to British evacuation, which began on April 24 and was completed by May 1. Equipment was lost, but the number of rescued was higher than expected, roughly 45,000. British fighting casualties were estimated at 5,000 killed and wounded. About 8,000 were captured.

Once again there were no British soldiers on the European continent, and no other fighting force faced the Axis in Europe. Hitler, in a speech delivered on May 4, gave the Wehrmacht's casualties in the Balkans as only 5,428. In reality, the Wehrmacht probably lost more than 20,000 men, most of them in mass attacks against the sacrificed defenders of the Metaxas forts and in the last furious drive to prevent British evacuation.

Balkan Aftermath.—After the surrender of Yugoslav armies, the Germans declared that King Peter's regime and the Yugoslav state had ceased to exist, and the country was split up by the conquerors. German-sponsored leaders of the Croat separatist group *Ustashi* (The Awakening) proclaimed the creation of a new Croat State. Ante Pavelic was to be its temporary head, and Croat soldiers in the Yugoslav Army were urged to revolt. The Ustashi introduced a totalitarian regime based upon brutal terrorism. Vast pogroms decimated the Jewish population. The treatment of Serbs and Croats who opposed the terrorists was just as harsh. Within the first six months of its rule, the Pavelic regime accounted for 300,000 victims. A Croat delegation went to Rome to offer the crown of a revived Croatian monarchy to Aimone, duke of Spoleto, prince of the Royal Italian House of Savoy. The duke accepted the throne but never came to Croatia. The Ustashi ruled Croatia contrary to the will of more than 90 per cent of the population.

Large Yugoslav districts in the west were awarded to Italy. Hungary got back what territory she had lost in 1918, with the exception of Croatia. Bulgarian territory was enlarged, and Germany took Slovenia, claiming the return of that province to the Reich, to which it had never directly belonged. What finally remained was placed under a Serbian puppet administration, headed by Gen. Milan Nedich.

Within Nedich's realm, the Yugoslav Army colonel, Draža Mihajlovic, loyal to King Peter's government, mobilized the *Četniks* to wage a guerrilla war against the invaders. The Četniks were superbly trained men of long and distinguished military service, numbering about 7,000.

The organization was created prior to World War I in an effort to smash raiding parties from neighboring Bulgaria. Many controversial stories were later told about General Mihajlovic's attitude. The Russians favored a more recent Yugoslav guerrilla organization of communist tendencies under Soviet-trained Josip Brož, later known as Marshal Tito.

There was at first a good deal of enthusiasm in Britain and the entire western world for the struggle of the Četniks. After liaison had been established between Mihajlovic and the British, a few supplies were delivered to the Četniks, mostly by air but some by a complicated sea-land route. A number of Allied airmen, forced down over Yugoslav territory, were rescued by the Četniks.

General Nedich recruited a force of 10,000 to fight the Četniks, but he was unsuccessful in his undertaking. During October 1941, the Germans had to keep between three and five first-line divisions in Yugoslavia, in addition to an even larger number of second rate troops, to safeguard their communications. They seized hostages, dispatched Gestapo units to deal with uprisings, and carried out large scale executions (8,100 were reported shot or hanged in 1941). Towns which gave assistance to the guerrillas were obliterated by the Luftwaffe.

In Greece, the German regime was just as harsh as in Yugoslavia, although, previous to the country's downfall, the Germans professed sentimental sympathies with the Greek people. The tragedy of starving and battered Greece, under German domination, aroused the civilized world.

CAMPAIGNS IN THE MIDDLE EAST

With typical thoroughness, the Germans prepared not only to recover their colonial empire lost in World War I, but also to gain control over most of the other important regions of Africa. Selected candidates for employment in a future German colonial administration were taught the most unusual African languages and dialects in special schools. Former German subjects in the lost colonies indulged in fifth column activities.

A special element of the Wehrmacht was trained for African warfare. Although the Italians were officially assigned to the task, the German High Command expected its ally to ask for assistance. Initial preparations for the creation of an Afrika Korps dated back as far as 1938. For reasons of transportation, it was decided that its numbers should be relatively small, but its efficiency and armament, superlative. Only men in prime physical condition were admitted to the Afrika Korps. Those who could not stand the requirements of the training were transferred to other units. The soldiers were put under heavy strain in hothouses, where the temperature was kept at the highest-known African levels. They had to endure privations, especially thirst, and still to continue vigorous physical exertions. Desert conditions were duplicated in sandy regions on the Baltic shore. The Afrika Korps was fully mechanized, its equipment was up-to-date, and its air support exceeded that of other panzer divisions.

The Korps consisted chiefly of the 21st and the 15th Divisions (the 15th being ready later than the 21st). Gen. Erwin Rommel was appointed commander. In World War I, Rommel had not risen above the rank of lieutenant. Later he served with the German police and joined the Nazi Party in its early days. Despite his lack of a higher military education, Rommel had unusual, natural military talents, and his ruthlessness assured him of Hitler's personal favor. Rommel had distinguished himself in the Battle of France. The British were well informed about the Afrika Korps. They could only hope that deployment of the Korps would take a long time. On March 21, 1941, when three British armored cars, patrolling the desert road beyond Agedabia, met three German armored vehicles, it was obvious that time was running short.

The Reconquest of Libya.—The British had left in Cyrenaica only the Australian 9th Division and elements of the 2d Armored Division, recently arrived from England. Most fighting vehicles were back in Egypt for reconditioning and repair. Communication lines were stretched to the limit. The manning of a coherent front line of sufficient length was impossible prior to the arrival of reinforcements moving up from far in the rear in small numbers. The RAF, too, was greatly reduced in strength. When General Rommel struck, the British were still hoping that the German tanks were only carrying out reconnaissance.

The German Afrika Korps was not at full strength, as only the 21st Armored Division was in the line. This division was solidly massed in advanced areas, with its communications guarded by Italians. Italian infantry, with substantial transportation, waited behind Rommel's panzers to join an eastward drive. General Italo Gariboldi, named as Graziani's successor, was in command of the Italian Army.

The Luftwaffe, deployed in considerable strength, operated from bases in Tripoli and Sicily. German planes hit British shipping and provided a constant air umbrella for convoys from Italy to North Africa. They also supported Rommel's drive on the ground, which took El Agheila on March 24. Confusion spread among the British, some of whom still discounted the Afrika Korps' activities as merely scouting operations, while others realized that a major offensive was developing. The Germans reached Bengasi on April 4, with the British falling back in disorder.

Both generals in charge of the British retreat, O'Connor and Neame, were captured when their staff cars were overtaken by German motorcyclists. Rommel, imitating Wavell's successful operation, split his forces at Bengasi. One column moved ahead at top speed along the coastal road; the other, bypassing the mountains, crossed the desert toward Fort Mechili. The garrison of Mechili was taken by surprise, and almost all the personnel were captured. Reinforcements coming up from Egypt blocked the roads, and British troops retreating along the coastal road were in imminent danger of being trapped. The destruction of depots during the retreat prevented the eastern forces from assisting those from the west. Some light British tanks, attempting to get back to their former base near Bengasi, actually reached the spot, only to find their fuel dumps destroyed. The tanks, running dry, had to be abandoned.

Disaster was prevented by a conversion of columns at the fortress of Tobruk, blocking the German coastal advance until the defense along the Egyptian border were manned. On April 15, the Australian 9th Division met the onrushing German 21st Panzer Division at Tobruk. The

German attack was repulsed. Rommel decided to leave only a small holding force there and continue at full speed toward Egypt, regardless of his men's exhaustion. Not even the most vigorous training was equal to the demands of the German general's ruthlessness. The British defenders of the border were faced by attackers on the verge of collapse and insanity for lack of water, as water supplies had fallen behind ammunition columns. Many German prisoners were taken, and the 21st Panzer Division came to a halt. Rommel turned back to assault Tobruk again, leaving only a screening detachment on the Egyptian border.

On May 1, Germans and Italians attacked the fortress. Their drive pierced the perimeter in one section but was stopped after a slight advance. The Australians held their own, and the assault changed into a siege. In order to neutralize Tobruk as a road block, Rommel had a new road built, called the *Achsenstrasse* (Road of the Axis), which made a detour of 40 miles to enable Bardia-bound convoys to bypass the fortress. The Luftwaffe bombed Tobruk constantly, with a total of 437 raids between May 1 and July 31, 1941. The British not only met the needs of the garrison, but, since they planned to use Tobruk as a major base in a future offensive, they also built up large reserve stores in the fortress. British casualties during the German drive amounted to 3,000.

On June 15, 1941, an attempt was made to relieve Tobruk. The British later referred to it as a reconnaissance in force, but the Germans claimed a major victory. Actually the British tried to catch Rommel unaware as they had caught Graziani, but the German general was more wary than the Italian marshal. Twelve British tanks, spearheading a column of motorized infantry, attacked the German positions on the Egyptian border. They were forced to withdraw, after a six-hour engagement, with losses they could hardly afford. A force of 100 German tanks repulsed the British, and twice that number were reported ready for action in the rear. A stalemate developed, with the lines running roughly along the Egyptian-Libyan border and around Tobruk.

As supplies and weapons from the United States poured into Egypt (partly by a 14,200-mile route from New York around the Cape of Good Hope, through the Indian Ocean and the Red Sea to Suez), German superiority in mechanized units was steadily reduced. General Wavell was assigned the task of guarding India and its immediate approaches, and the military administration of the Middle East was split into two commands: Syria-Palestine and Western Desert (both under Gen. Sir Claude Auchinleck).

Spain and Gibraltar.—On Aug. 8, 1940, the Spanish government named its price for an attack upon Gibraltar: "the rock" itself, French Morocco, the Oran region of Algeria, enlargement of Rio de Oro, the expansion of Spanish holdings in the Gulf of Guinea, and continued economic support. Siege artillery and bombers were to be supplied by the Germans.

The Reich was faced with the problem of deciding which was more important for the moment: Spanish entry into the war or the full collaboration of the Vichy government, which could not be expected to continue if Spain were given colonial territory at France's expense. A meeting between Hitler and Franco on October 23, at Hendaye on the French-Spanish border, produced no definite results. Since the British continued to resist, Franco's attitude stiffened. Hitler angrily reminded the Spanish *caudillo* that his fate was linked with that of the German and Italian governments. The general was afraid of unfortunate domestic reactions to Spanish participation in the war. The impatient Germans made it clear that their offer of support in an assault on Gibraltar would not be available indefinitely, as other more important campaigns were ahead. Franco was anxious to seize Gibraltar, but he wanted the Germans to capture Suez before he began his drive. As the capture of Suez did not materialize, and the Italians suffered another defeat in Africa, Spain maintained its nonbelligerent status.

The Conquest of Italian East Africa.—A small number of British troops slipped into Ethiopia from the Anglo-Egyptian Sudan to instigate a revolt against the Italians. Ethiopian volunteers, trained in British-controlled African territory, were called back to their homeland on July 13, 1940, to join the guerrillas (*Shifta*) inside the country. The Shiftas had once been bandits, at odds with the government, but anger over Italian domination turned the bandits into patriots. The location of Italian East Africa was good for an offensive but precarious for a defensive. The country was a gigantic, arc-shaped bridgehead from which diverging drives could be opened in every direction. If under attack, it could easily be overrun by concentric assaults from all directions.

British General Wavell, together with Lt. Gen. Sir Alan Gordon Cunningham and Lt. Gen. William Platt, prepared a full-scale offensive against Italian East Africa. General Cunningham was to drive from Kenya into Italian Somaliland, then to wheel north into Ethiopia, one column heading toward Neghelli, the other toward Harar. From the north, General Platt was to push southward along the Red Sea coast and, from Kassala and Gallabat in the Sudan, to drive into Eritrea. Asmara, Massaua, and Assab were his initial objectives. To keep the entire perimeter of the East African bridgehead under pressure, minor forces were to close in from northern Kenya and along the Blue Nile in the Sudan into Ethiopian mountains. Altogether, some 60,000 British and Dominion regulars were available against more than three times that number on the Italian side. Support from guerrilla fighters, coupled with Italian inefficiency, were expected to make up for the numerical disadvantage.

On Dec. 16, 1940, Cunningham's troops raided El Wak in Italian Somaliland with the support of the South African Air Force and some armor. South African and Gold Coast units took part in the raid. Although it was successful, the British did not give it much publicity, strengthening the Italian High Command's belief that it was only a reconnaissance. On January 8, the Italians opened three drives: one on Gallabat, one against Kassala, and one along the Red Sea toward Port Sudan. They were immediately repulsed. An Indian bayonet charge routed the Italians near Kassala and drove them back in disorder into Eritrea. On Jan. 21, 1941, Indians, Scottish Highlanders, and Sudanese units took up the pursuit and penetrated Eritrea 30 miles east of Kassala. New Ethiopian volunteers reentered their homeland the next day. This drive, too, was underestimated by the Italians.

Platt's columns from the Sudan, 15,000 strong, steadily gained momentum and reached Agordat, in Eritrea, on February 2. Their push was joined by units coming down from Port Sudan. Platt's troops next closed in on Cheren (Keren), the strongest Italian fortress in Eritrea.

Eritrea, the oldest Italian colony in Africa, had a superhighway leading to the capital of Asmara. Mountains from 4,000 to 6,000 feet high dominated the road. Their slopes were honeycombed by underground forts, armed with rapid-fire cannon and machine guns, and garrisoned with what the Italians considered their best troops, partly Black Shirt battalions. A determined defense should have held off the attackers indefinitely. A stand at Barentu was attempted by 10,000 Italians to prevent the Indians from reaching Cheren. It was not easy for the Indians to rout their opponents, even though the Italians were poorly supported by their air force, while British, South African, and Rhodesian pilots destroyed Italian planes on the ground and ruled the skies. The outskirts of Cheren were reached on February 12. The fight for that city, almost inaccessible to attackers, lasted until March 28. After losing about 50 per cent of their combat troops, the Italians abandoned the fortress city, leaving the road to Asmara open and the capital undefended. From Asmara, one of Platt's columns proceeded to the Red Sea, taking the harbor city of Massaua on April 10, and Assab, close to the border of French Somaliland, on June 10, while the other turned to its right to join the race for Addis Ababa, the prize objective.

When the Italian commander in chief, the duke of Aosta, finally realized the magnitude of General Cunningham's ambitions, he ordered the

bulk of his army, 96,000 infantrymen, 400 guns, and 300 aircraft, to be hurled against the British. The concentration of Italian forces was never completed. As fast as they arrived, they were smashed by the attackers.

On February 14, Cunningham's vanguard, marching along the coast, entered the port city of Chisimaio (Kismayu). Beyond Chisimaio, two Italian divisions defended the crossing of the Giuba (Juba) River, barring the way to Mogadiscio, Attacked by one South African division, the Italians suffered quick defeat, and Mogadiscio was entered on February 24. Italian casualties in the Somaliland campaign were 31,000 against only 205 for the British. Extensive booty was taken. The lack of fighting qualities of the Italian soldiers was again very evident.

With the capture of Mogadiscio, Italian Somaliland was practically under British control. General Cunningham lost no time in using the Italian-built highway for his drive toward Harar and Addis Ababa. Retreating Italians tried in vain to outdistance Cunningham's men in order to reorganize and offer resistance in front of Harar, but on March 26, it was in the attackers' hands, and Italian stragglers left to defend the city were captured.

Naval bombardment of Italian shore installations in British Somaliland began on March 15, with no effective reply. Indian regiments landed west of Berbera, while Somalis and Arabs, mostly refugees from the Italian invasion, swarmed ashore east of the town under the command of English officers. No major battle was necessary. The Italians were simply mopped up by the seaborne attackers and General Cunningham's Nigerians. Early in April, all of British Somaliland was restored to the empire.

The imperial forces marching on Neghelli from Italian Somaliland reached the town unopposed and joined a small detachment from Moyale which had arrived at Neghelli on March 23.

After the capture of Dire Dawa, General Cunningham formed a special column of Transvaal units and the King's African Rifles to speed up the drive along the railroad to Addis. Other units turned toward Djibouti, recovering the port and the rest of French Somaliland for General de Gaulle's Free French.

On April 5, the first South African armored cars entered Addis Ababa. General Cunningham had covered a distance of 1,150 miles in little more than two months, while it took Marshal Graziani 7 months to advance 425 miles in his conquest of Ethiopia in 1935–1936. Due to the size of Ethiopia, mopping-up operations lasted for a long time. Dessie fell on April 20. On May 6, the exiled emperor, Haile Selassie, returned to Addis Ababa. The duke of Aosta and his staff decided to concentrate their remaining forces of 35,000 at Ambi Alagi, which was a natural fortress. The Italians again failed to fight wholeheartedly and, on May 20, the duke was forced to surrender. A few, small, scattered Italian units and bands of Ethiopian collaborators, diehards who preferred death to surrender, held out in the region of Gondar during the rainy season. On Nov. 28, 1941, their last stronghold was captured. Rarely has any military force been as completely annihilated as was that of the duke of Aosta.

Even though the British victory was spectacular, it did not end the threat to Suez in North Africa. Shipments through the Red Sea did become less hazardous as a result of the elimination of the Italian and Vichy French grip on part of the Red Sea coast, although Madagascar in Vichy French hands was still something of a menace.

The Airborne Invasion of Crete.—After the German victory on the Greek mainland, the island of Crete (Krete) was the only Greek territory still free from German-Italian control and available as a base for the British. Crete has many anchorages, but only Suda Bay could accommodate a large fleet, and the island had only three airdromes, in Maleme, Rhéthymnon, and Erakleion. After the fall of Greece, all of the airdromes were under attack by the Luftwaffe, based on the Greek mainland. The few aircraft left from the RAF in Greece had to be removed from the three airfields in Crete because effective fighter protection would have had to come from North African bases, and the round trip was beyond the range of 1941 fighter planes. Crete was vital to British defense of the Mediterranean. The island in German hands would be a springboard for an attack on Cyprus and Luftwaffe bombing raids on Palestine.

The British realized that the Germans were planning an airborne invasion of Crete. The British garrison in Crete, prior to the fall of Greece, consisted of the 14th Infantry Brigade and 2,000 Royal Marines. The Greek soldiers on Crete numbered about 13,000, most of them inadequately trained and poorly armed.

A considerable part of the BEF rescued from the Greek disaster went to Crete. Thirteen thousand Britishers, 7,100 New Zealanders, and 6,500 Australians joined the garrison there. The command of the forces on the island was taken over by Maj. Gen. Bernard Freyberg. The British War Office reported that the exhausted and partially disorganized evacuees from Greece were survivors of the 4th and 5th New Zealand Infantry Brigade, and of the 6th Australian Division, who had to be formed into new units. The report continued: "Trenches, gun emplacements, wire obstacles, and demolitions had to be prepared, and such was the lack, even of spades, that men used their steel helmets to scoop out slit trenches. British officers were attached to Greek battalions which had little training and no equipment beyond rifles and 20 rounds a rifle . . ." British equipment was little better than the Greek, and as equipment was likely to decide the outcome of a battle, even the large number of troops did not make the British outlook very bright.

After a particularly heavy raid on Maleme airport, German parachutists descended on Maleme in the early morning hours of May 20. They were followed by glider-borne infantry, crash-landing in the area held by the parachutists. German airborne troops were organized in small divisions totaling 9,000 each, equipped with artillery up to 75 mm. caliber. Every man carried a tommy gun and special weapons for guerilla warfare, in addition to manifold small items designed to make him as comfortable and self-sufficient as possible. The firepower of a German airborne division was greatly superior to that of a larger defending division. By nightfall of May 20, the Germans held the Maleme field, but similar invasion attempts failed at Rhéthymnon and Erakleion. General Freyberg, still in control of the situation, withdrew a short distance from

Maleme and pressed the Germans from all sides.

Colonel General Löhr realized that his position was critical and that the area held by his men was too small to make large-scale descents in the darkness advisable. He hastily assembled an invasion fleet of all kinds of craft found along the Greek coast. Admiral Cunningham threw the might of his squadrons against the makeshift armada, defying the Luftwaffe umbrella.

During the night of May 21, one German transport fleet was completely destroyed; more vessels were dispersed the following night. The loss of 5,000 German lives, however, could hardly compensate for the loss of two British cruisers and four destroyers by Luftwaffe bombs. Before the battle for Crete was over, another cruiser and two more destroyers were sunk, with a heavy loss of naval personnel.

German airborne reinforcements poured into Maleme. Gliders and large transport craft, carrying troops and artillery, landed to the rear of the defenders, regardless of losses, infiltrating the island and severing communication lines. The Germans made an unsuccessful attempt to kidnap King George of Greece. The Luftwaffe was very active in the ground battle, and the weight of its bombs decided the outcome. No antiaircraft weapons were available to the defenders, and the RAF could not interfere. After Maleme was secure, airborne reinforcements were brought in at night also. German planes were frequently destroyed while discharging troops, and hundreds of Luftwaffe craft littered the ground of Crete. While the Germans bore the brunt of the struggle, Italian landing parties in boats from the Dodecanese Islands infiltrated Suda Bay. The Germans established themselves all along the northern coastline and blocked the roads.

On May 27, it was decided to evacuate Crete, and British destroyers took off the defenders. Greeks and Australians were ordered to retreat across the mountain range to the poor port of Sphakia on the island's southern coast. The Germans overtook some of the retreating troops and reached the hills overlooking the port on May 31. Embarkation was completed in haste and with considerable losses. Almost nothing was saved of the pathetic equipment.

The Battle of Crete lasted 12 days. It proved that large-scale airborne invasions were feasible. Almost 16,000 men were evacuated, 14,850 of them colonials. German casualties probably ran as high as those of the defenders, but the losses suffered by the Luftwaffe were less serious to them than the losses suffered by the British Navy, including three cruisers and six destroyers. Due to this defeat, the strategic situation of the British fleet in the eastern Mediterranean deteriorated dangerously.

The British were apprehensive about another airborne invasion of Cyprus, which was better fortified than Crete, but less well manned than the Greek island and not well equipped. The German drive in the direction of Palestine and beyond was not continued. The Wehrmacht's plans did not work out as expected.

Iraq and Syria.—The Germans traditionally are masters of precise timing, and the German General Staff expected exact timing from others. The fact that they did not get it ruined their plan to conquer the Middle East.

The British life line to India ran through Iraq and Iran, and its western section was flanked by Syria. A vital pipeline through these countries linked the Mosul and Maidan oilfields to Haifa in Palestine and Tripoli in Syria. When the Germans were ready to invade Russia, their control of these three countries would have meant even more than the breaking of British land communications to India and Burma. It would have bared the Russian southern flank and brought the Caucasian and Caspian oilfields—vital to the USSR—within bombing range. Such a situation might well have decided the battle for Russia in Germany's favor.

Syria was under French mandate. Early in the war, a French army under the command of Gen. Maxime Weygand stood ready to protect the approaches to key areas. After the fall of France, the former Weygand army became a liability rather than an asset to the British.

Since June 1930, the British had enjoyed the privilege of using Iraq's transportation facilities. Two airports were leased to the British, and the pipeline was under British guard. Prior to this agreement, following the Turkish defeat in World War I, Iraq had been British-mandated territory. Iran was fully independent, and the anti-British attitude of its government created a critical situation.

As the Germans well knew, British military strength in these vital areas was negligible. The Germans hoped it could not even cope with native uprisings, especially if the French in Syria assisted the rebels. The German General Staff, anxious to divert as little strength as possible from the future Russian theater of war, encouraged such uprisings and was ready to provide the natives with some air support and airborne supplies.

The German legation in Teheran (Tehran), Iran, was a center of anti-British intrigues. Bribes were distributed lavishly and effectively. All through the Arab countries, German agents were well equipped with cash and skilled in making promises. Any anti-British government that might establish itself in that area was assured in advance of German support.

The reports from Arab countries satisfied the Wehrmacht. Full cooperation could be expected from the Iran government. In Iraq, Rashid Ali el-Gailani, a scion of a respected family, prepared a coup d'état to drive the British out of the country. The situation in Syria was somewhat confused. Finally, Gen. Henri Fernand Dentz took over, eagerly promising the full support of his army for any anti-British venture. According to the Wehrmacht's blueprint, the plan was that, simultaneously with the capture of Crete, Rashid Ali should stage his putsch (rebellion) in Baghdad, the capital of Iraq, and the French in Syria should press on to Palestine and Transjordan while keeping some forces in reserve to aid the Iraq uprising if necessary. In both countries, air bases were to be prepared for the use of the Luftwaffe. The Germans expected a quick and decisive British defeat.

Orientals have little regard for precise timing. On April 19, a very small British force (dispatched because of alarming rumors) landed at Basra harbor, on the Iraq coast of the Persian Gulf, and wheeled along the Tigris River toward Baghdad. Afraid that the presence of the British might frustrate his coup, Rashid Ali struck on May 1, three weeks ahead of time. After seizing the government, he ordered his troops to

attack the main British air base at Habbaniya. The Iraq forces had some artillery, and the British had a few planes and armored cars. The Luftwaffe was not ready to help, much to the dismay of the Germans and Rashid Ali.

The British were outnumbered and lost the airfield temporarily. Some reinforcements were rushed into Iraq from Transjordan. The British shrewdly inspired rumors that the troops from Transjordan numbered several divisions with heavy armor, a very great exaggeration, but the bluff worked. Attempts by Rashid Ali to recruit more men failed because of the reports of British power. After four critical days, Habbaniya was recovered. The fate of Iraq hung in the balance for the rest of the month, but an armistice on May 30 confirmed the British victory, and Rashid Ali fled.

After consolidating their positions in Iraq, the British were faced with the equally uncomfortable problems of Iran and Syria. Not only was it difficult to send adequate forces to Iran, but Russia considered that country vital to its own security, and a British invasion of Iran would arouse anger and distrust in Moscow at the crucial time when Germany was about to become the common enemy of Britain and the Soviet Union. The problem of Iran, therefore, had to be postponed until the position of Russia was fully clarified.

As Rashid Ali had not kept to the German timetable, General Dentz became confused and decided to wait for further orders. General Dentz was waiting when the British took the initiative. The British government had learned the lesson that the only way to prevent German occupation of a region coveted by Berlin was to be there first in force.

There were few German airmen in Syria, but Dentz had 33,000 men under his command, with 80 guns and 90 ineffectual tanks. The infantry included well-trained foreign legionnaires and colonials. The British Army, under General Wilson, was made up of two divisions, with Australian, British, and Indian troops, and less artillery and armor than Dentz had at his disposal. The French defense system was in the form of a box, with Tripoli, Homs, Saida (Sidon), and Merdjayoun as key points protecting the capital of Damascus (Damas) and the main port of Beyrouth (Beirut). The British commander hoped that his offensive would surprise the French and shake their loyalty to the Vichy government. Neither hope was justified by events.

The British attack started on June 8, 1941. Free French contingents joined British, Australian, and Indian troops pushing toward Damascus. The outskirts of the city were reached on June 11, but an attempt to storm the capital met with a sharp reverse. It took the attackers more than a week to rally and repeat the assault. The Free French fought with distinction, but the garrison of Damascus was not easy to subdue. After heavy fighting, Damascus was occupied on June 21. The remnants of the garrison fell back toward Beyrouth. On June 22, a drive against Merdjayoun was resumed and led to the capture of the disputed city by the Australians. The box defense had been pierced. French desert strongholds in the eastern part of Syria also fell to the attackers. British troops, entering the country from Iraq, captured Palmyra.

Not even the Luftwaffe came to the assistance of the hard-pressed General Dentz. The Germans, fully engaged against Russia, disclaimed any interest in Syrian developments. Beyrouth fell July 12, 1941, ending the hostilities. An armistice gave control of Syria to the Free French. General Wilson's forces suffered 2,000 casualties, and the Vichy French, almost 8,000.

In July, the Russians and the British were fighting a common enemy, and the success of the Syrian campaign was just as important to the Soviet Union as it was to Britain. The initial step had been taken to open a southern supply route into Russia. The victory considerably improved Britain's defensive position, but it offered no springboard for an offensive and no opportunity to deploy fresh forces into other vital sectors. As long as the Germans remained close to the easternmost shore of the Mediterranean and the Red Army was under attack, relatively strong garrisons had to be maintained along the British life line.

EVE OF THE RUSSIAN ATTACK

Before opening the attack on Russia, the Germans were anxious to force Britain out of the war, or, at least, to reduce the empire to a state of helplessness. The possibility was not discounted in Berlin that the British would attempt to dispatch supplies to Russia, or to transport United States lend-lease goods to the Soviet Union if lend-lease were extended to that country. It was considered possible that the British might raid the western European coast if the German garrisons there were depleted in order to keep the Wehrmacht in Russia at full strength. It was vital to German plans to wipe out British shipping.

Naval Action in the Atlantic.—The German Navy increased its submarine warfare by introducing new tactics. U-boats were sent out in wolf packs, aided by scouting planes, and fired torpedo salvoes at convoys whenever they had a chance to attack them in close formation. Such salvoes frequently scored hits. Even if no major damage were inflicted, the proximity of a pack of submarines forced the convoys to disperse, which meant fewer trips and a considerable loss of speed. With the Germans in control of the Atlantic coastline from east of the North Cape in Norway down to the French-Spanish border, the Luftwaffe was also able to attack shipping on a steadily growing scale. British shipping losses mounted dangerously. From the outbreak of the war to the end of June 1941, they amounted to 7,058,677 tons (including neutral ships).

German reports gave British losses as one million tons a month. Experience proved that British reports were more reliable than German, but British figures did not include damaged vessels which were able to make port. Many of them had to undergo long repairs, and some were put out of action permanently. British and Dominion warship losses presented an increasingly difficult problem of adequate convoy protection. Everything depended on keeping the sea lanes open. The war was lost for Britain if a sufficient amount of supplies could not be obtained. The beneficial effects of lend-lease were reduced as long as the "carry" provisions of the United States Neutrality Act remained in effect.

The German Navy Command decided to add the threat of powerful surface units to that of submarines. Battleships equipped with heavy caliber guns were able to inflict severe damage on merchant ships and to destroy lighter escort vessels.

On May 21, 1941, the German battleship *Bismarck* and the heavy cruiser *Prinz Eugen* left Bergen harbor in southwestern Norway. Their tonnage was officially listed as 35,000 tons and 10,000 tons respectively, but the real figures were 45,000 and 18,000 tons. Their departure and northwestward course, obviously to approach the North American coast, were spotted by the British. On May 24, the German units were met by the British 42,000 ton battle cruiser *Hood,* the largest ship the Royal Navy could muster, and the powerful, modern, 35,000 ton battleship *Prince of Wales.* A brief engagement was fought in Denmark straits between Greenland and Iceland. A lucky hit from one of the *Bismarck's* 15-inch guns hit the *Hood's* forward ammunition magazine, and the ship sank with a heavy loss of life. The *Prince of Wales* suffered superficial damage. Damage to the German ships was not disclosed.

The disaster's moral effect in Britain was even more marked than the material effect. A considerable part of the British Navy was thrown in against the *Bismarck.* Five battleships from the home fleet, including the *Prince of Wales,* and one battleship from Gibraltar, with the protection of two aircraft carriers and a number of smaller craft, gave chase to the German ships which were reported to be on their way to the French port of Brest. Off the coast of Brest about 400 miles, the *Bismarck* was located by an American-built Catalina plane. Torpedo planes taking off from the aircraft carrier *Victoria* scored three hits on the big ship, which continued to proceed toward Brest at reduced speed. The *Prinz Eugen* went ahead and reached port. On May 26, the *Bismarck* was attacked by the bulk of the British Navy. After taking an almost incredible battering from guns of every caliber, the *Bismarck* was finished by torpedoes launched by the cruiser *Dorsetshire.*

The *Hood* was avenged, but the German 26,000 ton battleships *Scharnhorst* and *Gneisenau* were joined by the *Prinz Eugen* at Brest, and they were expected to try to raid Atlantic convoys. The RAF attempted to disable these ships. Constant British bombing raids were carried out in Brest harbor and, after the *Scharnhorst* moved to La Pallice, the latter port also was hard hit. None of the German ships were destroyed in the raids. There was no real relief from the threat of German surface attack, although caution or damage kept the vessels in port and out of action for lengthy periods.

Air War in Western Europe (1941).—German air raids against Britain continued all through the winter and spring of 1941. These air attacks had three objectives: (1) to blockade Britain by destroying shipping and harbor installations; (2) to disrupt British production; (3) to lower the morale of the British people by attacks on residential areas. Official British figures for civilian casualties were given as follows:

Month (1941)	Killed	Wounded
January	1,539	2,023
February	739	1,068
March	4,298	4,794
April	6,068	6,902
May	5,394	5,181
June	399	461
Total	18,437	20,429

Although British shipping suffered substantial losses and industrial damage was serious, the British showed no sign of weakening. The Royal Air Force hit back in growing strength. Raids on cities within the Reich increased. The bombardment of the French invasion coast was kept up whenever weather permitted.

German air activity and British casualties were sharply reduced after June 1941, when the Luftwaffe massed most of its available planes on the eastern borders and vassal states of the Reich in an effort to crush the Soviet Union.

German-Japanese-Russian Pacts.—The influence of German political and military advisers increased in Tokyo during the period of the Reich's military ascendancy. The Germans did not want Japan to go to war with Russia. Hitler's government believed that the Reich alone was strong enough to deal with the Soviet Union and did not need to let Japan share the expected spoils. Germany wanted Japanese aggression to move in a direction involving a clash with the United States. German agents in Japan asserted that their country was prepared to aid Japan in case of war with the United States. Evidence of German strength in Latin America (particularly in Argentina, where German and Japanese industrialists cooperated) convinced Japanese politicians that Germany's foothold in the Western Hemisphere was a serious threat to the United States. Japan's German advisers pointed out that control of Siam (Thailand), the Dutch East Indies, the Philippines, and Australia would be more profitable than the barren Siberian regions which bordered Japanese-held Manchuria. The opposition would also be less formidable than the Independent Red Banner armies.

Japan and the Soviet Union had agreements covering Japanese fishing rights in Russian coastal waters and industrial concessions on northern Sakhalin. As long as they were in existence, war between Russia and Japan was highly unlikely. On Jan. 20, 1941, acting upon German advice, Japan renewed the fishery and industrial pact with Russia for another year.

On March 23, Japanese Foreign Minister Yosuke Matsuoka visited Hitler in Berlin, where the stipulations of the Tripartite Pact were revised. Germany offered its partner full assistance in any conflict with the United States. On the other hand, Japan's foreign minister agreed to keep hands off the Soviet Union.

This was a German diplomatic victory. With German support officially assured, Japan was sure to press its aggressive policy toward the United States and British, Dutch, and French colonies rather than divert new forces to Manchuria. Faced with the imminent prospect of war with Japan, the United States was expected by Germany to keep its war production at home. In that case, lend-lease supplies to Britain would be sharply curtailed and would not go to Russia after the German attack was launched. Whatever the outcome of a war between the United States and Japan might be (not all German military experts expected Japan to win), both sides would presumably be completely exhausted. Early in July 1941, Ribbentrop considered the revision of German policies to induce Japan to attack Russia, but the Japanese were not responsive.

The Japanese dreamed of an Asiatic coprosperity sphere which would bring almost one billion people under their control. They were convinced that their world supremacy could not be contested by any nation, including Germany, if the United States were eliminated as a rival in Asia and the British Empire were crushed. After signing the agreements in Berlin, Matsuoka was sure that they were favorable to Japan.

From Berlin, the Japanese foreign minister proceeded to Moscow. On April 13, he signed a Russo-Japanese pact stating that if either signatory became involved in hostility with one or several other powers, the other contracting party would observe neutrality throughout the conflict. The treaty included a mutual pledge of territorial integrity and inviolability. In addition, the USSR guaranteed to respect the existing status of Manchukuo, while Japan pledged itself to respect that of Outer Mongolia. The pact could not be renounced prior to April 13, 1945.

Russia, too, for the time being, was satisfied with the treaty. As the German threat was becoming more acute, it was very important to Moscow to be safe from a Japanese attack in the rear. Instead of reinforcing the Independent Red Banner armies, some of the eastern Siberian forces might be freed to be dispatched to the west. Minor troop movements in that direction were carried out early in May but soon came to a halt.

Flight of Rudolf Hess.—On the evening of May 12, 1941, the German radio announced that Rudolf Hess was missing. The *Deutschlandsender* hinted that the 47-year old deputy führer might be rather unbalanced mentally. It also mentioned his passion for flying and stated that Hitler had explicitly forbidden Hess to pilot an airplane. Two hours later, the British radio asserted that Hess had been in English custody since the evening of May 10.

These reports gave rise to controversial interpretations of Hess' mission. It was generally presumed that he had come to make a peace offer to England. Persistent rumors were heard to the effect that Hess hoped to save Germany from a two-front war when the attack against Russia began. The British were anxious to keep the German government from learning how far its plans had been revealed, and official utterances shortly after Hess' flight were confined to the statement that the deputy führer had landed by parachute near Glasgow, Scotland. He had flown from Augsburg in Bavaria, in a Messerschmitt fighter plane stripped of its equipment, and broke an ankle in a parachute jump after the machine ran out of gas. He asked to see the duke of Hamilton, whose estate was close to the place where he landed. Hess was taken to a Glasgow hospital for treatment, pending internment as a prisoner of war. The duke of Hamilton said that he did not remember having seen Rudolf Hess before. In later broadcasts, the German radio spoke of Hess as a "deluded seeker of peace" and a "deranged idealist."

British Foreign Office documents, made available to the court in Nürnberg War Crime Trials, revealed that the duke of Hamilton and Mr. Ivon A. Kirkpatrick of the Foreign Office interviewed Hess. Hess first said that there was no foundation for the rumor that Hitler was contemplating an early attack on Russia. According to Hess, Hitler wanted to stop unnecessary slaughter and wished an agreement outlawing war between Germany and Britain on condition that Britain would abandon her "traditional policy of always opposing the strongest power in Europe." If England would give Germany a free hand in Europe, Germany would give England a free hand in the empire, with the sole reservation that Germany's former colonies must be returned. When asked whether he included Russia in Europe or in Asia, Hess replied in Asia. Mr. Kirkpatrick retorted that, since Germany would have a free hand in Europe only, she would not be at liberty to attack Russia. Obviously forgetting that he had previously denied Hitler's aggressive intentions against the Soviet Union, Hess remarked that Germany had certain demands to make of Russia which would have to be satisfied either by negotiation or by war. Hess also stipulated that Prime Minister Churchill was not a person with whom the führer could negotiate.

Speaking of the United States, Hess vehemently insisted that avaricious Americans had designs on the British Empire. Canada, he said, would certainly be incorporated into the United States. He pointed out that the Germans had figured on American intervention and were not afraid of it. They knew all about American aircraft production and the quality of United States aircraft. Germany could outproduce England and America combined. Germany had no designs on America. The so-called German peril was a ludicrous figment of the imagination. If England and Germany were to make peace now, he added, America would be furious, as America really wanted to inherit the British Empire.

Whether or not Hess acted upon Hitler's orders, or with Hitler's knowledge, was never revealed. It can be assumed, however, that he did not act altogether independently.

Although he did not see Hess, Churchill passed full information along to Moscow with the warn-

ing that the German attack was impending. He also affirmed Britain's determination to continue the fight until Germany was defeated.

Molotov Sees Ribbentrop.—Russia reacted strangely by dispatching Foreign Commissar Molotov to Berlin. Molotov offered German Foreign Minister Ribbentrop a full military alliance in return for certain territorial concessions after victory, which included: the lands occupied by the Soviet forces since 1939, complete control of the Dardanelles, a free hand in Iraq and Iran, and enough of Saudi Arabia to give the USSR control of the Persian Gulf and the Gulf of Aden. After consultations with Hitler, Ribbentrop coldly rejected the Russian offer, because the Russian demands were too ambitious.

On May 15, Russia ordered the ministers of Belgium, Yugoslavia, and Norway to leave the country. By doing so, she publicly accepted the German contention that governments in exile were no longer the legal representatives of their respective countries and that occupied states had ceased to have an independent foreign policy.

Mounting Tension between U.S. and Axis.—On May 21, the United States freighter *Robin Moore* was sunk by a German submarine. President Roosevelt, in a special message to Congress, branded the German action as an attempt to intimidate the United States and to drive American commerce from the seas as a part of the Nazi scheme for world conquest. The President accused the German government of acting as an international outlaw engaged in piracy and annouced that the United States would claim full reparation for American losses. Supplementing the previously proclaimed state of limited emergency, Mr. Roosevelt proclaimed an unlimited state of national emergency.

According to German monetary laws, (copied by Italy), foreign assets owned by German and Italian nationals respectively were under government control and had to be kept at the government's disposal. Such assets were used partly to pay for essential war imports and partly for propaganda purposes under various disguises. Since the outbreak of the war, most of such funds had been spent for political propaganda, cleverly directed by consular officials and employees of tourist offices. In order to stop this practice, on June 14, 1941, Roosevelt ordered in the United States the freezing of the assets of Germany, Italy, and all invaded or occupied European countries where German monetary laws had been introduced. On June 16, the United States government ordered all German consulates in the country to be closed by July 10. Employees of German travel and propaganda agencies were asked to leave the United States by July 15. Germany countered by closing American consulates. Italy followed suit, whereupon, on June 22, Italian consular offices in the United States were ordered closed.

On June 20, the United States Senate adopted a House amendment to a law passed during World War I, giving the President far-reaching authority to regulate movements in and out of the country of both citizens and aliens. On the same day, export controls were placed on petroleum products, prohibiting shipments from the Atlantic coast to any country except the British Empire, Egypt, and the republics of the Western Hemisphere.

U.S. Occupation of Strategic Bases.—Following the German occupation of Denmark, the parliament of Iceland proclaimed its independence from the mother country. A small force of British troops went to Iceland to protect the island from German aggression.

It was vital to the countries of the North American continent that no German line be established from Norway via Iceland to Greenland. As the United States was already in charge of the security of Greenland, it was a logical step to extend that protection to Iceland. On July 7, 1941, with the German attack on Russia already under way, Roosevelt disclosed that United States naval forces had landed in Iceland at the invitation of the Reykjavik government. The president also revealed that United States troops had gone to the newly acquired United States bases at Trinidad, off the South American coast, and in British Guiana, to forestall Nazi "pincers" against the Western Hemisphere. This announcement was hailed by the British, while the Germans denounced it as "a stab in the back."

Pacts with Turkey.—On March 24, 1941, the Soviet government, which had had a non-aggression pact with Turkey since 1925, made an additional pledge to the Turkish government to maintain its neutrality in case Turkey were obliged to defend its territory. In March, it seemed as if the Turks might be in immediate danger of German aggression. After the end of the Balkan campaign, however, Russia was more seriously threatened than Turkey. It became of the utmost importance to Russia that Turkey should not allow German troops to pass through its territory in preparation for an attack on the Soviet Caucasus.

German diplomatic activity in Turkey continued after the defeat of Yugoslavia and Greece, and Ambassador von Papen informed the Turkish government that Russia had aggressive intentions toward Turkey.

Dr. Kurt Clodius, German economic expert and professional negotiator of economic agreements, went to Ankara to try to bring Turkey into Germany's economic orbit. The Reich needed Turkish chromium, but Britain had purchased and arranged for long-term deliveries of the total Turkish output of this vital metal. Dr. Clodius offered German war materials in exchange for Turkish products. Britain tried to counter the German moves, but the hard-pressed empire had very little to offer.

The announcement of a German-Turkish pact on June 18, came as an unhappy surprise to England. Germany and Turkey agreed to respect each other's territory, to consult each other on all questions affecting their common interests, and to make sure that radio and press (under government control in both countries) promoted a spirit of friendship and mutual confidence. Closer economic cooperation was also outlined. Turkey later agreed to deliver chromium to Germany after Jan. 1, 1943.

It was scant comfort to the British that Turkish Foreign Minister Sükrü Saracŏglu spoke of the continuation of the treaty with Britain. In private discussions, Ribbentrop disclosed that he considered Turkey a potential ally. Later events proved that Turkey never considered an actual alliance with the Reich, but, alarmed by the fate of the Balkan States, was anxious to conciliate the Germans.

On August 12, 1941, Great Britain and the Soviet Union assured Turkey that neither had

designs on the Straits or any other Turkish territory.

Iran and Afghanistan.—No less than 3,000 German "tourists" were reported in Iran in June 1941. With the toleration of the government, they acted as a fifth column and infiltrated he country's administration and economy. Repeated protests lodged by the British minister in Teheran, Sir Reader Bullard, were of no avail. Energetic action had to be postponed, pending the development of German-Russian relations.

From Iran, German agents moved into Afghanistan as economic experts, engineers, educators, prospective industrialists, and alleged advisers on the country's technical development. They were members of the Nazi party and tried to put Emir Mohammed Zahir Shah under pressure. The exiled Emir Ammanullah was ready to ascend the throne as a German puppet ruler, and the Fakir of Ipi, long an antagonist of Britain, was urged to stir up a revolt on the Indian border.

The emir of Afghanistan, determined to preserve strict neutrality and to drive the fifth columnists out of the country, ordered the deportation of all German and Italian nationals in the summer of 1941. On July 16, after Russia was invaded, the Soviet and British governments requested Premier Ali Mansur of Iran to order an immediate reduction in the number of the Germany colony. No satisfactory answer was received. Both the premier and Shah Mohammed Reza were pro-German. After diplomatic representations were unsuccessfully repeated on August 16, on August 25 Britain and Russia decided to take action.

In a two-day campaign against token resistance, the British and the Russians seized control of Iran. On August 27, a new government was established under Ali Feroughi, and the shah, on Sept. 10, 1941, abdicated in favor of his 21-year old son, Reza Pahlevi. Enemy nationals were surrendered to the occupying powers. The German, Italian, Rumanian, and Hungarian legations were closed. New supply routes were opened to Russia through Iran by land from India and by sea.

On June 29, 1942, the governments of Russia, Britain, and Iran agreed that Russian and British troops would be admitted to Iran with the understanding that this was not a military occupation and would interfere with the normal life of the country no more than was absolutely necessary. The independence and sovereignty of Iran were to be protected, and the British and Soviet forces were to leave six months after the end of the war.

Finland as a German Military Base.—The Finnish Army was not fully demobilized after the winter war of 1939–1940. Cooperation with Germany in a future war against Russia was immediately considered, and German infiltration of Finland began while the Norwegian campaign was still under way. A civilian air base at Petsamo was built up into a first class military installation, and the road from Norway into Finland through Inari was enlarged. German military missions worked with the Finnish General Staff. Field Marshal Baron Mannerheim was not active in these plans.

As the Finnish lack of modern equipment was considered appalling, the Germans decided to send aircraft and armored equipment. It was understood that this equipment was not to be handed over to the Finnish Army or operated by Finnish soldiers, but that it would be controlled by the Wehrmacht. Beginning in April 1941, German troops in great numbers arrived in Finland. Some came by boat from German Baltic ports, some from Norway, and a considerable number were transported through Sweden by railway. Gen. Nikolaus Falkenhorst, German commander in Norway, paid prolonged visits to Finland. German troops were mostly concentrated in the north of the country, facing Murmansk and Kandalaksha. Smaller groups, partly armored, took up positions in the central and southern sectors of the Finnish eastern border region.

GERMANY OPENS WAR ON RUSSIA

Plans for "Operation Sea Lion" (the invasion of England) never went beyond the first draft. Its tremendous problems deterred the German General Staff from a move that might have brought World War II to a quick and victorious conclusion. In August 1940, German attention was focussed on another plan called "Directive 21—Op. B" and later "Operation Barbarossa." At Zossen, near Berlin, the German General Staff worked on the gigantic project of crushing the Soviet Union. According to statements made after the Reich's surrender, the plans were completed on Dec. 5, 1940, and submitted to Adolf Hitler. The führer issued a secret order which began: "The German armies must be prepared to crush Soviet Russia in a quick campaign before the end of the war against England."

Later it was claimed that some of the German generals warned against the attack on Russia, stating that the German Intelligence Service had failed to produce conclusive information about recent Russian plans, the number of military personnel, and equipment. The fifth column that Germany tried to plant in Russia was not considered reliable.

German Intelligence and Plans.—Little information from inside Russia reached the German Intelligence Service after 1936. Before that time, Germany knew considerable about the Soviet armed forces. The Germans had complete technical data on Russian armor and aircraft through 1936, and panzer specialists were supplied with blueprints pointing out the weak spots of Russian tanks in heavy red lines. Russian aircraft designs became the object of special studies by Luftwaffe officers.

The Russian operational plan PU-36 also became known to the Germans. It was drafted by Marshal Mikhail N. Tukhachevski and was considered to be the cornerstone of Russian defense. Between the Dnieper (Dnepr) and Dvina rivers, according to PU-36, the Russians were to organize a defense in depth with its center at Smolensk. Light machine gun nests were to be established in front, heavier automatic weapons further to the rear, followed by an echelon of field guns, antitank artillery, and pill boxes. These obstacles were supposed to slow down the attackers' advance and to inflict heavy casualties upon them before they could reach the main line of strong fortresses where huge masses of infantry were to be massed. The fortresses were to form the "Stalin Line."

Tukhachevski was executed with 223 other high-ranking officers. The Russian General Staff decided to change PU-36. The Stalin Line was never completed, but it is possible that German operations in the Battle of Smolensk (which they

won but not decisively), were one of the main reasons for the Reich's final defeat.

The German General Staff had been friendly with Russian military authorities since the days of the Weimar Republic. Plans for German-Russian military cooperation were not abandoned immediately after Hitler came to power. Some of the German militarists insisted that, allied with Russia, they would be able to conquer the rest of the world, and that afterward their superior organizing talents would guarantee permanent command of the coalition. Others preferred to conquer Russia. The second school of thought won out in 1940, although the opposition did not vanish completely.

The magnitude of Operation Barbarossa was unparalleled. It was to fulfill the German dream of world domination through control of the natural wealth of Russia. The Germans were sure of their ability to exploit Russian resources, including manpower, to an unprecedented degree. The idea was not original with Hitler that the Reich would live in affluence with the Ukraine and the Urals in German hands. He only repeated in *Mein Kampf* what had been told previously. According to the German plan, Russia was to be split into a number of small states, reverting to its status before the Mongol and Tatar invasions. National rivalries were to be fomented to support German aims. The Germans living in the "Volga German Republic" were expected to become Russia's Sudeten Germans. Ukrainian nationalism, too, was expected to play a major role in the German game.

Discontent with the Soviet system was also expected to be useful. Here, too, German intelligence reports were inconclusive. German agents had little opportunity to talk to the average Russian, who was trained to be distrustful of foreigners and unresponsive to their questions. The relative silence of the common man was occasionally interpreted by the Germans as a symptom of disaffection, although this silence was usually prompted by fear of the consequences of loose talk. The Soviet Union's system of keeping its citizens informed about events abroad only as the government saw fit led the average Russian to believe that his living conditions were superior to those abroad.

When the Germans later moved into Soviet territory, their behavior appeared to confirm Russian statements that conditions were worse outside of the USSR. Their tyranny aroused furious resistance, because the German plan was that Russia should be exploited rather than administered. Puppet rulers, under German orders, stood ready to assume command in conquered territories. All states set up in Russia were to be supervised by commissars from Germany under Hitler's direction.

It was planned to strengthen the Wehrmacht to 300 divisions, including 30 armored divisions which would have almost twice their previous equipment. Successful tank types, basically unchanged, were to be reinforced in armor. German artillery equipment was built up. In addition to the 75-mm. field cannon, the number of 88-mm. and 105-mm. guns was greatly increased. A 150-mm. long-barrel cannon with a range of almost 22 miles, and a 150-mm. howitzer with a 10-mile range were introduced in large numbers. Eight and fourteen inch siege guns were ready to batter the "Stalin Line." Mortars ranged from 50- to 615-mm. caliber (the latter giant was used only at Sevastopol). The most common type was the 81-mm., and one of the most effective was the six-barrelled, 152-mm. *Nebelwerfer*. The Luftwaffe relied chiefly upon ME-109, ME-109-F, ME-109-G, ME-110, HE-113, Focke Wulf 190 and 190-A-3 fighter planes, Heinkel 111, JU-87, and JU-88 bombers, and the Focke Wulf 107 reconnaissance plane.

At the opening of the great drive, it was estimated that the Wehrmacht numbered about 250 divisions, 25 of them armored. Between 50 and 70 divisions were kept in France and other occupied countries and a small number in North Africa to guard against surprise landings. United States Intelligence reports estimated the number of trained German soldiers available at 3,500,000 on active duty and 3,350,000 in reserve; the Finns at 401,000; the Rumanians at 800,000 on active duty and almost 1,000,000 in reserve. The Finnish and Rumanian figures were rather too large, but the estimated number of Germans was probably accurate. As the drive to force citizens of conquered countries into German war industries increased, a great number of formerly draft-deferred German factory workers could be added to the reserves. Altogether, substantially more than 300 divisions were lined up along the western side of a 2,000-mile front, running from the Arctic Ocean to the Black Sea.

The supreme commander was Field Marshal Gen. Walther von Brauchitsch. From the Arctic Ocean to the region east of Kandalaksha, Gen. Nikolaus von Falkenhorst was in charge of a German army of six divisions. Between his right wing and the region of Lake Ladoga, small Finnish forces screened Karelian borders. Further to the south, down to the Finnish Gulf west of Viipuri, the main Finnish forces under Mannerheim, supported by two German divisions and considerable armor, stood ready to drive toward the Karelian Isthmus in the direction of Leningrad.

Three German army groups were deployed from East Prussia to the Black Sea. The northernmost group, its flank resting on the Baltic shore, consisted of the Sixteenth and Eighteenth Armies under the command of Gen. Wilhelm von Leeb. The central group, (Second, Fourth, and Ninth armies under Field Marshal Gen. Fedor von Bock) was by far the strongest. It was to carry out operations in the direction of Moscow. To the south, Field Marshal Gen. Karl von Rundstedt, in charge of the Sixth and Seventeenth armies, later to be joined by the Twelfth, was to drive the Russians out of eastern Galicia and the Ukraine. Hungarian and Slovak divisions joined Rundstedt's troops in the Carpathians. Small Italian groups were sandwiched between German forces. The extreme right flank, based upon the Black Sea, was under the nominal command of Rumanian Marshal Ion Antonescu.

Two newly created panzer armies under Gen. Heinz Guderian, top tank specialist of the Wehrmacht, and Gen. Paul von Kleist, were to be moved around wherever needed to act as superbattering rams. For the opening drive, they were at von Bock's disposal. The Germans had between 15,000 and 18,000 tanks, the Luftwaffe, about 10,000 first line planes.

The Wehrmacht expected the main Russian stand to be made in the center, with the point of gravity in and around the theoretical Stalin Line, according to PU-36. The flanks of the Red Army were considered weak and could be

pushed back and enveloped. The army group under von Bock was to bear the brunt of the fight. Its assault on Moscow was to be carried out in three jumps of about equal length: the first to Minsk, the second to Smolensk, and the third, in pursuit of a routed enemy, to the Russian capital. During the second and third phases of the central drive, the armies from Finland were to cut Russian communication lines from Murmansk and Archangel to Leningrad and Moscow, and to outflank the retreat of remnants of the central Red Army toward the Ural Mountans. After the battle of the Stalin Line was won, Rundstedt was to conquer the Ukraine, the Donbas, and the Donets region, and to race on toward the Caucasian oil fields, the most prized objective of the German drive. The Ukraine produced 20 per cent of Russia's wheat; the Donets Basin, 60 per cent of its coal; the Ukrainian Krivoi Rog mines, 60 per cent of its iron; and the Caucasian wells, 90 per cent of its oil.

The campaign had to be short. German winter equipment was not completed, and anti-freezing devices were inadequate to keep planes in the air and tanks rolling in sub-zero weather. As usual, weather forecasts played an important role in German planning. Early rains could not be ruled out, and German armor would be seriously hampered on muddy ground. The motorized Wehrmacht depended upon roads in reasonable condition to operate efficiently.

Russia's communications were in poor shape. Russian farmers and soldiers (75 per cent of the soldiers were farmers) were accustomed to almost incredible conditions of transportation. Their vehicles, largely horse-drawn, were adapted to mud and swamps. The lightest type of Russian field gun was mandrawn and could go wherever men went. West of Moscow, the Russian roads and railways were in relatively better condition than east of the capital. Therefore, the Wehrmacht had to try to win the war west of Moscow. Prior to the outbreak of the war, the Russians operated 53,163 miles of railways. A few paved roads ran east and west through the Baltic States to Leningrad, from the western border via Minsk and Smolensk to Moscow, and from Poland to Kiev. In a roughly north-south direction they ran from Estonia via Kharkov to Rostov, from Leningrad to Moscow, and from there to Rostov via Voronezh. North-south communications were needed to switch German panzer armies, and there were none east of the capital.

Tactically, the Germans introduced an innovation called *Keil und Kessel* (wedge and kettle). It was based upon the well-known blitz. In the wedge-and-kettle attack, the assaulting army was grouped into three formations. First came the bombers which were to penetrate enemy territory to a depth of about 200 miles. They were followed by armor, motorized infantry, and artillery. Main infantry forces followed 20 to 60 miles behind the armored divisions. After reaching maximum penetration, the point of the wedge was to swing in a huge arc (to the left or to the right, according to actual battle conditions) back to the main battle line, drawing a strangling arm around an enemy group. The infantry would then move up to close the arm into a ring. The kettle operation was to chop up the encircled group and to annihilate it piecemeal.

Rundstedt later deviated from the pattern when he realized its costliness. The German General Staff presumed that enemy reserves would not be able to reach the points of penetration. The Red Army had huge reserves available, however, and they attacked wherever necessary to help encircled units break the ring. Armored wedges frequently came between two fires, and encirclers were in positions alien to a German general's orderly mind.

It was occasionally suggested that the Germans wanted to keep the timetable of Napoleon in his Russian campaign. This is not likely, as the outcome of his campaign did not invite imitation. The French emperor had started his drive on June 24, 1812. The Wehrmacht opened on June 22. Napoleon reached Moscow on September 14. The Germans obviously planned their arrival earlier in the season.

The Red Army.—Although extremely reluctant to give information about its armed forces, the Russian government lost no opportunity in claiming their unconquerable strength. Official parades to which foreign representatives had access showed superlatively trained units, not in large numbers, but with excellent equipment. United States Intelligence reported estimated Russian first-line forces at 4,110,000 men, with 3,140,000 trained reservists of which 110,000 and 40,000 respectively were in the air force. This proved to be an underestimate.

After its territorial acquisitions in 1940, the Soviet Union had more than 192,000,000 inhabitants. Compulsory military service was enforced, and an average class of draft age numbered 1,600,000, of whom only 4.4 per cent were physically unfit. Military service began at 19 and lasted 2 years in the infantry, 3 years in the coast guard, and 4 years in the navy and air force. After their active service, the men were on furlough for the balance of a five-year period. Thereafter, they were enlisted in the army reserve for three terms up to the ages of 35, 45, and 50 for enlisted men and 60 for officers. In 1941, 11,000,000 Russians had received full training, and about the same number were partially trained. Guerilla warfare was part of the Russian defensive pattern and training.

The Russian armament system was based upon the principle of fire power. In 1938, a Russian Army Corps, with all its weapons in line, could throw 79 tons of projectiles a minute, in contrast to 61 for a French Corps and 60 for a German. The same principles prevailed in the Red Air Force. In 1938, Russian military leaders considered their air force to be as strong as those of Germany, France, and Great Britain combined. One bomb salvo from the Russian Air Force was figured at 6,000 tons, compared to 3,000 for the Germans, 1,700 for the French, and 1,500 for the British.

Such theories were obsolete by 1941 standards. What mattered was how many pieces of artillery and small arms could be thrown into mobile action. The Germans excelled in this field, provided that good communications were available. The important factor in the air was the number of planes able to reach the target despite anti-aircraft fire and interception. The German planes, faster and more heavily protected than their Russian counterparts, had the advantage.

The total number of Russian tanks did not exceed 10,000 when the Wehrmacht attacked. The principal light tank models in use in the Red Army were the T-60, developed from the amphibious 5.8-ton model, equipped with one

20-mm. cannon and one machine gun, and the T-70, slightly heavier than the T-60, with reinforced armor mounting a 45-mm. cannon. The medium T-34 tank had a top speed of 31 miles an hour (faster than any other Russian model), a range of 160 miles, and was equipped with one 76-mm. cannon and two machine guns. Light and medium tanks, except for the T-34 in 1941, were not all welded, making them particularly vulnerable in certain spots known to the Wehrmacht. Two heavy types were all welded: the KV (42.3 tons) and the KV-2 (52 tons). Soviet cavalry was only partly mechanized, and a great number of mounted saber regiments were still on active duty.

The backbone of Russian artillery was the 76-mm. field cannon, a weapon superior to its German counterpart. Russian field artillery equipment also included a 45-mm. cannon, the lightest field gun in use, to be drawn by nine men. The principal medium pieces included the 122-mm. cannon and the 122- and 152-mm. howitzer. Superheavy artillery, frequently displayed in parades and newsreels, was not available in large numbers and did not play an important part in the fighting. The Russians used mortars of 50, 82, and 122mm. caliber. The Red Army's secret weapon was the "Kostikov's gun," named after the engineer who designed it and later popularly referred to as *Katyusha.* It was a truck-mounted, rocket-launching platform. In the early stages of the war, Kostikov's gun was not fired by regular artillerymen, but picked crews of *NKVD* (secret police) troops.

Principal Red fighter planes were the light MIG, the heavier YAK with water-cooled engine, the LAGG, and the Chaika. The main Russian bombers were the PE-2 and the PE-3. A special attack plane, the IL, better known as the *Stormovik,* a heavy and rather slow single-engined machine designed for attacks on ground forces and artillery emplacements, proved to be very effective. While the technical development of the Soviet planes was inferior to Luftwaffe standards, their special winter equipment was definitely superior. In winter, skis were fixed on the landing gear, and special antifreeze compounds kept the engines operating at even the lowest temperatures. German air superiority during the warm season was lost in winter.

The Russian commissar of defense and acting commander-in-chief was Marshal Semyon Timoshenko. His Chief of Staff, Gen. Kyril Meretskov, was known from the Finnish campaign. The Russian armies were divided into three groups assigned to protect the Soviet Union's most important cities: Marshal Klimenti E. Voroshilov in charge of the Leningrad sector, Marshal Timoshenko of the Moscow sector, and Marshal Semyon N. Budyonny of the Kiev sector.

The leading architect of Russian strategy, vice commissar of defense and military adviser to Joseph Stalin, was Marshal Boris Shaposhnikov who had served with distinction under the czarist regime.

If there were any offensive plans against Germany in the Russian archives, they were not apparent in the initial stages of the war. The historical pattern of Russian defensive action called for an initial retreat to lure the aggressor into the vastness of Russian space. Shaposhnikov's strategy followed the czarist Russia's traditions. After inflicting as many casualties upon the attackers as possible, the Russian armies were to retire in good order, even if it meant the abandonment of very important territory. Guerillas were to harass the German supply system (as the Cossacks raided the *Grande Armée* lines in 1812). With Russian reserves gradually moving up from the rear, the invading army was to be weakened not only by fighting losses but also by the necessity of detaching an ever larger number of troops to guard its supply lines. According to Shaposhnikov, the Red Army should remain elastic, acting as a huge spring which would bend backward without breaking and then recoil with tremendous violence as soon as Russian counterpressure was stronger than German pressure.

The number of Russian divisions along the western border was not officially revealed. Estimates varied from 75 to 180 divisions, with the latter figure probably close to the facts. Another 50 divisions were kept in the Far East along the Manchurian border. Other substantial forces, estimated at no less than 35 divisions, were stationed in the regions bordering the Middle East to protect the Caucasus in case the Wehrmacht overran Egypt, Suez, and Palestine, or passed through Turkey.

The central Russian Army Group (Moscow) was stronger than the northern (Leningrad) and the southern (Kiev) groups, but not to the extent that the Germans supposed.

Opening of Hostilities.—Without warning, the Wehrmacht attacked the Soviet Union in the early morning hours of June 22, 1941. With huge armadas of Luftwaffe planes overhead and spearheaded by the most formidable array of armor yet employed in the war, German columns drove from East Prussia in the direction of Kaunas, Grodno, and Bialystok and from central Poland to Brest-Litovsk and into the region east of Lublin. Diversionary thrusts on a smaller scale were carried out over the Carpathian range and along the Rumanian border. The initial impact was tremendous. By June 24, Kaunas, Grodno, and Brest-Litovsk were already in German hands. It appeared that the Russians had been caught off guard and were unable to stem the German advance, although the first communiqués issued by Moscow were rather optimistic in tone.

Adolf Hitler announced by radio to his people that another aggression was under way.

"It was a difficult step for me," the führer said, "to send my minister to Moscow in order to work against the British policy of encirclement. I hoped that it would be possible to lessen the tension [between Germany and Russia]." Referring to Russian claims on Rumania, Hitler stated that Rumania had asked for German and Italian guarantees of the integrity of the rest of her territory before acceding to the Soviet demands, and that he had decided to give these guarantees "with a heavy heart." According to Hitler, Molotov asked for Russia the right of unrestricted passage through the Dardanelles and for bases in the Bosporus. Hitler then denounced Russia for concluding a pact of friendship with Yugoslavia after the anti-German coup. Without going into details, Hitler charged his opponents with planning to involve Germany in a long war and, with the help of United States' supplies, to throttle the Reich. He concluded his address as follows:

"The moment has come when waiting would be a crime against Germany. For weeks, the Russians have committed border violations and

Red planes have been flying over German territory. The march of the German armies has no precedent in history. Together with the Finns, we stand firm from Narvik to the Carpathians. On the Danube, and on the shores of the Black Sea under the command of Marshal Antonescu, German and Rumanian soldiers are united. The task is to safeguard Europe and thus save all. I have therefore decided today to give the fate of the German people, of the Reich, and of Europe, again into the hands of our soldiers."

Six hours after German troops invaded Soviet territory, Molotov delivered an address to the Russian people on behalf of Joseph Stalin. He emphasized that the Soviet Union had faithfully abided by her pact with Germany and called the German attack a perfidy unparalleled in the history of civilized nations. Orders had been given to the Red Army to "repulse this predatory assault, which started under a pretext that is a sheer lie." Molotov expressed confidence that a crushing blow would be inflicted upon Russia's former nonaggression pact partner.

Britain's reaction to the latest German act of aggression was of crucial importance. One school of thought in Germany still believed, despite the failure of Hess' mission, that England, traditionally suspicious of bolshevism, either would consider another German offer of peace or would refrain from active assistance to Russia. Such hopes were promptly dashed in a broadcast by Churchill.

"We are resolved to destroy Hitler and every vestige of the Nazi regime," he said. "We will give whatever help we can to Russia and the Russian people. We will appeal to our friends and Allies to take the same course. We have offered to the government of Soviet Russia any technical or economic assistance in our power."

The United States reaction to the German attack was expressed on June 23 by Undersecretary of State Sumner Welles, speaking for the president. Mr. Welles reiterated American distaste for communism, but declared that Hitler was the immediate danger and that Hitler's foes deserved United States help.

The most complimentary comment on the attack came from Spain, where Ramón Serrano Suñer, foreign minister and brother-in-law of General Franco, told a gathering in Madrid that the Soviets must be exterminated. The Spaniard spoke of the Russian campaign as a crusade, a term which was frequently used in the Axis camp.

The Finnish government, despite Hitler's claim that the Finns stood firmly with the Germans, denied aggressive intentions and called its military measures purely defensive. On June 26, however, the Helsinki government, charging Red air attacks on Finnish territory, declared war on the Soviet Union. Field Marshal Mannerheim assumed supreme command. His order of the day, contradicting assertions of Finnish defensive aims, stated that the sword would not be sheathed until the whole of Karelia was incorporated into Finland.

Lend-Lease Extended to Russia.—According to provisions of the law, only countries whose defense was vital to United States security were entitled to lend-lease. Analysts in Washington came to the conclusion that the conquest of Russia would remove armed resistance from Germany's eastern flank and extend that flank to the Pacific. It would also furnish Germany with invaluable resources and make possible an all-out attack on Britain and the conquest of North Africa.

Early in August, Harry Hopkins, an adviser to President Roosevelt, flew to Moscow to meet Stalin. Two weeks after his return, lend-lease was granted to the Soviet Union, starting with short-range bombers, pursuit planes, tanks, and antitank guns. It was understood that gasoline, food, and raw materials would also be delivered, if needed. The British, although in urgent need of war material and all kinds of civilian supplies, sent planes and tanks to Russia. On July 9, the London Ministry of Economic Warfare announced the completion of arrangements for large-scale assistance to the USSR. Neither the United States nor Britain delivered their most modern weapons. During the first year of lend-lease, Russia received 3,052 planes, 4,084 tanks, 30,031 vehicles of various types, and 831,000 tons of miscellaneous supplies.

For reasons of urgency, most of these supplies were shipped along the relatively short but precarious northern route to Murmansk. This route was flanked by German air bases in Norway and Finland and led through waters infested by German submarines based in Norway. The British Navy suffered heavy losses on the Murmansk run.

The military situation in Russia, during the fall and winter of 1941–1942, was extremely critical. It can be stated without exaggeration that the final German defeat in Russia would not have been possible without United States and British equipment to make up for a part of the Red Army's losses. The Soviet government, however, was reluctant to give publicity to Allied assistance.

Russian Pacts. — Immediately after Churchill's radio address, Sir Stafford Cripps went to Moscow to meet Joseph Stalin. On July 13, a British-Russian pact was announced in which each country pledged itself to give the other full assistance and also agreed that neither would conclude a separate peace. On July 15, Churchill termed the pact with Russia an alliance. It was later extended to a period of 20 years.

Under the sponsorship of the British government, the Russian ambassador to Britain, Ivan Maisky, had no trouble in concluding alliances with Norway, the Netherlands, and Czechoslovakia. The problem of coming to terms with the Polish government in exile, still resentful of the Soviet attack in 1939, was more complex. On July 30, after two members of the Polish government had resigned in protest and another had refused to sign the pact, Gen. Wladyslaw Sikorski, on behalf of Poland, signed a treaty of peace with the USSR which also pledged cooperation in the struggle against Germany.

The Atlantic Charter.—On August 14, 1941, a report was released from the White House announcing that the president of the United States and the prime minister of Great Britain had met on board H. M. S. *Prince of Wales* off the coast of Newfoundland, and had agreed upon certain common principles in the national policies of their respective countries on which they based their hopes for a better future for the world. These common principles between the United States and Great Britain, were referred to as the Atlantic Charter (q.v.).

The Charter was signed by Franklin Delano Roosevelt and Winston S. Churchill. The Brit-

ish minister of supply, Lord Beaverbrook, who was present at the meeting, proceeded to Washington to discuss the question of United States supplies for Great Britain and the Soviet Union. British-United States economic relations were to be adjusted by lend-lease. Great Britain owed the United States $425,000,000 for supplies delivered prior to lend-lease, and the Reconstruction Finance Corporation was authorized to grant a loan to Britain to pay that debt.

The German Offensive in Russia. — After two days of the Wehrmacht's drive from East Prussia and Poland, a huge pincers movement started. The objective was Minsk, the first main target on the road to Moscow. Pressure was exerted along the line running between Bialystok, Wolkowysk, and Brest-Litovsk. Frantically counterattacking without adequate air and armored support, Russian infantry forces were quickly defeated. The Russian-planned retreat was speeded up and thrown off balance. German-armored spearheads, advancing to the limit of their range, pushed on rapidly toward Kobryn en route to the important railway junction of Baranowicze. Other mobile units crossed the Niemen River, capturing Vilnius on June 26. The von Leeb army group raced toward Riga. Within four days the whole of Lithuania was crossed. One of von Bock's pincers threatened Minsk from the north and another arm, along the northern edge of the Pripet Marshes, drove on to envelop Minsk from the south. Two deep wedges penetrated the Russian lines, and a huge kettle formed. With German panzers reported in the region of Minsk, the northern and southern German spearheads met.

The stubbornness of Russian resistance, under most difficult conditions, surprised the Wehrmacht. In previous campaigns, the German infantry had seen relatively little action except for mopping up operations. In Russia when the panzers drove deep into the flat country, Red Army units, left to guard the rear, attacked German infantry; pitched battles were fought in which the outcome depended upon available equipment. When German and Russian forces met in about equal numbers and equal equipment, the Wehrmacht occasionally suffered local setbacks. In the opening stages of the campaign, such setbacks were always more than offset by the progress in other sectors. The battle picture was sometimes confused, with several opposing echelons encircling each other. It was partly due to such confusion that the Russian central armies escaped irreparable defeat in the Battle of Minsk. Another factor in the salvaging of substantial parts of Marshal Timoshenko's army was the use of light, man-drawn field guns. Even small units had some artillery support. The attitude of the Russian soldiers under aerial bombardment also helped to account for the survival of a large proportion of the battered army. The nerves of the sturdy Russian peasants were little affected by air bombing and strafing.

The Germans wrongly termed the Battle of Minsk a battle of annihilation. They put the final figure of captives at 323,000, with total Red casualties reaching 500,000. It was obvious that German reports were exaggerated, but Russia's situation was undoubtedly critical. On July 2, Stalin admitted the loss of Lithuania, the greater part of Latvia, and western White Russia and reported a growing threat to the Ukraine. He frankly described the nation's grave peril, but added: "Invincible armies do not exist and have never existed. We must win."

Stalin's appeal culminated in an order to the Russian people to carry out a "scorched earth policy." The people were told to destroy their property, including homesteads and supplies of all kinds, rather than surrender it to the Germans. This order was faithfully carried out. As a result, the Wehrmacht, accustomed to living on the country it invaded, had to depend on its own supplies, which could not be transported fast enough to keep up with the marching troops.

Guerrilla warfare was conducted on a large scale, and trained men who had not reached the mobilization centers on time formed bands, bases being *kolkhoz* farms and factories. The guerrillas took the following oath: "I, a Red guerrilla, swear to my comrades in arms that I shall be brave, disciplined, and merciless to the enemy. To the end of my days I shall remain faithful to my country, my party, and my leader, Stalin. If I break this oath, may severe punishment be meted out to me at the hands of my comrades." Close cooperation between the people and the guerillas enabled the Russian High Command to keep them supplied through intricate channels, even when the battle lines were far away. Their tactics were to ambush Wehrmacht columns, to attack advanced air bases, to destroy transportation lines, and to harass panzers. When the German supply columns lagged behind the armor, panzer divisions would radio for gas trucks.

Mounted Red guerrillas, constantly on the alert, listened in on these calls and raced to the spot to attack the German tanks with inflammable liquids while they were immobilized.

Simultaneously with the organization of guerrilla warfare in Russia, the Kremlin called on communists in all occupied countries to join in fighting the invaders. Underground resistance already existed but was poorly organized. No matter how few in numbers, communists everywhere were fanatically devoted to Russia and experienced in underground activities. The western and central European underground helped somewhat to lessen the terrific pressure upon the Red armies.

In the summer of 1941, former Russian Foreign Commissar Maxim Litvinov urged Great Britain to attack the European continent to relieve the eastern front. British preparations were not far enough advanced to permit such an attempt. The empire had to concentrate its forces for defense of the home islands and of the Middle East, where the vital interests of Russia and Great Britain coincided.

Bock's army group raced on to prevent the Moscow group from rallying and regrouping to hold what the Germans expected to be the Stalin Line. German air observers reported the Russians in chaotic dissolution. Actually, although the Red Army's marching form was never up to Wehrmacht standards, and their retreat was not orderly, the Red Army commanders still had most of their men under control. The strength of the stand they were able to make in and around Smolensk was much greater than Bock expected.

In the extreme north, General Falkenhorst did not reach his objective, which was to sever the railroads running southward from Murmansk and Archangel respectively, linking Leningrad and Moscow with the White Sea ports and interconnecting at Vologda. The Red group at

Leningrad deployed larger forces than the Germans expected to protect the vital communication lines, and the Arctic wasteland was not a suitable battleground for mechanized forces. Early German reports of the capture of Kandalaksha and the severance of the Murmansk line were not borne out by the facts. The German High Command was dissatisfied with the Finns. The latter, weakened by losses during the previous war, showed no offensive strength. Even on the shores of the Gulf of Finland, where Mannerheim's main forces were concentrated, the advance was disappointingly slow and did not reach Viipuri, close to the border, until August 30. At that time, the right wing of Leeb's army, driving on Leningrad through the Baltic States, was already at Luga, 90 miles south of Leningrad. The plan to carry out a huge encirclement in the north lagged far behind the German timetable.

Riga fell to the Germans on July 1; the Wehrmacht crossed the Dvina and also captured Tallinn. On August 12, the Germans considered the capture of the Baltic States to be complete. Only Ösel and Dagö islands, off the Gulf of Riga, remained in Russian hands until the fourth and fifth months of the campaign.

Marshal Budyonny's Kiev group did not join in the speedy retreat of the central army groups. Budyonny attempted to delay the German advance by holding out in forward areas, where Bock's right flank could be threatened. The Red Army's position in Galicia, however, was precarious. Pushing over the Carpathian range from Hungary on barely passable roads, Rundstedt's Hungarian and Slovak auxiliaries, supported by German armor, drove into the rear of the Russians through the Galician oilfields. Red resistance at Stanislawow was strong, and Timoshenko's diversionary counterattacks from Cernăuti were quite effective. Rundstedt's left wing outflanked eastern Galicia from the north through Kovel and forced Budyonny to evacuate the Galician city of Lwów. Cernăuti was invested on July 4, and Budyonny, outmaneuvered, had to retreat and could not prevent the Wehrmacht's attack from spreading steadily southward. On July 17, Kishinev in Bessarabia was taken.

Rundstedt aimed to maneuver his opponent into a natural trap formed by the Dniester River on the west, the Dnieper River on the east, and the Black Sea on the south. After one month of fighting in Bessarabia, the Germans crossed the Dniester and, approaching Kiev, moved into the region of Vinnitsa. Budyonny ordered his troops into prepared positions near the Ukrainian capital. By falling back farther to the east and abandoning Kiev, Budyonny could probably have avoided the trap, but he might have exposed the southern flank of Smolensk's defenses. During the first month of the campaign, the Wehrmacht occupied 175,000 square miles of Russian territory.

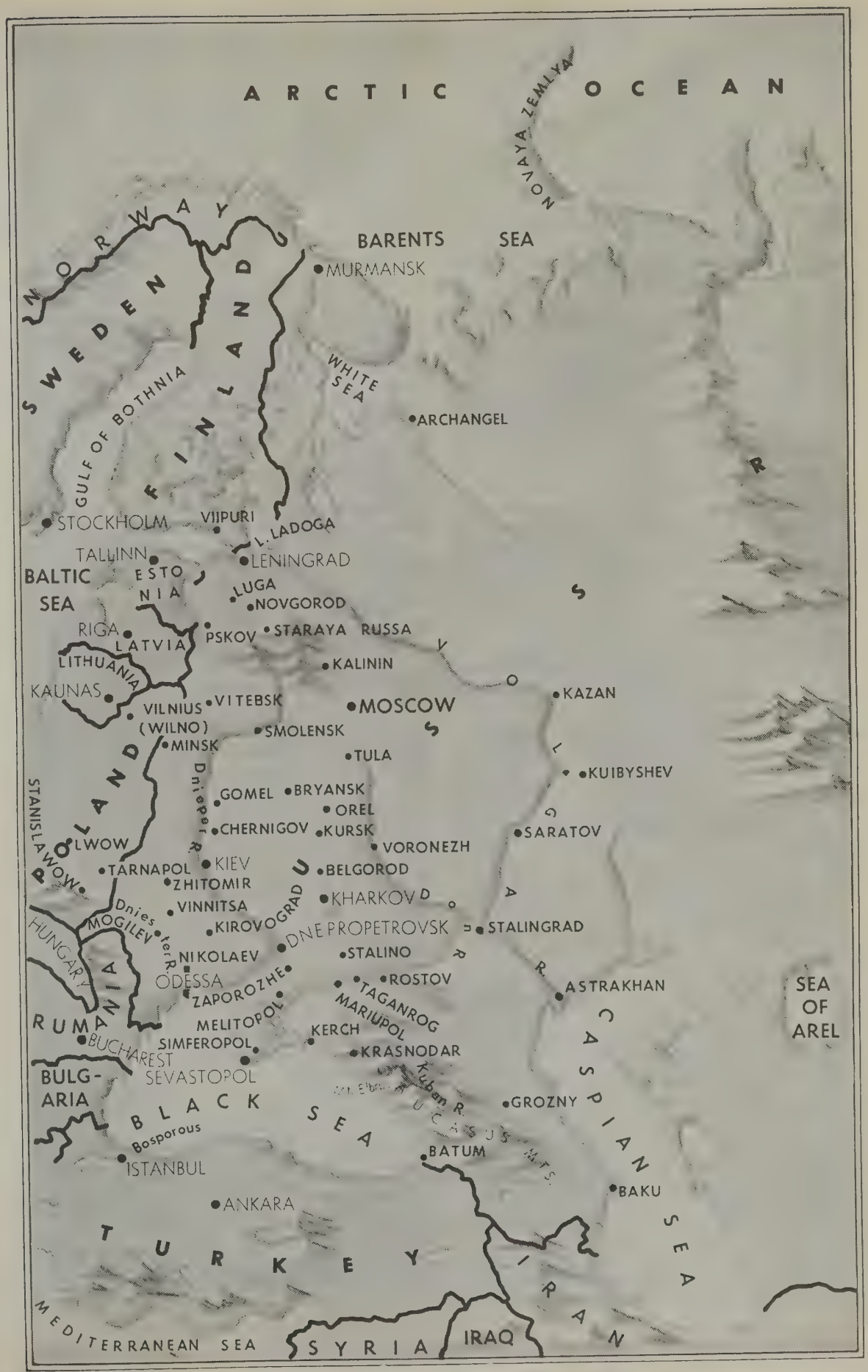
Following the official claim that von Bock had captured Smolensk on July 17, unofficial German reports forecast the dissolution of Russian resistance and insisted that the three main cities of Russia were about to fall. The Spanish Blue Division, on its way to Russia, was believed to have come too late to take part in the fighting. The Red Army's last reserves, according to German sources, were thrown into a losing battle on the central front.

On July 17, Smolensk still remained partly in Russian hands, and total destruction of the city by bombs and shells failed tc dislodge Timoshenko's forces. Von Bock's army was drawn up in the shape of a five-pronged fork. The region offered many natural obstacles such as water courses, marshes, small lakes, and thick woods. The Red Army made perfect use of them, forming islands of resistance, defending narrow passages between lakes, and using camouflage to the utmost. The Wehrmacht's losses in armor mounted steadily, while the Russians used few tanks, relying on antitank weapons. German losses were larger than those of the enemy. Isolated concrete fortifications, built before 1937, seemed to confirm the German belief that they were about to crush the Stalin Line. On August 7, 1941, the Red Army lost the rest of the ruins of Smolensk. The Germans claimed a decisive victory and again boasted of smashing the Stalin Line and of opening the way to Moscow, which had been under air attack since July 21. Timoshensko's reserves held firm. The Germans had won a tactical victory, but not even the capture of the 300,000 prisoners they claimed could alter the fact that it was by no means decisive.

Von Bock's victory fell short of its ultimate goal of annihilating the main Russian forces. Another major battle on the central front could only be fought after thorough regroupment and after smashing the Kiev wedge which flanked the central and southern German Army Groups. This wedge virtually severed the most crucial communication line between the forces commanded by von Bock and von Rundstedt.

A major battle, fought near Uman between August 10 and 12, ended in a Russian defeat. Rundstedt's plan of driving Budyonny's army group into the water trap seemed on the verge of success. The Red Army still clung to its Kiev bridgehead across the Dnieper River, in an effort to flank the attackers, but it could not prevent Kleist's armor from overrunning the country along the Bug River, driving on to Kirovograd and the lower Dnieper River. The important industrial region of Dnepropetrovsk, with the iron ore deposits of Krivoi Rog and the manganese deposits of Nikopol, fell into German hands. On August 24, the Russians, following their scorched earth policy, blew up the great Dnieper dam at Zaporozhe. Budyonny ordered his defeated armies to fall back in order to avoid annihilation between the two rivers and the sea. This operation, carried out haphazardly, was extremely costly. Some of Budyonny's forces, unable to reach the Dnieper, retreated to the big Black Sea port of Odessa, which soon came under siege.

Budyonny had to choose between fighting the Germans at Kiev, which could hardly be held for any length of time, or falling back to better positions to await reserves and protect the industrial city of Kharkov and the Donets region. The Red marshal decided to make a stand at Kiev and suffered the worst defeat that any Russian Army commander experienced during the war. The Germans claimed 665,000 prisoners. Budyonny's army group was reduced to remnants, able only to fight rear-guard actions. It seemed doubtful that they could delay the German advance long enough to bring up reserves from far in the rear to organize effective resistance. With Timoshenko's group expecting another violent German assault, and Voroshilov's armies forced to give


ARCTIC OCEAN
NOVAYA ZEMLYA
BARENTS SEA
MURMANSK
NORWAY
SWEDEN
FINLAND
GULF OF BOTHNIA
WHITE SEA
ARCHANGEL
STOCKHOLM
VIIPURI
L. LADOGA
TALLINN
LENINGRAD
BALTIC SEA
ESTONIA
LUGA
NOVGOROD
RIGA
LATVIA
PSKOV
STARAYA RUSSA
LITHUANIA
KALININ
KAUNAS
VILNIUS (WILNO)
VITEBSK
MOSCOW
KAZAN
SMOLENSK
MINSK
TULA
KUIBYSHEV
POLAND
Dnieper R.
GOMEL
BRYANSK
OREL
CHERNIGOV
KURSK
SARATOV
STANISLAWOW
LWOW
VORONEZH
TARNAPOL
KIEV
BELGOROD
ZHITOMIR
KHARKOV
VINNITSA
Dniester R.
MOGILEV
KIROVOGRAD
DNEPROPETROVSK
STALINGRAD
HUNGARY
NIKOLAEV
STALINO
ODESSA
ROSTOV
ZAPOROZHE
TAGANROG
ASTRAKHAN
SEA OF AREL
RUMANIA
MELITOPOL
MARIUPOL
KERCH
BUCHAREST
SIMFEROPOL
KRASNODAR
BULGARIA
SEVASTOPOL
Kuban R.
GROZNY
BLACK SEA
CASPIAN SEA
Bosporous
BATUM
CAUCASUS MTS.
ISTANBUL
BAKU
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IRAN
MEDITERRANEAN SEA
SYRIA
IRAQ

ground in the north, the situation looked extremely precarious for the Red Army.

Despite their victory at Kiev and the conquest of 125,000 and 65,000 square miles respectively in the second and third months of the campaign, the Germans were faced with a critical problem. The goal of Rundstedt's armies was the Caucasus. Even discounting the resistance of the remnants of the Kiev group, the season of operational weather was considered too short in which to drive that far. A considerable portion of the armor and the planes assigned to Rundstedt's group was therefore switched back to Bock for another "Battle of Moscow."

With what he had left, von Rundstedt took up the pursuit of the beaten enemy. The speed of his advance was delayed less by actual resistance than by communication troubles. Heavy rains transformed dirt roads into seas of mud. Supply columns were held up. Despite rain and mud, Mariupol, Taganrog, Stalino, and Kharkov were taken. Odessa held out until October 16. The defenders battled for the almost unfortified port city, street by street. The bulk of their forces was finally evacuated by sea and shipped to Sevastopol.

Joseph Stalin took charge of the Commissariat of Defense, becoming the Red Army's commander-in-chief and later assuming the rank of a marshal of the Soviet Union. Budyonny and Voroshilov were relieved of their field commands and assigned to the training of reserves. General Khorzin was put in charge of the defenses of Leningrad, while Gen. Georgi K. Zhukov defended Moscow.

The Russian people shouldered the increasingly heavy burden of the war with fortitude. Fifth column activity was admitted by the Russians only in the "Volga German Republic," where farmers of German stock had lived for centuries without losing their basically Teutonic characteristics. Finally the Supreme Soviet announced the abolition of the Volga German Republic, "as a result of their failure to report on preparations for diversion being conducted by many among them." The population of the Volga Republic was deported to undisclosed destinations, and its territory was divided between two adjoining regions.

In the north, Leeb's left flank reached Narva on the Russia-Estonia border, while the right wing took Pskov, Staraya Russa, and Novgorod, overcoming dogged Red rear-guard resistance. Tallinn resisted until August 30. The drive to encircle Leningrad was on!

Leningrad and the adjoining naval base of Kronstadt were soon under fire. Leningrad could not be termed a fortress, but Marshal Voroshilov, still in command at that time, put the entire civil and military population to work preparing the city's defenses. Although the attackers' ring never closed tightly, the siege of Leningrad was one of the most protracted in modern history. The city's supplies were adequate for a short period only. Whatever was needed in addition to these supplies had to be brought in over Lake Ladoga through gaps in the blockade. Some factories worked underground, with primitive conditions, to supply the defenders with ammunition. Constant sorties attempted to press back the besiegers.

By the end of September, with Russian counterattacks halted, von Bock had massed about 60 infantry and 15 panzer divisions, the latter later increased to 20. The Luftwaffe was assembled in the greatest strength that available bases could accommodate. The Russian Air Force was outnumbered at least 3 to 1; the Red armored forces, 5 to 2. The Luftwaffe's attempts to smash the Russian Moscow group's reserves were hampered by cloudy weather and superlative camouflage. German raids on Moscow were costly and of limited effect. The great drive opened on October 2. The next day, before conclusive results were attained, Adolf Hitler delivered a speech in which he referred to the mighty attack under way and promised the imminent collapse of all Russian resistance.

The situation in the central sector was extremely critical for Russia. The German troops formed a huge semicircle, with Moscow in its center, and drew steadily nearer to the capital. The obvious aim was to close the giant pincers behind Moscow. The Red Army could no longer afford to sacrifice space in order to gain time, and fought for every inch of ground as best it could against the overwhelming mechanized might of the Wehrmacht. Guderian took Orel on October 12; Weichs captured Bryansk on October 13; the German Seventh Army took Kaluga, and two newly formed reserve armies seized Vyazma and Rzhev the next day.

When the Germans were in the outskirts of Tula, the rumble of artillery fire was audible in Moscow. The Russian government moved to Kuibyshev, farther to the east, and Stalin ordered Moscow to be defended street by street if the Germans reached the capital.

On October 23, almost one month sooner than expected, the first snow fell along the central front. The first snowfall in Russia had heralded disaster to Napoleon's *Grand Armée* in 1812. Also, the initial impact of Bock's drive had lessened. He had to gather fresh strength before attempting to administer a knockout blow. His lines, formed to meet the exigencies of the battle rather than according to a well conceived plan, were good springboards for another assault but were not well suited for defense. The German High Command had to make a crucial choice: to continue the offensive, despite the beginning of the winter season, or to take up defensive positions. Necessary defensive adjustments might have been completed without Russian interference, but failure to reach Moscow in a continued offensive was bound to lead to severe losses. The Germans chose to continue the drive, underestimating the strength of the Red Central Army Group and overestimating the results of Rundstedt's continued advance in the south. Probably Hitler urgently requested the attack, in an effort to make good his premature boasts.

The German Twelfth Army set out to conquer the Crimean Peninsula, connected to the southern Russian mainland by the narrow, bottleneck-shaped Perekop Isthmus. The improvised defenses of the isthmus could not hold back the attackers. Despite the gallant Russian defense, lack of heavy equipment and the successful use of German paratroopers accounted for the relatively quick collapse of the Russian positions. Theodosia and Simferopol fell, and the Twelfth Army moved on Kerch, gateway to the narrow straits leading toward the western foothills of the Caucasian mountains and a good base for a later drive, but still distant from the coveted oil wells. German patrols even crossed the straits but ran into superior Red reserves. An attempt to

take Sevastopol by a surprise coup ended in failure. Sevastopol was one of the strongest fortresses in the world, amply equipped with heavy artillery.

Marshal Timoshenko, now in charge in the south, had traded space for time. By not throwing many of his valuable reserves into battles which he considered premature, he succeeded in building up a considerable force east of the Don River. His opponent, von Rundstedt, planned to move to a line running from Kharkov along the Donets River, and from its mouth along the Don to the shore of the Sea of Azov. The unconquered fortress of Sevastopol remained an uncomfortable thorn in his side. To occupy this line, Rundstedt had to take Rostov-on-the-Don. General Kleist's panzer army, still at Rundstedt's disposal, was assigned to the task and occupied the city on November 23. Beyond the thickly frozen Don River, three Red armies of Timoshenko's group awaited the attack. Kleist had only three armored, one motorized, and one infantry division in line when the Reds, moving over the ice of the river, struck at Rostov. On November 30, the city was retaken, and the Germans had to retreat. The Russian drive reached Stalino on December 20 and recaptured Kerch ten days later.

The German retreat was orderly, and the Russians did not succeed in breaking through at any point. The area regained by the Red Army in the south was of moderate strategic and economic importance. The moral effect of the German setback was tremendous. For the first time during the campaign, the Russians scored a victory. For the first time, their strategic plan of retreat followed by a counter-drive of massed reserves was put into effect successfully. Stalin's statement that there were no invincible armies was confirmed.

While Timoshenko was attacking, Zhukov was engaged in a precarious defensive action on the central front, and the defenders of Leningrad were hard-pressed. The number of Bock's forces was limited only by available deployment space. The German marshal threw all the forces he could muster into the battle. Three German divisions probed the defenses of Tula, but they were severely mauled. Von Leeb tried to drive through a wilderness of forests and marshes to Tikhvin, not far from Leningrad. Even if the drive on Moscow failed, the Germans wanted to sever the Russian supply line between the main armies and Murmansk, where lend-lease and British munitions were unloaded. The attackers reached Tikhvin but were quickly repulsed. General Meretskov struck back at the German forces, recapturing Tikhvin and driving the Wehrmacht toward the Volkhov River. The pressure on Leningrad was eased, and Russia's life line remained open. During the last week of November and the first week in December, the Wehrmacht battered furiously at the Red lines before Moscow. All German movements were repulsed with heavy losses. The German panzer divisions were increasingly paralyzed by low temperatures, and the Wehrmacht's chief offensive arm, the Luftwaffe, disappeared from the skies. By December 5, German offensive power was exhausted. The Russian "spring" recoiled, although its vigor was reduced by extremely high losses. Russian armies began six different attacks, and by December 16, the German retreat became general. The Russian offensive was under way.

German territorial gains had been 80,000 square miles during the fourth month and 50,000 during the fifth month, but Russian advances gradually recaptured part of the lost ground. Losses in men and materiel were undoubtedly extremely high on both sides, but figures given by both Germans and Russians seemed unreliable, if not fantastic.

Hostilities in the Atlantic.—Because the Axis disregarded established rules, the United States had to deviate from former concepts of neutrality in the interest of its security. German and Italian merchant ships in United States ports were seized on March 30, 1941, when their crews were suspected of planning acts of sabotage. In the Atlantic, the attack on the United States freighter *Robin Moor* was followed by other German submarine attacks against vessels flying the United States flag. After the sinking of the *Sessa* on September 11, President Roosevelt, in a world-wide radio address, warned the Axis powers that American warships and planes would attack Axis warships entering waters considered vital to the defense of the United States. The question of using the United States Navy to protect ships carrying lend-lease munitions stirred up a vigorous domestic controversy, but the step was taken.

In September, the *Pink Star* was attacked off Iceland. In October, the tanker *I. C. White* and the freighter *Lehigh* were torpedied in the South Atlantic and the *Bold Venture* in the North Atlantic, all of them outside of the war zone proclaimed by the Germans.

On October 17, the House of Representatives repealed the section of the Neutrality Act of 1939 which made it unlawful to arm United States merchantmen. The Senate amended the bill by repealing the paragraphs of the Neutrality Act prohibiting American vessels from carrying goods or passengers to belligerent nations and from passing through waters designated as combat areas, but the bill and its amendment became law.

The lifting of the shipping ban had far-reaching effects upon Britain and the Soviet Union. The British were fighting a losing battle in the Atlantic, because their losses of shipping space far exceeded the possibility of replacement, even including lend-lease ship deliveries. Russia's supply of war material depended upon British supremacy at sea.

German attacks on United States shipping were not limited to merchantmen. In October the United States destroyer *Kearny,* on patrol off Iceland, was heavily damaged by a torpedo. On October 30, the destroyer *Reuben James* was torpedoed in the same waters and sunk with considerable loss of life. United States warships frequently used depth charges against lurking U-boats, but the measure of their success was not revealed by either side.

British Naval Disasters in the Mediterranean.—In the closing months of 1941, the Royal Navy suffered a series of disasters in the Mediterranean which threatened the defense of North Africa. The 33,950 ton battleship *Nelson* had her bow blown off by a torpedo and was put out of action for 6 months. The 22,000 ton aircraft carrier *Ark Royal* was sunk by a single torpedo. Aside from the gravity of the loss, responsible British circles began to question the efficiency of the construction of British carriers. The 31,000 ton battleship *Barham* was sunk by a salvo of

torpedoes off the coast of Libya with a loss of 800 men. Gibraltar no longer prevented German U-boats from entering the Mediterranean. An inland waterway linked Germany with the southern coast of France. The Wehrmacht was in virtual control of French transportation and communication facilities. U-boats were knocked down and shipped through the Rhine-Rhone canal to the Mediterranean coast where they were reassembled. On December 19, a daring raid by a handful of Italians hit the port of Alexandria, protected by anti-submarine nets, underwater mines, and other obstructions. Clad in diving suits, the Italians succeeded in entering the harbor and fixing limpet bombs on the bottoms of the battleships *Valiant* and *Queen Elizabeth* (30,600 tons each). Explosions blew large holes in the ships, flooding compartments and putting both vessels out of action for many months.

The British fleet in the Mediterranean was left without capital ships, while the Italians, after repairing the damage suffered at Taranto in 1940, had four battleships in service. As large British units had to be hurriedly dispatched to the threatened Far East, and as others were engaged in guarding precarious supply lanes, no reinforcements were immediately available. In addition, the British High Command had to be prepared for possible air and seaborne invasions of Egypt, Svria, or Palestine (which did not materialize).

British Redeployment in the Middle East.—British plans to build up an army in Egypt to deal with the situation created by the arrival of Rommel's Afrika Korps were hampered by the course of events in Russia and in the Far East. With the Germans advancing in southern Russia, the threat to the Middle East from the north increased. The recapture of Rostov-on-the-Don by the Russians lessened the threat but did not eliminate it. The British decided to build a force to defend the lifeline areas against a possible German invasion. The few available divisions were no match for the southern German Army Group in Russia, but they strained the tenuous British forces in North Africa. Australian troops were sent to hold the new defense line referred to as the Levant-Caspian front.

The forces needed to bring the Egyptian-Libyan campaign to a successful conclusion were much smaller than those used in the major European theaters of war. Scarcity of communications and of operational space restricted the number of troops, but the British were hard pressed to furnish even a relatively small number when General Auchinleck planned his drive to conquer North Africa.

Battles in Libya.—During the summer of 1941, the garrison of Tobruk was reinforced, and stores of supplies were built up in order to prepare the fortress as an offensive base for future operations. Colonial units plus the garrison of Tobruk (referred to as the 70th Division) were called the Eighth Army and put under the command of Gen. Sir Alan Cunningham of South African fame, who took his orders from Auchinleck. The 70th Division, with the 32d Tank Brigade, and imperial forces on the Egyptian border formed the Eighth Army. The Eighth was joined by the 7th Armored Division, partly equipped with United States 14-ton Honey tanks, the 22d Armored Brigade, New Zealanders, Indians, and South Africans. Most of the Axis forces, under Gen. Erwin Rommel, were concentrated around Tobruk, obviously the main obstacle to combat before fighting a major engagement on the Egyptian frontier. The Axis forces under Rommel had the German 15th and 21st Panzer and the 19th Light Infantry divisions in line, in addition to the Italian Ariete Division and six understrength Italian infantry divisions.

The British plan of attack assumed that Rommel would stage an all-out assault on Tobruk and was set for before dawn on Nov. 18, 1941. It was not postponed, even though the expected German attack on Tobruk failed to materialize, because Rommel's deployment seemed to correspond to the British blueprint. Air preparation, planned on a large scale, was hampered by a tremendous thunderstorm. The RAF was not able to function until hours after the land attack had started, following a heavy artillery barrage. The downpour also inundated German airfields and prevented dive bombers from taking off during the opening phases of the battle. Both sides suffered substantial losses in subsequent air battles, although the German Messerschmitt 109 F was superior to the Britsh fighter planes. The opening of the British drive was announced in rather exuberant terms by Prime Minister Churchill, who expected a decisive victory.

The 22d British Brigade met the Italian Ariete Division. The Italians fought harder than usual, but, after losing one third of their armor without repulsing the British, they fell back in reasonable order toward Sidi Rezegh. New Zealanders and Indians, supported by naval shelling, pressed on along the coast toward Tobruk, by-passing the Axis escarpment. The main tank battle developed badly for the Eighth Army. The strategy of splitting the 7th Armored Division into the 4th and 7th Armored Brigades proved disastrous. The 7th Brigade met the panzers at Sidi Rezegh and took a severe beating from their concentrated power for two days. The 22d and 4th Brigades, called hastily as reinforcements, were delayed. The 22d could not disengage itself from the Ariete Division in time, and the 4th was shooting up supply columns instead of racing to the danger spot. When they finally reached the battlefield, little was left of the 7th Brigade's armor, and the 5th South African Brigade had lost 3,800 men and almost completely disintegrated under a German panzer attack.

The German Mark 3 and Mark 4 tanks were superior to any the British could muster. The Mark 3 mounted a 50 mm. and the Mark 4 a 75 mm. cannon, whereas the British tanks had only 37 mm. guns. The German cannon outranged the British by about 800 yards, so the Mark 3s and 4s could fire between 12 and 15 rounds before the British came into range, thus wiping out between 20 and 30 per cent of the attackers. On November 24, Rommel's armor broke through beyond the Egyptian border, mysteriously missing the main British supply dump by about four miles.

General Auchinleck rushed to the battlefield and relieved Cunningham from his command. Realizing that the situation was critical, the British decided to resume the offensive before Rommel could move. Tanks were constantly arriving from the rear area, making up for part of the losses. The British 25-pound cannon, assigned to tank units, proved to be an outstanding antitank weapon.

Evacuating the Egyptian border area, the Germans moved back toward Tobruk, driving a wedge in the British corridor along the coast, but

the situation was soon rectified. On December 10, after costly fighting, the relief of Tobruk was completed. With his position deteriorating, Rommel decided to retreat all along the line. The tables were turned. The Axis position in the coastal border area now became a thorn in the Eighth Army's side, as Tobruk had been in Rommel's.

The Axis had well prepared positions at Gazala (not a settlement, but a geographical name for a stretch of desert). British reconnaissance disclosed that the panzers, too, had suffered serious losses, and that no more than 60 German tanks were ready for action. Superior firepower, however, made them still a formidable opponent for the depleted British armor. Once more the Eighth Army attempted to sandwich the Axis forces. Under cover of dust storms, British armor moved around the Gazala line toward Bomba, behind the Axis forces, while the infantry advanced frontally. Rommel realized the vulnerability of his position in time to pull out.

Despite heavy losses, the Royal Navy was still actively shelling coastal highways. The Axis commander decided to avoid the precarious coastal road. Abandoning Bengasi, Rommel retired across the desert to a spot 100 miles south of the city and dug in south of Agedabia. The reliability of German motorized equipment explained the small German losses. Italian losses were higher, as Italian trucks and cars were fast but unreliable. Advanced British patrols were unable to disrupt the retreat.

After taking Bengasi on Christmas Eve, the British had to try to eliminate the Axis position at the Egyptian border. On Jan. 1, 1942, South Africans attacked Bardia, held by approximately 9,000 Germans and Italians, who surrendered after a sharp engagement. Sollum was taken, and Halfaya capitulated. Churchill, hailing the Eighth Army's successes, disclosed that 11,500 Germans and 13,000 Italians had been killed or wounded and 36,500 prisoners had been captured. Axis tank losses were estimated at 386 and plane losses at 850. Chances to continue the drive toward Tripoli seemed fairly good. On January 7, Rommel withdrew to El Agheila.

In January, three German armored columns made a reconnaissance in strength and found the British extremely weak. Putting the full impact of his power into what had been planned as a reconnaissance, Rommel seized the main road to Bengasi, forcing a number of British tanks from the paved highway to the marshlands, where they had to be abandoned. Packed into one tight column, Rommel's forces thrust diagonally toward a convergence of desert tracks, 75 miles southeast of Bengasi. As little British armor was available, the RAF was called upon to stem the onslaught. Losses were inflicted upon the panzers and their supplying vehicles, but the advance could not be checked. Bengasi was retaken by Axis forces on January 28.

After losing much of the ground it had recently gained, the British Eighth Army stabilized its lines at Tmimi and Gazala. Large amounts of matériel, moved up for the drive on Tripoli, were lost in the retreat. Immediate resumption of their offensive was out of the question. Most of the Cyrenaican airfields were again under German control, giving the Axis an advantage in the air.

Each side had two large ports of supply. The Axis had Tripoli and Bengasi; the British, Tobruk and Alexandria. Both had one paved highway to carry supplies and two inland strongholds. The battle for Cyrenaica had to be fought again.

The Battle of Malta.—With the defense of the eastern Mediterranean temporarily entrusted to British submarine and destroyer flotillas with the support of a few cruisers, shore-based, torpedo-carrying aircraft from England had to be transferred to the Mediterranean.

The defense of Malta became more vitally important than before. If Malta were lost, air attacks on Axis convoys would be almost impossible, and the few British convoys which moved through the Mediterranean would be unprotected. German and Italian aircraft were concentrated to bomb out the tiny isalnd, and as many as 300 bombers a day came over Malta. The RAF on Malta was almost wiped out, but effective ground defenses made Axis losses high.

With United States support, the British attempted to replenish Malta with food, ammunition, and aircraft. In March 1942, the United States aircraft carrier *Wasp* succeeded in carrying plane reinforcements to Malta. A British convoy also reached the island, after beating off a big Italian flotilla. Despite the gallantry and sacrifice, however, Malta's offensive value was greatly reduced during the critical stage of the battles in North Africa.

JAPAN'S PATTERN FOR CONQUEST

The expansion of Japan had begun long before the 20th century dictatorships were established in Europe. The empire's ties with the Axis powers were the product of opportunism rather than kindred ideology. Japan's imperialism had highly realistic aims, although much of its strength and popular support came from such mystic beliefs as the emperor's reputed descent from the Sun Goddess and his divine mission to rule the world. Japanese ambitions grew with success and the apparent weakness of potential opponents.

From 1904 to 1941, Japan was planning to build an empire encompassing the most populated regions of Asia, taking in about one half of the world's total population and a considerable portion of its natural resources. This empire was to be organized along the lines of an industrial feudalism, based upon an economic system of low wages and colossal monopolies. It would be strong enough to defy any attempt to destroy it, and its mass production would offer overwhelming competition for industries working on the basis of relatively high wages, individual initiative, and mass consumption. The foreign trade of other nations was to be ruined by such methods.

With World War II under way, and the strength of two potential rivals in Asia, the British Empire and the USSR, threatened by German military successes, the Japanese government was anxious not only to press the advance into Asia but also to eliminate the United States as a major factor in the Pacific. The defeat of France and the Netherlands was considered an opportunity to take over those countries' Far Eastern possessions. German pressure upon the Vichy government to accede to Japanese demands was accepted as timely assistance, although some of the Japanese realized that their interests in Asia were bound to clash with those of Germany as soon as the Reich conquered Europe and expanded into Africa. Although it was frequently denied by Japanese politicians, their

distrust of Germany tended to hasten the events which led to the outbreak of the United States-Japanese war. Japan wanted to gain an impregnable position before the Germans could establish themselves in Asia.

China and India were more attractive to Japan as prospective fields of expansion than Russia's Asiatic possessions. The latter covered roughly 40 per cent of the continent's surface but was populated by only 4 per cent of its inhabitants. Potential development of this vast area was considered a difficult problem, as the average Japanese was traditionally averse to pioneering abroad. Nevertheless, Japan was anxious to weaken the Soviet Union in the Far East, since it was the Soviet Union's obvious aim to regain what czarist Russia had lost to Japan in the war of 1904–1905 and Soviet Russia had had to concede after the revolution.

In 1938 and 1939 respectively, Russia and Japan engaged in two major clashes, close to the Korean and the border region of Outer Mongolia. Large forces were involved and heavy casualties suffered, and Japan came to realize that Russia was again a great military power. The pact which had been concluded by Japanese Foreign Minister Yosuke Matsuoka in Moscow in 1941 was designed to neutralize the powerful Independent Red Banner Armies along the Manchurian and Korean borders and on Sakhalin Island until Japan could dispose of her rivals.

Prelude to Aggression.—Japan joined the Allies in World War I. Her military contribution was limited chiefly to the conquest of German-held Tsingtao and the occupation of German Pacific islands. As a result of this minor participation, the Japanese Empire, at a cost of about 300 lives, gained control of more than 600 islands and a vast expansion in the Pacific. The Japanese were also able to move temporarily into the Russian Maritime Province, including the harbor fortress of Vladivostok, and into Siberia as far as Irkutsk in 1918. In 1922, Japan forced the Russian government to grant concessions in the northern half of Sakhalin Island, amounting almost to full control of that strategically important region, and to extend Japanese fishery concession in Russian Far Eastern waters in return for the Japanese evacuation of Russian mainland areas. Most of the Siberian coast was thereafter under constant threat of seaborne invasion. This deal was followed by the Japanese purchase of Russian stock in the vital railroad running through Manchuria from Manchouli to Dairen.

Although the Japanese could not impose their will upon the United States and Great Britain. they took a strong stand at the Washington Naval Disarmament Conference of 1922. On Feb. 6, 1922, in his closing speech, Baron Kijuro Shidehara spoke of Japan's "special interests" in China. The conference agreed that the ratio of United States, British, and Japanese capital ships should be 5–5–3. This was advantageous for Japan (although hers was the ratio of 3) because her navy was concentrated in Far Eastern waters, whereas the United States had to guard both the Atlantic and the Pacific, and the British had to patrol all Seven Seas. The United States further agreed to maintain the status quo with regard to fortifications and naval bases in the Aleutians, and in all American islands west of Hawaii, which prevented any further fortification of the Philippines, Guam, Wake, and the Gilbert Islands. Britain accepted a similar obligation for British possessions east of 110° latitude, except for regions near the Dominions.

A Decade of Japanese Aggression: 1931.—With disarmament of the Western Powers in progress, Japan's military preparations were speeded up. The crucial event occurred on Sept. 18, 1931, when the Japanese marched into Manchuria. The United States minister in China, reporting to the State Department, termed this an act of aggression, long planned and carefully executed. On Sept. 22, 1931, United States Secretary of State Henry L. Stimson informed the Japanese ambassador that the responsibility for determining the course of events rested upon Japan.

On Oct. 5, 1931, the League of Nations, discussing the situation in Geneva, was advised by the United States consul there that the League should neither relax its vigilance nor fail to exert its full authority toward regulating the actions of both China and Japan. The United States government would endeavor to reinforce the league's decisions. A United States note to Japan and China called the attention of both governments to their obligations under the Briand-Kellogg Pact.

1932.—On Jan. 7, 1932, the United States government informed China and Japan that it would not admit the legality of any situation created de facto, or anything impairing the right of United States citizens in China, or any treaty brought about by methods contrary to the Briand-Kellogg Pact. The puppet government of Manchuria, installed soon after by the Japanese, was not recognized by the United States.

On Feb. 2, 1932, Sino-Japanese hostilities flared up in Shanghai. The United States offered to mediate. The Chinese accepted the proposal, but the Japanese turned it down. On Aug. 13, 1932, United States Ambassador Joseph C. Grew, in Tokyo, informed the State Department that public animosity in Japan was being built up against foreign nations in general and the United States in particular. He stated that the Japanese military machine was designed for war and would welcome war with unlimited self-confidence.

1933.—In January 1933, after consolidating their position in Manchuria, the Japanese occupied Jehol province in northern China, and the Japanese ambassador in Washington insisted that the "Manchurian incident" was closed.

On Feb. 24, 1933, the League of Nations accepted the report of the Lytton Commission to the effect that the Japanese military operation in Manchuria was not an act of legitimate self-defense, that the puppet regime had been set up contrary to the wishes of the people, and that Japan's action was incompatible with its existing international obligations. Secretary Stimson expressed the agreement of the United States government with the findings and conclusions of the League. On March 27, 1933, Japan gave notice of its intention to withdraw from the League.

1934.—Japanese Foreign Minister Koki Hirota, in a message to Secretary of State Cordell Hull on Feb. 21, 1934, claimed that no question existed between the two countries which could not be amicably solved. Hull replied that he hoped all questions could be solved to the lasting advantage of all concerned. In a further conciliatory gesture, Hirota told Ambassador

Grew that Japan was neither seeking special privileges in China nor threatening Chinese integrity. But the Japanese ambassador in Washington told Secretary Hull that Japan had a superior and special function in connection with the preservation of peace in eastern Asia.

On Dec. 27, 1934, Grew reported that things were said and written in Japan to the effect that it was Japan's destiny to rule the world. The Zaibatsu (leading Japanese industrialists) and extremists in the armed forces had clearly defined aims, while the average Japanese, who had little to gain from his country's conquests, was whipped into a state of frenzy to make him eager to die for the greater glory of his emperor.

The ambassador's report concluded that, unless the United States was prepared to subscribe to a *pax Japonica,* the United States Navy should be built up to full, treaty strength.

On Dec. 29, 1934, Hull expressed regret when the Japanese government served notice of the termination of the naval treaty of 1922. In 1934, while the Japanese embarked on a large-scale, naval building program, the United States Navy was below treaty strength.

1935–1936.—At the London Naval Conference of 1935–1936, the Japanese delegates asked for the establishment of a uniform maximum level for the fleets of the three participating nations. The United States delegates opposed the proposal on the ground that naval parity would give Japan effective naval superiority. The Japanese withdrew from the conference when Great Britain and the United States refused to accede to their demands.

On Nov. 25, 1936, Japan signed an anti-Communist pact and thus became even more closely associated with Germany. Nine days later, Ambassador Grew disclosed that foreign diplomats in Tokyo believed that a secret military understanding had already been reached between the German and the Japanese General Staff. A number of high Japanese officers, including Gen. Tomoyuki Yamashita, went to Germany to study the tactics of the new Wehrmacht.

1937.—On Jan. 8, 1937, President Roosevelt announced that he had directed the Navy Department to proceed with the construction of two replacement battleships. In 1937, the United States Army was expanded to a strength of 158,000. The Secretary of War, in his annual report for 1937, said that the army was not keeping pace with the enormous expansion of the military establishments of other powers. The Japanese considered the time ripe for a drive to conquer China. The United States was militarily unprepared, and Britain, also unprepared, was preoccupied with the constant growth of the German war machine. The Japanese believed that German aggressiveness would cause the great powers to appease Japan at China's expense.

On July 7, 1937, Japan engineered the historic "incident of the Marco Polo bridge," near Peiping in northern China, which started the Sino-Japanese war. Japan expected a swift victory, but the campaign developed into a protracted war which lasted for more than eight years and was terminated by Japan's unconditional surrender to the Allies.

Secretary Hull called in the Japanese and the Chinese ambassadors to offer the services of the United States for a peaceful settlement of the Sino-Japanese dispute. Grew reiterated Hull's offer, but the Tokyo government failed to respond.

The United States did not accept the Japanese drive into China as another fait accompli. Less than one month after the offer of mediation, the State Department declared that the existence of hostilities was a matter of serious concern to all nations and appealed again to all parties to refrain from war. The League of Nations called Japanese action in China a violation of existing treaty obligations. The United States, together with 18 other nations, held a conference at Brussels to consider a peaceable means to hasten the end of the conflict and urged that hostilities be suspended and negotiations started.

The Japanese government disregarded this appeal also. On Dec. 12, 1937, Japanese aircraft, operating in the Yangtze River area over China, attacked and destroyed the United States gunboat *Panay* and three United States merchant vessels with a loss of American lives. An immediate demand by the United States for a formal expression of regret, complete indemnification, and the assurance that no further attacks by Japanese armed forces would occur against United States nationals or property in China was accepted by Japan.

1938.—The people of the United States were anxious to preserve peace and feared that a strong stand by the government might involve the country in a war. By a close vote of 209 to 188, the House of Representatives rejected a proposal for a constitutional amendment requiring a popular referendum as a prerequisite to a declaration of war by Congress. In a special message to Congress on January 28, the president recommended the strengthening of the national defense. His recommendations, including a 20 per cent increase in the naval building program, were accepted in substance. Still United States military and naval strength lagged far behind that of potential aggressor nations. Aggressors did not fear America, and some of the governments of the threatened countries did not believe in American determination and ability to come to their aid.

Although Japanese purchases of aircraft and aeronautical instruments were still being made in the United States, the State Department notified manufacturers and exporters that the government strongly opposed sales to countries whose armed forces were using airplanes for attacks on civilian populations. This "moral embargo" was extended nine months later to materials essential to airplane manufacture and to machinery needed for the production of high quality, aviation gasoline. It did not apply to the export of ordinary gasoline or steel and iron scrap.

1939.—President Roosevelt warned Congress, on January 4, that peace was not assured.

As Chinese resistance was unexpectedly strong, the Japanese poured further reinforcements into China, constituting a threat not only to the Chinese but also to French, Dutch, and British possessions. The European countries were not in a position to attempt to stop the Japanese, because their military preparations had to concentrate on the imminent German threat in Europe. In July, the United States government notified Japan that the commercial treaty between the two countries (in existence since 1911), was to end within six months. This act removed the

main obstacle to a full embargo upon shipments to Japan.

1940.—In April, the Japanese foreign minister expressed concern about the maintenance of the status quo in the Dutch East Indies. Secretary Hull, in reply, emphasized the importance of the Dutch East Indies to world commerce. He declared that an intervention in the domestic affairs of the Indies, or any alteration of their status quo by other than peaceful processes, would be prejudicial to the stability of peace and security in the entire Pacific area. A month later, when the Netherlands was already overrun, the Japanese ambassador told Secretary Hull that his government had no intention of altering the status of the Indies.

In a discussion with the British ambassador and the Australian minister, Mr. Hull insisted that a Sino-Japanese peace should not be made at China's expense. Great Britain was then in imminent dar er of invasion. As Russia was still cooperating with Germany, the United States, if attacked by Japan, could not count upon assistance from any quarter. Neither could the United States government passively tolerate the extension of the Japanese hold on other Asiatic countries. Once Japan's position was consolidated, it might be impossible to dislodge the Japanese, and the "new order" in Asia would become a reality.

The Export Control Act, authorizing the president of the United States to prohibit or curtail the export of basic war materials, was the principal weapon to be used against Japanese expansion. Such expansion occurred when the Japanese moved into northern Indo-China. Under the Export Control Act, further exports of steel and iron scrap were prohibited. The Japanese ambassador protested to the secretary of state that this might be considered an unfriendly act. Mr. Hull replied that the external policy of Japan aimed at the conquest of all valuable territory in the Pacific area. The embargo went into effect on Oct. 16, 1940.

On July 17, Great Britain, during the period of the empire's greatest distress, had yielded to Japanese pressure and agreed to close the Burma Road for three months. With this overland supply route severed, the situation of the defenders of China was bound to suffer. After the Japanese seizure of parts of French Indo-China, the London government realized that attempts at appeasement only encouraged Japanese aggressiveness, and traffic over the Burma Road was resumed on October 17. At that time, as Prime Minister Churchill later admitted, the British government was inclined to underestimate Japan's military strength. Although the Chinese were traditionally unmilitary, and their equipment was infinitely inferior to Japan's, Japan had not succeeded in breaking Chinese resistance in more than three years of warfare, even though she had thrown a million men into the conflict. Such a poor showing by the Japanese encouraged the British to stiffen their attitude.

The Four Freedoms.—The president's budget message of January 1941, called for $11,000,000,000 for national defense. In his address to Congress on Jan. 6, 1941, the president said that the United States looked forward to a world founded upon four essential freedoms: freedom of speech and expression, freedom of every person to worship God in his own way, freedom from want, and freedom from fear, "the kind of world which is the very antithesis of the so-called new order of tyranny which the dictators seek to create."

1941—The Year of Decision.—At the end of 1940, Ambassador Grew cabled to the secretary of state that the aggressive elements in Japan saw in the world situation a golden opportunity to carry out their ambitions, that they believed the European war would be ended with a quick German victory, and that the Japanese position in "Greater East Asia" should be consolidated while Germany was still willing to cooperate. Any effective opposition from the United States was discounted. The Japanese took into consideration the possibility that a victorious Germany might constitute a new hazard to their program of expansion.

There was danger that United States sanctions, such as a drastic embargo, might bring Japanese retaliation, probably a sudden blow by the army or navy. If the United States could preserve the status quo in the Pacific by adhering firmly to its principles until Great Britain was successful in the European war, it might be possible to undertake a readjustment of the whole Pacific problem on an equitable basis.

In January, Ambassador Grew sent another alarming report, indicating that Japanese military forces planned a surprise mass attack on Pearl Harbor in the event of trouble with the United States.

Secretary Hull insisted that many people in the United States still failed to grasp the nature of the crisis and its meaning to this country. If the aggressors should win the war, they planned to make the people of other nations into serfs, to abolish their liberties, rights, laws, and religion. Behind the mask of peaceful professions, Japan had accumulated vast striking forces; they had infiltrated shock troops, disguised as travellers and businessmen, to set up organizations for spying, sabotage, and propaganda; they were endeavoring to sow hatred and discord; they were using every tool of economic attack, bribery, and corruption to weaken their prospective victims until a military movement could complete the task of subjugation. Peace on that basis was nothing more than a trap.

Referring to the question if aid to freedom-loving nations and a vigorous policy of defending our interests would give an aggressor an excuse to attack the United States, the secretary said that no nation would attack if the United States were strong enough to defend itself.

The new Japanese ambassador to the United States, Admiral Kichisaburo Nomura, presented his credentials to the president on March 8. In his opening conferences with Hull, Nomura tried to minimize his government's aims of military conquest and insisted that United States embargoes were a matter of increasing concern to Japan. The secretary blamed Japan for having taken the initiative in aggressive expansion and said that the people of the United States viewed German-Japanese movements with concern.

On May 11, Mr. Hull told Admiral Nomura that there should be no serious difficulty if Japan really desired a peaceful settlement in the Pacific. The following day, the Japanese ambassador handed a statement to the secretary which defined the Tripartite Pact as a defensive alliance, designed to prevent nations not already involved in the European war from engaging in it. The memorandum suggested that the government of the

United States should request the Chiang Kai-shek regime in China to negotiate peace with Japan. Japan would ask for the independence of Manchuria and would insist upon the right to station Japanese troops on Chinese territory for a joint defense against Communism. Japanese expansion toward the southwest Pacific area was declared to be of a peaceful nature. The memorandum also urged the resumption of normal trade relations between the United States and Japan, and that the United States should cooperate in the production and procurement of natural resources, such as oil, rubber, tin, and nickel, which Japan required. The United States and Japan were to guarantee jointly the independence of the Philippine Islands on condition that the Philippines would maintain a status of permanent neutrality.

Secretary Hull's counter-proposal, handed to Nomura on June 21, suggested that both governments should affirm that their policies were directed toward lasting peace. The United States government reiterated that its attitude toward the war in Europe would be determined by considerations of self-defense. The United States was willing to suggest that China should negotiate with Japan, provided that Japan would first discuss the terms to be proposed to China with the United States. The resumption of normal trade relations would be considered. Both governments should disclaim publicly any territorial designs in the Pacific area. Japanese-United States negotiations concerning the neutralization of the Philippines would be considered at such time as the United States might desire after Philippine independence was achieved.

On July 4, the United States government sent a message to the Japanese prime minister, referring to reports that Japan had decided to attack Russia. Such an act of aggression, the message said, would destroy any hope for peace in the Pacific. Four days later, the Japanese government denied any intention of fighting the USSR. Actually, the German ambassador in Tokyo, following Ribbentrop's orders urged the Japanese to attack Russia, but Japan was waiting for the situation on the Russo-German front to become more conclusive. Japan's primary interests lay in other directions.

Disregarding United States admonitions, the Japanese government, supported by its Tripartite partners, exerted pressure upon the French Vichy government to sanction its control of French Indo-China. On July 22, Marshal Pétain's cabinet granted Japan the right to maintain troops and to establish air and naval bases in southern Indo-China. The Japanese ambassador in Washington told Hull that his country's action was taken solely to assure an uninterrupted supply of foodstuffs and raw materials. The secretary replied that this move was regarded as evidence that Japan intended to pursue a policy of forcible conquest.

The president of the United States told Ambassador Nomura that he would do everything in his power to obtain an agreement with Great Britain, the Netherlands, and China that Indo-China would be considered a neutral area, provided Japan was ready to make a similar commitment and would refrain from occupying southern Indo-China. Roosevelt further expressed the belief that Japanese policies were due to German pressure and that Hitler was bent on world domination. He warned Nomura that if Germany succeeded in defeating Russia and in dominating Europe and Africa, it would turn next to the Far East and the Western Hemisphere, and suggested the possibility of eventual cooperation between the navies of Japan and the United States against Hitler as a common enemy. Despite Mr. Roosevelt's efforts, Japanese forces moved into southern Indo-China.

On July 26, Japanese assets in the United States were frozen by executive order. This resulted in the virtual cessation of trade between the two countries.

On August 6, the Japanese ambassador stated that his government was prepared to withdraw its troops from the southwest Pacific areas, except for Indo-China, and to withdraw from there also after a settlement of the "China incident" was reached. In return, the Tokyo government proposed that the United States should suspend its military measures in the southwest Pacific, advise Great Britain and the Netherlands to do the same, restore normal trade relations with Japan, use its good offices to initiate negotiations between the Japanese government and that of Generalissimo Chiang Kai-shek, and recognize Japan's special status in French Indo-China even after the withdrawal of Japanese troops.

On August 15, President Roosevelt handed Nomura a document containing the warning that, if the Japanese government continued military aggression, the United States government would be compelled to take all necessary steps to safeguard its legitimate rights and interests. Another document, handed to the ambassador simultaneously, stated that the United States was prepared to resume informal exploratory discussions if Japan suspended its aggressive activities, embarked on a peaceful program for the Pacific, and accepted the principles to which the United States was committed.

On August 28, the Japanese prime minister, Prince Fumimaro Konoye, suggested that a meeting be arranged between him and the president of the United States to discuss all important problems pertaining to the Pacific area. Konoye's message, delivered to the president by the Japanese ambassador, was accompanied by a declaration that Japan was ready to withdraw from Indo-China as soon as the China incident was settled and a just peace established in East Asia, and that Japan would take no action against the USSR as long as the Russians remained faithful to the Soviet-Japanese neutrality pact.

President Roosevelt's reply of September 3, expressing his desire to collaborate with the prime minister, suggested that precautions be taken to assure the success of the meeting by entering into preliminary discussions of the four principles upon which relations between nations should rest: respect for territorial integrity and sovereignty; non-interference in the internal affairs of other countries; equality, including commercial opportunity; and non-disturbance of the status quo except by peaceful means. Grew reported that Konoye claimed to enjoy the warmest support of responsible army and navy leaders.

Considering that Konoye had headed the Japanese government when the "China incident" occurred, his peaceful intentions were doubted by United States officials. It was learned that the military element was to be heavily represented in the Japanese delegation. Hopes for the success of the meeting were scant, and failure was bound to produce an immediate crisis.

A revised proposal, handed to the secretary of state by the Japanese ambassador, promised that Japan would not resort to military action against regions south of Japan "without justifiable reason." The memorandum also stated that, in the event of American participation in the European war, the "interpretation and execution of the Tripartite Pact by Japan would be independently decided"; that Japan would be ready to withdraw from China "upon the rehabilitation of general and normal relationships between Japan and China"; and that United States economic activities in China would not be restricted "as long as pursued on an equitable basis." It asked the United States to abstain "from measures and actions prejudicial to the endeavor by Japan concerning the settlement of the Chinese affair." This proposal actually gave the Japanese an opportunity to act as they pleased by interpreting the various points to suit themselves. On October 2, Secretary Hull insisted that the proposed meeting be preceded by the clarification of certain principles. The Japanese ambassador hinted that failure to arrange the meeting quickly might result in the replacement of the Konoye government by another less devoted to peace. On October 18, Prince Konoye resigned and was succeeded by Lt. Gen. Hideki Tojo.

On November 3, Ambassador Grew cabled that economic measures, such as embargoes, would not avert war and would not result in Japan's collapse. He warned of the danger of underestimating the extent of Japanese preparations or of assuming that they amounted only to saber rattling.

On November 7, the United States Cabinet was informed by Secretary Hull that relations between Japan and the United States were extremely critical. On November 11, Secretary of the Navy Frank Knox stated that the United States was confronted by the necessity of extreme measures of self-defense in the Atlantic and was likewise faced with grim possibilities in the Pacific. Undersecretary of State Sumner Welles supported the warning by saying that "at any moment war may be forced upon us."

On November 10, Prime Minister Churchill declared that, if the United States should become involved in war with Japan, a British declaration would follow within the hour.

Early in November, the Japanese government informed the United States government of its desire to send a special representative, Mr. Saburo Kurusu, to Washington to assist Nomura in his conversations. Mr. Kurusu was received by Roosevelt and Hull on November 17. The Japanese envoy failed to produce any new proposals. Another report by Mr. Grew emphasized the necessity for vigilance against a sudden Japanese attack in regions not involved in the Sino-Japanese conflict. The ambassador considered it probable that the Japanese would make use of every possible tactical advantage, including the elements of surprise and initiative. The Japanese envoy and the United States secretary of state met daily, but Kurusu was ready neither to renounce his country's association with Germany nor to budge from the basic Japanese policy in East Asia.

In discussions with high United States government officials, between November 25 and 28, the secretary of state emphasized the critical nature of United States-Japanese relations. Mr. Hull expressed the belief that Japan was likely to commit new acts of conquest. Plans for defense should be based on the assumption that the Japanese might feature the element of surprise in their strategy.

A suggestion made during the discussions, that the United States should take the initiative by opening hostilities against Japan, was rejected. It was felt that the people of the United States would not support this action.

On November 29, Cordell Hull told British Ambassador Lord Halifax that the diplomatic discussions between the United States and Japan were virtually at an end and that the matter would now be turned over to officials of the army and navy.

On December 1, the secretary of state again conferred with Nomura and Kurusu. He mentioned the belligerent attitude of Tokyo and emphasized that there was a limit of tolerance beyond which the United States could not go.

Heavy Japanese troop concentrations were reported from Indo-China. From there, the Japanese threatened the Philippines, the Dutch East Indies, Burma, Malaya, and Siam. Regrouping in China pointed to an impending attack on Hongkong. Japanese convoys, obviously carrying large bodies of troops, were sighted in the South China Sea.

On December 5, Ambassador Nomura explained that the alarming concentrations of Japanese troops were a natural sequence of Chinese troop movements along the northern border of Indo-China. The ambassador further expressed his concern about the increasing preparations of the ABCD (American, British, Chinese, Dutch) powers in Asia. Actually, the British battleship *Prince of Wales* and battlecruiser *Repulse* were on their way to Singapore, while the Dutch fleet, composed of light surface units and submarines, assembled in the waters around Java, Sumatra, Borneo, and the Celebes. Their combined strength was greatly inferior to that of the Japanese Navy in Far Eastern waters.

On December 6, President Roosevelt telegraphed a personal message to the Japanese Emperor Hirohito, stating that developments in the Pacific contained tragic possibilities. He urged that Japan and the United States should agree to eliminate any form of military threat. The presence of Japanese military, naval, and air forces in great numbers in Indo-China raised doubts as to the defensive character of their presence. The message concluded by saying that both the president and the emperor had a sacred duty to restore the traditional amity between their countries and to prevent further death and destruction in the world.

Opening of Hostilities.—On Dec. 7, 1941, at 7:50 A.M. Honolulu time, 1:20 P.M. Washington time, the Japanese opened hostilities against the United States by a surprise air attack on the naval base of Pearl Harbor, on Oahu in the Hawaiian Islands. This sneak attack followed the Japanese pattern in 1904, when a surprise raid by Japanese torpedo boats hit the Russian Far Eastern Fleet at Port Arthur, its main port and fortress. It justified the warnings of Ambassador Grew and exposed the fatal error of underestimating Japanese intentions. The attack put the main United States Fleet out of action for many months.

The Declarations of War.—While the attack on Pearl Harbor was under way, Nomura and Kurusu called on Secretary Hull to hand him

a memorandum which charged the United States with obstructing peace between China and Japan, failure to cooperate with Japan, scheming to extend the war, aiding Great Britain, and preparing to attack Germany and Italy. The memorandum claimed that the United States was ignoring actual conditions in China and that Mr. Hull's proposal of November 26 menaced Japan's existence. The United States and Great Britain were charged with conspiracy to obstruct Japanese efforts toward the establishment of peace by the creation of a new order in East Asia. "In view of the attitude of the American government," the memorandum ended, "the Japanese government must conclude that it is impossible to reach an agreement through further negotiations."

Cordell Hull's answer was: "I have never seen a document more crowded with infamous falsehoods and distortions, on a scale so huge that I never imagined until today that any government on this planet was capable of uttering them."

After the attack on Pearl Harbor, Ambassador Grew was informed by the Japanese foreign minister that Emperor Hirohito wished the memorandum presented to Hull to be regarded as the emperor's reply to President Roosevelt's message. It was added, "also as a reply," that "the establishment of peace in the Pacific, and consequently in the world, has been the cherished desire of His Majesty, for the realization of which he has hitherto made his government continue its earnest endeavors."

At 11:00 A.M., Tokyo time on December 8, (9:00 P.M. December 7, Washington time) the United States ambassador in Tokyo received a communication from the Japanese foreign minister to the effect "that there has arisen a state of war between Your Excellency's country and Japan beginning today."

During the morning of December 8, President Roosevelt asked Congress to declare a state of war between the United States and Japan. Both Houses acted immediately with only one dissenting vote. At 4:10 P.M., the president approved a joint resolution providing that the state of war between the United States and the government of Japan, which had been thrust upon the United States "is hereby formally declared." The president was authorized and directed to employ the entire military and naval forces of the United States to carry on the war against Japan, and Congress pledged all the resources of the country to bring the conflict to a successful termination.

In a radio address delivered on December 9, President Roosevelt warned the country that, as Germany and Japan conducted military and naval operations in accordance with a joint plan, Germany and Italy would probably consider themselves also at war with the United States. He added that it would be futile to eliminate the danger of Japan if the country should then find the rest of the world dominated by Hitler and Mussolini. "We are going to win the war and we are going to win the peace that follows," the president concluded.

The German government had repeatedly violated its international obligations, and it had a strong incentive to disregard its pledge to Japan. The United States would be too engrossed in hostilities with Japan to be likely to declare war on Germany and Italy of its own initiative. Moreover, the concentration of American attention in the Pacific could be expected to reduce the flow of American supplies to the nations fighting the Axis in Europe. But Hitler decided for war. No doubt he expected the collapse of the United States and was eager to share the spoils.

On December 11, Germany and Italy declared war on the United States. The same day, without a dissenting vote, Congress passed, and the president approved, resolutions declaring a state of war between the United States and Germany and between the United States and Italy.

The United Nations.—On Jan. 1, 1942, the Declaration of the United Nations was signed in Washington, D.C., by representatives of the governments of the United States, Great Britain and Northern Ireland, the Union of Soviet Socialist Republics, China, Australia, Belgium, Canada, Costa Rica, Cuba, Czechoslovakia, the Dominican Republic, El Salvador, Greece, Guatemala, Haiti, Honduras, India, Luxembourg, the Netherlands, New Zealand, Nicaragua, Norway, Panama, Poland, South Africa, and Yugoslavia. It was accepted in 1942 by Mexico, the Commonwealth of the Philippines, and Ethiopia (Abyssinia).

The declaration bound the signatory governments to subscribe to the purposes and principles of the Atlantic Charter; to defend life, liberty, and religious freedom; to preserve human rights and justice in their own lands as well as in other lands; to pledge themselves to employ their fullest resources, military and economic, in the common struggle against the members of the Tripartite Pact and its adherents; and finally, not to make separate armistice or peace with their enemies.

THE UNITED STATES AT WAR

With the United States well behind other countries in the armament race, both Germany and Japan hoped that America would be unable to overcome her disadvantage in time to prevent an Axis victory. The German General Staff maintained that armed forces could not be improvised and that military institutions of long standing and basic indoctrination of the popular mind were necessary to build an effective army. The German war lords argued that it had taken Germany more than ten years of clandestine planning and five years of open preparation to rearm, although the General Staff was always in existence, and the average German was military-minded. Experience with the United States Army in 1918 was not considered convincing. The United States forces in World War I were greatly outnumbered by the French and British, and German reports minimized their part in the German defeat. Furthermore, German industrial experts were confident that the Reich could outproduce the United States. American war industry was considered to be in an experimental stage which could not be developed quickly into mass production. Figures of airplane and tank output in the United States were discounted in Germany as propaganda. The Germans also relied strongly upon pro-German elements in the United States to sabotage the country's war effort by subversive action and propaganda.

As German submarine warfare was constantly expanding, and the United States Fleet was believed to be permanently crippled by the Japanese sneak attack, German experts doubted any American ability to transport substantial forces to the European or African theater of war.

After Pearl Harbor, the Japanese hoped that

the United States could not compensate for its severe naval losses in time to prevent the establishment of permanent control of the Pacific and the Indian oceans by the Japanese Navy. The public effect of British and Dutch naval intervention was minimized. Once Japanese forces were firmly established in vital bases, and United States, British, and Dutch strongholds were eliminated, the Allies would not be able to prevent the rapid spreading of Japanese conquests in what Tokyo propagandists termed the "co-prosperity sphere."

The comparative lack of United States preparations unquestionably jeopardized the country's defenses in the early stages of the war, but, after a badly needed breathing spell, the United States began to show its growing strength. United States production eventually proved far superior to that of enemy countries, and the fact that it was not already standardized in late 1941 allowed the United States to adapt according to the most recent tests of battle.

The U.S. Navy.—On July 1, 1940, the total tonnage of navy vessels was 1,082,000 for Great Britain, 998,000 for the United States, and 815,000 for Japan. Considering that the British had already suffered losses, and Japanese figures were not reliable, the United States Navy was substantially below parity, even as fixed by the expired Washington treaty. Prior to 1940, the United States building program was listed at 894,000 tons, the British at 736,000, and the Japanese at 441,000 (including vessels under construction). The actual Japanese program was much more extensive.

In messages of May 16 and 31, 1940, asking for military and naval appropriations of $1,182,000,000 and $1,227,000,000, President Roosevelt called for additional armaments. The first message requested the construction of 3,000 navy planes and a large increase in naval personnel. The president emphasized the necessity for a two-ocean navy, and he wanted the United States to be able to turn out at least 50,000 planes a year. Congress, in 1940, authorized a total navy of 3,049,480 tons, completion of which was not expected before 1946. Personnel for a two-ocean navy was estimated at 486,000 officers and men, including pilots for 15,000 naval aircraft.

The 1940 building program included 17 battleships between 35,000–60,000 tons. In 1941, two 35,000 ton battleships, the *North Carolina* and the *Washington,* the 20,000 ton aircraft carrier *Hornet,* 12 destroyers of an improved 1,700 ton-type, and 9 submarines joined the navy. Four more North Carolina class battleships were nearly completed. Naval craft, numbering 213, were put into service between Jan. 1, and Sept. 1, 1941, most of them small vessels, such as minesweepers, submarine chasers, and patrol boats. The conversion of 193 merchantmen took place for use as hospital ships and navy auxiliary vessels. During the war, the building program underwent a radical change, with top priority given to aircraft carriers and aircraft tenders. Warships of all types were built with unprecedented speed.

At the time of the Pearl Harbor attack, the United States had 216 major combat craft, including 17 battleships, 6 aircraft carriers, and 37 cruisers. Of these warships, 102 were stationed in the Pacific and 114 in the Atlantic. Most of the battleships were more than 20 years old. Great Britain and the Netherlands had 50 surface craft in the Pacific, mostly light units.

Two United States task forces were at sea when the Japanese struck their surprise blow, one returning from Midway, the other bound for Wake Island. Eight battleships of the Pacific fleet, 9 cruisers, and one third of the Pacific destroyer flotilla were in Pearl Harbor. Two heavy cruisers were on patrol south of the Hawaiian Islands; 2 cruisers were escorting troopships to Manila, where the light cruiser *Boise* had just arrived; 2 more cruisers and 13 destroyers of the "Asiatic Fleet" were at anchor in Manila Bay; and 3 light cruisers were on duty in southeastern Pacific waters.

The U.S. Army.—After meeting the request (July 10, 1940) for another 5 billion dollars for national defense, Congress granted the president authority to call the National Guard and Reserve personnel into active service. In 1940, the United States Army rose from 220,000 to more than 600,000 men, still far below the level of the other great powers. A further increase to 1,200,000 was authorized, and a new military organization was set up in 1940. Gen. George C. Marshall, as commanding general of the field forces and chief of staff of the army, directed and supervised the training. Supply and quartermaster duties were administered by the War Office through corps area commanders. Nine geographical corps areas were under separate tactical commands, and four field armies were established. Mechanized units and tanks were organized as armored forces, directly responsible to the chief of staff. In 1942, it was planned that 54 air combat groups, with 12,800 planes, would be an element of the field forces to operate under the direct control of General Headquarters. A mobile field army was organized under General Headquarters, made up of one armored corps of two divisions, the General Headquarters air force, and a reserve that consisted chiefly of heavy artillery and heavy tanks. Four air force divisions were set up in the continental United States, corresponding to the four field armies, and a provisional parachute group was organized.

On Oct. 9, 1941, in the last official announcement issued prior to Pearl Harbor, the total figure of army personnel was 113,000 officers and 1,475,000 enlisted men, of which 537,000 belonged to the Regular Army, 270,000 to the National Guard, 76,000 were reserve officers, and 705,000 were selective service trainees. Most of the army was stationed in the United States.

Five reorganized armored divisions were ready late in 1941. Their equipment included 158 light and 232 medium tanks, 79 armored cars, 54 self-propelled howitzers (105 mm.), 39 self-propelled howitzers (75 mm.), 27 antitank guns (37 mm.), 24 mortars (81 mm.), and 38 mortars (60 mm.) per division. In 1941, each U.S. infantry division had 162 Browning automatic rifles, 54 light machine guns (30 caliber), 72 heavy machine guns (30 caliber), 36 machine guns (50 caliber), 81 mortars (60 mm.), 36 mortars (81 mm.), and 36 antitank guns (37 mm.). The bazooka was introduced later. Infantrymen were equipped with the Garand rifle (30 caliber) and a 45-caliber tommy gun.

The U.S. light field artillery used 75-mm guns and 75-mm. and 105-mm. howitzers; medium artillery was equipped with 155-mm. howitzers and 4.7-inch guns; heavy artillery with 155-mm. guns and 8-inch and 240-mm. howitzers. The 75-mm. gun, once the backbone of the field artillery, was largely superseded by the 105-mm.

howitzer, but it remained an effective antitank weapon.

Coastal defenses used guns of 3 inch, 155-mm., 6, 8, 10, 12, 14, and 16-inch caliber, the latter capable of firing a 2,340 lb. projectile at a range of about 28 miles.

Bofors antiaircraft guns (40-mm.) and 3-inch AA guns were in use in antiaircraft defenses, with a 90-mm. gun in preparation.

U.S. Tanks.—Many types of armor were in the blueprint or experimental stage when the war began. The "Honey" and the "Mae West" (the latter a training tank) were the best known of the light models. The medium M-3 General Grants, mounting a 75-mm. cannon, were ready, and the M-4 General Shermans, mounting a 75-mm. cannon, in addition to .50-, .45-, and .30-caliber machine guns, were in production. A heavy 60-ton model, T-1, was in the blueprint stage. Self-propelled guns were developed, such as the M-7, mounting a 105-mm. howitzer, the M-12, with a 155-mm. gun on an M-3 chassis, and a light fast vehicle, mounting a 75-mm. gun.

U.S. Airplanes.—The United States Army owned 78 and the Navy, 38, of the 2,453 airports in the United States. The aircraft building program for 1941 called for 60,000 planes in 1942 and for 125,000 in 1943. Hardly more than 5,000 war planes were ready for action at the time of the Japanese attack, although monthly production rose from 630 in January to 2,700 in December 1941. The United States fighters were the Bell Airacobra, Brewster Buffalo, Curtiss Kittyhawk, Curtiss Tomahawk, Curtiss Mohawk, Douglas Havoc, Grumman Martlet, Lockheed Lightning, and North American Mustang. The bombers were the Boeing Flying Fortress, Brewster Bermuda, Consolidated Catalina, Consolidated Liberator, Curtiss Cleveland, Douglas Digby, Douglas Boston, Douglas Nomad, Lockheed Hudson, Martin Maryland, Martin Baltimore, Vega Ventura, and Chesapeake. Other types existed in blueprints or were under production.

Selective Service.—The Selective Service Act, providing for peacetime conscription, was signed Sept. 16, 1940. Under the act, male residents of the United States between the ages of 21 and 36 had to register, whether or not they were citizens of the United States. A quota was to be filled each month. Under the initial stipulations of the act, the grand total of men was limited to 900,000 serving at one time. By July 1, 1941, the planned quota was 789,000. In the first draft, the registrant's number was drawn from a large bowl. Later, selective service was handled by local draft boards. On the day set for registration (Oct. 16, 1940), 16,500,000 persons presented themselves at their local boards, which gave an estimate of the total number available for compulsory service.

National Defense Advisory Committee.—A National Defense Advisory Committee was appointed on May 28, 1940, to coordinate resources of men and material for the defense of the United States. It included the Divisions of Industrial Material, Production, Transportation, Labor, Agriculture, Price Stabilization, Consumer Protection, State and Local Cooperation, Coordination of Purchasing, Defense Housing, and the Bureau of Research and Statistics.

Prior to Dec. 7, 1941, the committee authorized contracts for, among other items, 50,000 airplanes, 130,000 engines, 55,000 guns and mortars, 9,200 tanks, 300,000 machine guns, 400,000 automatic rifles, 380 warships, and 200 merchant ships.

Office of Civilian Defense.—The Office of Civilian Defense was created on May 20, 1941, to coordinate federal, state, and local civilian defenses, to plan and execute programs for the protection of life and property in emergencies, and to train volunteers in the interest of defense. By the end of 1941, 6,000 local defense councils were organized, with one million persons trained or enrolled. Civilian defense tactics, as operated in Great Britain under German air attack, set the pattern for civil defense in the United States.

JAPAN AS AN ENEMY

In August 1940, Lieutenant General Tojo (later the Japanese prime minister) demanded that army personnel work with more efficiency. "A day of idleness at this time is as criminal as 100 years of idleness in peacetime," he proclaimed. The Japanese went to the very limit of their strength to make final preparations to attack the United States. Obedience which completely disregarded life and health was typical of the Japanese soldier, who was taught to take military orders to be divine commands. He was among the poorest paid soldiers in the world. In 1941, enlisted men received the equivalent of $2.36 a month. A lieutenant general's monthly wage was $111.09. Of the soldier's pay, 80 per cent went to his family and 1/16 into a savings fund. His diet consisted of rice, tea, dried fish, and a few pickles. Even on this meager diet, the Japanese soldier was able to endure severe hardships.

Japanese sailors weighed 40 to 50 pounds less than the average American navy men and were between 6 and 8 inches shorter. They needed less space than the crews of fighting ships of other nations, and their living quarters were even more congested. The Japanese claimed that this was why their ships could carry more fuel and ammunition than corresponding foreign craft.

Japan had compulsory military service. Approximately 13,900,000 men were subject to conscription, and a patriotic Women's Society for National Defense had 6,400,000 members, mostly belonging to the middle class. Recognizing the Japanese belief in the superiority of the male, women did not aspire to a soldier's job, but they devoted themselves to every kind of assistance they could give the fighting men.

The Japanese Army.—At the time of the Pearl Harbor attack, the Japanese had a total of 72 regular and reserve divisions ready for action, in addition to about 25 smaller auxiliary divisions and some independent brigades and cavalry divisions. Japanese regular and reserve divisions numbered about 25,000 men each, the independent brigades having half that figure. An auxiliary division was about equal to an independent brigade.

In the Chinese theater of war, there were 16½ regular and reserve divisions, 9 newly organized auxiliary divisions, 12 independent brigades, 2 cavalry brigades, and special engineering, communications, and medical units.

Beginning in 1940, another army was assembled in Japan-controlled Indo-China and on Hainan Island, close to the future theater of war. These forces were equipped with the best matériel the Japanese could muster and were specially trained in jungle warfare. The soldiers were taught to use tricks and ruses and to utilize

natural facilities to infiltrate enemy lines. Their equipment was well adapted to the jungle, much better than anything the Allies possessed during the critical period following Pearl Harbor. Later in the war, the United States Army gained full superiority in this kind of equipment.

Well hidden from observers and without interference, the Japanese massed 27 regular and reserve divisions and a small number of auxiliary divisions and independent brigades in the area adjoining the objectives of their impending drives in Asia and the Pacific.

Twenty Japanese divisions and almost twice that number of Manchurian puppet divisions stood along the Russo-Manchurian border as a strong guard and a constant threat. The fighting value of the Manchurian divisions, however, was far below that of the Japanese. Approximately 8 divisions were ready in the Japanese homeland to be shipped to any theater of war where they might be needed.

Although the Japanese General Staff accepted German tutorship, the Wehrmacht's pattern of armored warfare was not introduced in the Japanese Army. The tremendous quantities of gasoline needed were not available in China, and transport conditions in other Asiatic theaters of war did not encourage the use of panzer divisions. Airpower was well developed in Japan and used to the limit in land and sea warfare.

Japanese soldiers were equipped with the Meiji 38 rifle (Arisaka) introduced in 1905 and a 1911 model of the Arisaka carbine. The 1925 Nambu automatic pistol and the light Nambu machine gun, both closely resembling the German Mauser, and a heavy machine gun, patterned after the French Hotchkiss of 1914, were the most numerous of the automatic weapons. The infantry used trench mortars of 72-mm. (M 22) and 81-mm. (Stokes Brandt). Two types of very light, short-barrelled cannon (37-mm. and 70-mm., model 1922) accompanied the foot soldiers. They also served as antitank weapons, but their slow rate of fire and moderate muzzle velocity reduced their efficiency. Some small caliber, antitank cannon were manufactured in Osaka, Japan, by a branch of the Boehler Works of Austria and Germany.

Antiaircraft artillery used two extra light gun models of 13.2-mm. and 20-mm. caliber respectively, the first of the Hotchkiss type, the other of Swiss Oerlikon make, in addition to medium 75- and big 105-mm. guns. Attached to each infantry division was one regiment of light field artillery with 36 cannon and 12 howitzers, using 75-mm. German Krupp and French Schneider-Creuzot guns, and howitzers of 105- and 120-mm. caliber, copied from Krupp and Schneider originals. Medium artillery was equipped with 105-mm. guns and 150-mm. howitzers, from 1905 Arisaka to 1930 Schneider models. Heavy artillery (3 regiments and 8 independent battalions) had guns from 150- to 410-mm., howitzers of 240, 300, and 410-mm., and railway guns of 240-mm. caliber.

The Japanese Air Force.—The Zero fighter and the newest Mitsubishi bomber were hidden from foreign observers before their use against the Allies. The Zero, in particular, had an excellent performance. At the outbreak of hostilities, it was better than any comparable United States plane. Japanese plane production reached 600 a month.

Prior to Dec. 7, 1941, the Japanese used the Nakajima 19, the Mitsubishi Soyokaze (a two-engined naval bomber resembling the German Junkers), and two other Mitsubishis: the obsolete 92, and the light 97. Japanese warplanes were equipped with 20- and 25-mm. cannon and 25.6-caliber machine guns. As these craft were thought to be of rather poor quality, the performance of the Japanese Air Force in the early stages of the war against the Allies came as a shocking surprise.

The Japanese Navy.—On Dec. 7, 1941, the Japanese had 180 major surface fleet units in the Pacific against 152 in the Allied Pacific and Asiatic fleets combined. After Pearl Harbor, Japanese superiority was overwhelming, and the Japanese were able to mass superior naval power wherever their operational program made it advisable.

Japan's major naval units included 10 battleships, 8 aircraft carriers, and 46 cruisers. This gave the Japanese Navy an advantage in number of cruisers and aircraft carriers over the United States Fleet. A 5,401,000,000 yen building program adopted in 1940 financed the construction of three heavy cruisers of the Chichibu class (approximately 15,000 tons), with fighting capacities almost equal to those of a battleship, five battleships of the Nissin class (40,000 tons), and a number of aircraft carriers and plane tenders. Japanese battleships of the Ise, Huso, Haruna, and Kongo classes, launched between 1912 and 1916, were thoroughly modernized. Japanese naval equipment generally was excellent.

Japanese shipbuilding procedures were much slower than those developed in the United States. Unable to replace its losses to a considerable extent during the war, the Japanese Navy's position was bound to deteriorate when the war dragged on. Although the leaders of the Japanese Army discounted United States fighting strength, some high Japanese naval officers were worried about the United States shipbuilding program.

Sino-Japanese War.—On Dec. 7, 1941, the Sino-Japanese war automatically became part of World War II. The military situation in China did not change much in 1941. Wherever the Japanese invaders succeeded in gaining ground, they were soon driven back by Chinese counterattacks.

In November 1941, Chinese War Minister Ho Ying Chin gave the total number of Chinese fighting forces at 6 million, of which 4 million were said to be in action. A check on these figures is hardly possible, but apparently they were exaggerated. China could not have supplied such a large number of troops. The army had no armor, only a very few United States aircraft manned by the American "Flying Tigers," some obsolete artillery, and pathetically few heavy infantry weapons. Japanese technical superiority, generalship, and organizational abilities were beginning to be felt.

Few supplies reached China from abroad. Major Chinese ports were in Japanese hands, and the approaches to the China coast were dominated by the Japanese Fleet. The Burma Road, China's land outlet to the British Empire, was closed during part of 1941. At best, it could carry only a small fraction of the supplies that China needed. Russian aid amounted to almost nothing. The Soviet Union was not favorable to the Chungking government. In addition, the Russians needed supplies themselves and were not yet inclined to risk war with Japan

Late in 1941, aside from the whole of Manchuria (Manchukuo) and much of Inner Mongolia, the Japanese held more than 500,000 square miles of the eastern provinces of China. Unoccupied China had an area of roughly 2,300,000 square miles, with a population of 250 million. Almost 200 million lived in occupied areas.

The Japanese aimed to drive through the Yangtze River valley to Chungking, and from there via Kweiyang and Kunming to Burma. If they had succeeded in reaching their goal, unoccupied China would have been hopelessly isolated and by-passed by Japanese forces from China. These forces would then have joined the armies from Indo-China in a drive to conquer India.

The Chinese blocked the push into the Yangtze River valley, but their situation was precarious, because interior strife was reducing the country's power of resistance.

The Communist Party of China, disbanded in 1937 under the Kuomintang-Communist agreement for a united front against Japanese aggression, was reconstituted. On Jan. 17, 1941, the National Military Council ordered the dissolution of the "Fourth Route Army" because of rebellion. The Fourth Route Army defied this order and was backed by the Communist Party (then called the Central Revolutionary Military Committee) with its seat at Yenan in northern Shansi Province. The Central Revolutionary Committee presented twelve demands as the price of further cooperation with Chungking, including the abolition of the one-party Kuomintang rule. The Chungking government ignored the demands.

The Japanese, in an effort to widen the breach, concentrated their operations against the Chungking forces and did not attack the Communists. Chungking charged the Communists with inactivity in the struggle against Japan. The Communists insisted that they were still fighting the enemy, but there was little evidence to prove it.

THE DISASTER AT PEARL HARBOR

Although the United States Army and Navy in the Hawaiian Islands and other Pacific outposts knew that the situation with Japan was critical, defensive preparations were inadequate at the major naval base of Pearl Harbor. Lack of effective patrols permitted a substantial Japanese naval task force to sail within striking distance of Pearl Harbor without interference.

During the night of Dec. 6, 1941, the United States destroyer *Ward* detected a submarine in the defensive area outside of Pearl Harbor. The submarine was attacked with depth charges and subsequently sunk. This incident failed to alarm the army and navy commands. At 7:00 A.M. Sunday, Dec. 7, 1941, an army private, operating a listening device at Pearl Harbor, reported approaching planes. His warning was ignored. United States carriers were at sea, and it was assumed that they were friendly planes. United States aircraft remained grounded, and ships (including 8 of the 9 battleships of the Pacific Fleet) were moored at their berths.

The submarine sunk by the USS *Ward* was one of the midget submarines which the Japanese used in their sneak attack, and the planes reported by the listener were an armada of more than 100 Japanese, carrier-based aircraft heading for the warships in Pearl Harbor. Maps found later on dead Japanese airmen proved that the exact location of the vessels was known to the Japanese command.

In addition to a number of army planes, there were 301 United States naval planes on Oahu, of which 54 were noncombat craft and 99 were not serviceable. Half an hour after the first blow fell, only three United States planes had taken off.

The Japanese raid was divided into five phases:

Phase I lasted from 7:50 to 8:25 A.M At Hickam Field, 18 Japanese dive bombers raided the airbase, blasting army aircraft parked in orderly rows and hitting 9 dive bombers at the smaller base on Ford Island. The heavy ships of the Pacific Fleet, moored in their berths, were attacked by 21 torpedo planes that made four runs, while 30 Japanese dive bombers effected 8 strikes at the same targets, and 15 horizontal bombers executed a high level attack. The immobile targets were easy to hit.

During Phase II (8:25 to 8:40 A.M.), 15 dive bombers attacked the submarine base and some of the already damaged surface units.

Phase III (8:40 to 9:15 A.M.), 30 horizontal and 18 dive bombers raided "Battleship Row" again and then hit the smaller ships in "Middle Loch."

In Phase IV (9:15 to 9:45 A.M.), dive bombers that were out of bombs raked the docks and the decks of the stricken vessels with machine gun fire, while two other groups of dive bombers, with bomb loads, coming in from the southeast, hit the navy yard and Battleship Row. Two more groups from the northwest bombed and strafed Ford Island and the ships in Middle Loch. In Phase IV, 27 Japanese planes were engaged.

In Phase V, all enemy aircraft left. With the general confusion subsiding, numerous sortie movements of ships still navigable were under way.

Antiaircraft batteries, inactive in the opening phases, fired intensely later. Their fire hit not only Japanese but United States aircraft. The carrier *Enterprise,* which had been at sea when the raid got under way, launched 18 dive bombers, 4 of which were downed by United States antiaircraft fire. With runways blocked and blasted and approaches barred by fire and explosion, the United States Air Force was immobilized. Of the naval planes, only 52 were capable of flight after the raid. Land-based artillery mistakenly fired upon United States warships outside of Pearl Harbor. The Japanese task force off Pearl Harbor left without being intercepted.

The Japanese lost 28 planes. In addition, three midget, two-man submarines were destroyed, one of them by the *Ward,* two inside the harbor. The role of the submarines in the raid was negligible.

An official United States communiqué admitted the loss of the battleship *Arizona,* the target ship (old battleship) *Utah,* the destroyers *Cassin, Downes,* and *Shaw,* and the minelayer *Oglala.*

Actually, losses inflicted upon the United States Pacific Fleet qualified the raid as a major disaster. Of the battleships, the *Arizona* was sunk in its berth, burned and blasted in two; the *West Virginia* had settled into shallow water at its berth; the *California* was sunk at its berth; the *Nevada* ran aground; and the *Oklahoma* was sunk bottom up. In addition, the *Pennsylvania,*

Maryland, and *Tennessee* were damaged by bombs. The destroyers *Cassin* and *Downes* were twisted by fire. The destroyer *Shaw* had her bow blown off. The minelayer *Oglala* was sunk. Damage of varying degrees was inflicted upon the light cruisers *Helena, Honolulu,* and *Raleigh,* the seaplane tender *Curtiss,* and the repair ship *Vestal.* No aircraft carriers were in Pearl Harbor when the raid occurred. Casualties were 2,638 officers and men killed and 946 wounded.

Three of the damaged battleships were at sea in less than two weeks; three took several months for repair. The damaged light cruisers left port by the end of January 1942. Although salvage work was successful beyond anticipation, the United States Fleet was temporarily crippled; complete Japanese naval superiority was achieved.

No attempt was made by the Japanese task force to land troops in the Hawaiian Islands. The raid was aimed at the United States Fleet and not at the establishment of an island base so remote from Japan and the Japanese Pacific bases. The Japanese believed that, after the disaster, the United States Navy, compelled to concentrate on the American Pacific coast, would be unable to interfere with methodical expansion of Japanese conquests in the Pacific, from the Philippines to Australia. Japanese domination of the Pacific was planned to spread like a tidal wave.

In almost simultaneous attacks, the Japanese struck in a colossal arc from Hawaii to the Gulf of Siam: at Hongkong; at Siam; at Kota Bharu on the Siam-Malayan border; at the Philippines; at Midway; at Wake Island; and at Guam.

Land forces employed in the drives were not as large as those engaged in major European campaigns, but this was a colonial war, in which transportation was a major factor, and local conditions limited the number of troops to be deployed. The Japanese, in control of the Pacific, were able to gain local superiority for some time.

After recovering from the initial blow, the United States Navy was chiefly concerned with maintaining communications with Australia, then dangerously close to the theater of operations.

A committee headed by Justice Owen J. Roberts of the United States Supreme Court, reporting on the results of its investigation of the Pearl Harbor disaster, found dereliction of duty on the part of Maj. Gen. Walter C. Short, commanding the Hawaiian Department of the Army, and Rear Admiral Husband E. Kimmel, commander of the Pacific Fleet. Both officers were relieved from their commands, pending court-martial proceedings. These courts-martial did not materialize. General Short and Admiral Kimmel waited four years before they had an opportunity to present their version of the reasons for the disaster before a Congressional investigating committee. Investigation showed that cooperation between the highest offices in the nation's capital and the Pacific armed forces was not sufficiently established during the period of emergency preceding the opening of hostilities. Although told to be alert, the army and the navy were advised by the government not to do anything that might arouse Japanese resentment. Absolute responsibility for what happened at Pearl Harbor was not established.

EARLY WAR IN THE PACIFIC

The British Cabinet declared war upon Japan on Dec. 8, 1941. Similar declarations followed immediately by China, Canada, Colombia, Costa Rica, Cuba, the Dominican Republic, Guatemala, Haiti, Honduras, El Salvador, Mexico, Nicaragua, Panama, the Netherlands, the Dutch East Indies, the Union of South Africa, Australia, New Zealand, deGaulle's Free France, Poland, and Czechoslovakia. Venezuela severed diplomatic relations with Japan. Although hostilities in China were already in their fifth year, there had been no previous declaration of war by either country. Simultaneously with the declaration of war on Japan, China also declared war upon Germany and Italy.

On Dec. 22, 1941, Prime Minister Churchill, accompanied by a staff of 80 military and naval advisers, arrived in Washington, D.C., for parleys with American authorities. British Field Marshal Wavell meanwhile conferred with Generalissimo Chiang Kai-shek in Chungking, while British Foreign Secretary Anthony Eden went to Moscow to meet Joseph Stalin. Chiang Kai-shek, greatly concerned about the prospect of a Japanese invasion of Burma which would virtually isolate hard-pressed China from its Allies, offered Chinese reinforcements to the British. No agreement was reached, although the subject was thoroughly discussed. In Moscow, Stalin urged the establishment of a second front in Europe to support the Red Army's winter offensive and to prevent the Germans from preparing a dangerous counterblow in the spring and summer of 1942. At that time, all that the British could contribute actively to the war in Europe was to step up the RAF offensive against Germany and the German-occupied countries of western Europe, thus keeping substantial portions of the Luftwaffe away from the eastern front. A number of German divisions were tied up in the west by the potential threat of British concentrations in the home islands, and lend-lease supplies helped Russia substantially.

On Dec. 26, the British prime minister told the United States Congress that 1942 would be a year of preparation for a vigorous offensive in 1943. During the parleys, it was agreed that each of the major belligerents would assume responsibility for a particular theater of operations and would coordinate their plans according to a joint program. A united command of all land, sea, and air forces in the southwest Pacific was established under Field Marshal Wavell, with Maj. Gen. George H. Brett, chief of the United States Army Air Corps, as his deputy. Admiral Thomas C. Hart, commander of the United States Asiatic Fleet, was put in charge of all naval forces in the area. Generalissimo Chiang Kai-shek accepted command of the land and air forces of the United Nations in the Chinese theater of war and such parts of Siam or Indo-China as might come under Allied control. British Gen. Sir Henry Pownall was appointed Field Marshal Wavell's chief of staff. These appointments were made public on Jan. 3, 1942.

The Rape of Siam (Thailand).—The Japanese threat to Siam, increasing during the year 1941, came to a head when hostilities between the United States and Japan materialized. On March 11, 1941, some eastern areas of French Indo-China were awarded to Siam by the Tokyo government. During the following summer, Japanese political and economic infiltration became more active, while Japanese troops assembled along the Siam border. Informal warnings by the United States and British governments to

Bangkok, indicating that the presence of Japanese troops on Siamese territory would not be acceptable, had no effect. Siam, with 200,148 square miles and 15,750,000 inhabitants, could do little to defend itself. It had a very small army and no modern equipment. Although it was an empty gesture, the Siam Assembly (Dec. 6, 1941) gave Premier Luang Pibul Songgram full authority to order defensive measures.

On Dec. 8, 1941, at 2 A.M., the Japanese ambassador to Siam presented a note to the premier demanding that Siam grant the right to Japanese troops to use its territory for an attack against Malaya. Without waiting for a reply, the Japanese crossed the border from Indo-China's Cambodia Province and landed on the shores of the Gulf of Siam, investing the capital of Bangkok. Scattered resistance was quelled and, at 7:30 A.M., the Siam government acceded to all Japanese demands.

The Siam government subsequently carried out a policy of submission and collaboration, tremendously improving the Japanese position for attacks upon Malaya and Burma. It also facilitated Japanese naval campaigns in the waters east of the Indian Ocean and created favorable conditions for Japanese air supremacy in regions vital for the defense of British and Dutch possessions.

The British did not take any effective measures to protect Singapore, although the invasion of Siam could have been foreseen ever since the German victory in western Europe left the French domestic government neither able nor willing to hold Indo-China. Britain's 400 million dollar fortress of Singapore, backbone of British strength in the Far East, was designed to repulse a seaborne attack, and to protect Malaya against invasion from the south. With Siam under Japanese control, Malaya was open to land attack from the north, and Singapore's value was greatly reduced. Neglected in earlier British preparations when French Indo-China and Siam served as barriers, Burma was faced with a formidable hostile army at its borders. The distance between Japanese armies on the Asiatic mainland and India shrank dangerously. Japanese preparations were carried out methodically, and there was little the Allies could do to offset them. On Jan. 7, 1942, British and United States aircraft raided Bangkok and Japanese lines of communication in Siam in small numbers. On January 25, the Siam government declared war on the United States and Great Britain. A few ineffectual Siamese troops joined the Japanese invaders of Burma.

Guam.—On Dec. 8, 1941, the United States outpost of Guam (225 square miles and 23,500 inhabitants) was raided twice by Japanese planes. One minesweeper in the harbor was sunk. On December 10, the Japanese landed troops on Guam, and the small garrison was overwhelmed after two days of fighting.

Wake.—Wake Island (four square miles), which had been proclaimed a naval defensive area on May 15, 1941, was attacked by Japanese sea and air forces on Dec. 9, 1941. The defending force of 400 marines, under the command of Maj. James P. Devereux, upheld the finest fighting traditions of the marines. The attackers lost one cruiser and three destroyers by gun fire. A few United States fighter planes of obsolete type, kept in the air by incredibly skillful repairs, repeatedly challenged Japan's superior air force. The battle lasted until Dec. 22, 1941, when the outnumbered marines succumbed to a seaborne invasion.

Midway.—In 1939, the United States Congress authorized the construction of a naval, air, and submarine base on Midway Island (28 square miles). The island had been a station on Pan American Airway's route to Manila since 1935. In March 1941, Congress appropriated $9,707,000, and on May 15, 1941, Midway was declared a naval defensive area. The Japanese selected Midway as another early objective. Repeated air attacks failed to disrupt the island defenses, however, and no invasion was attempted.

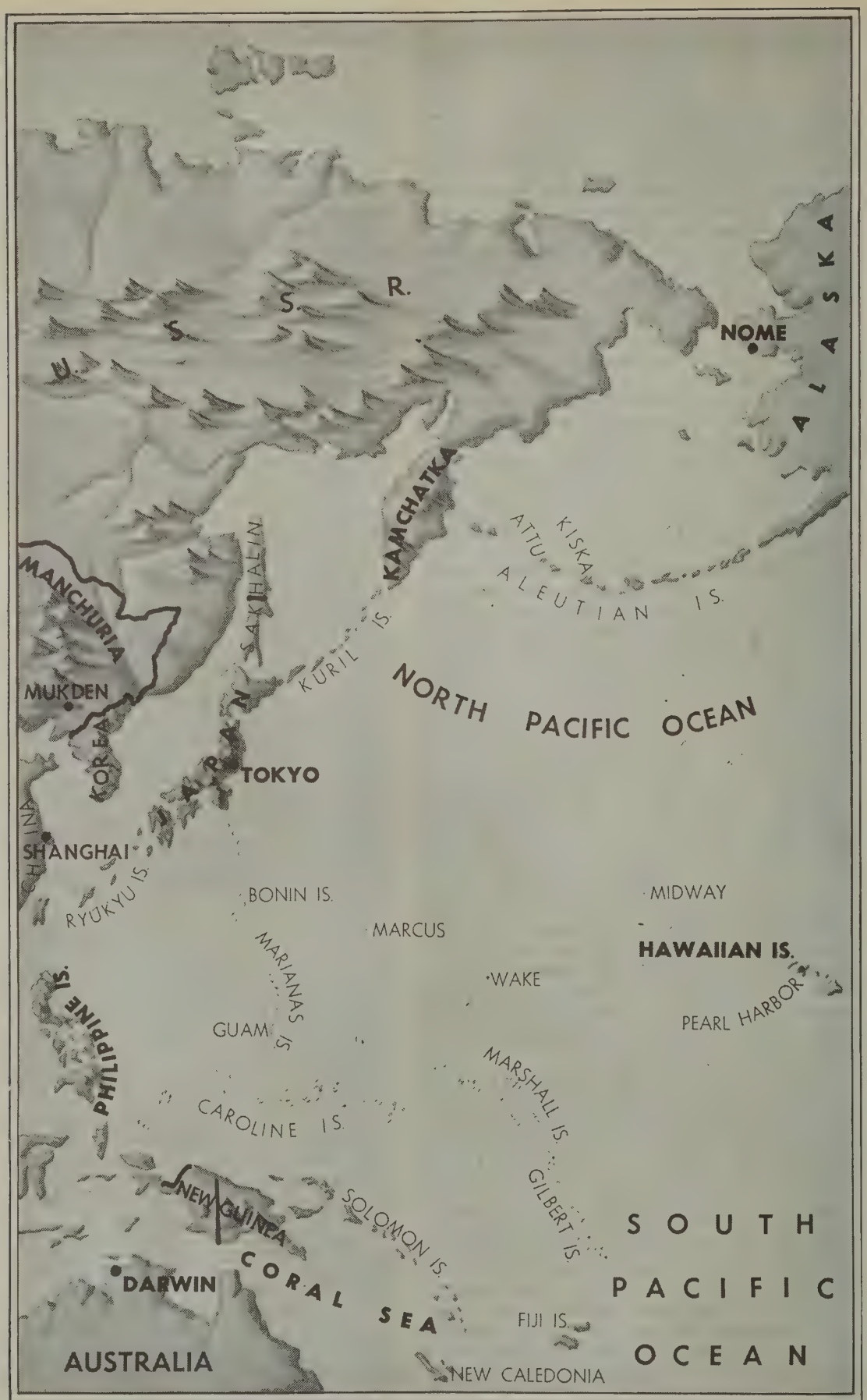
The Fall of Hongkong. — The British Crown Colony (1700 miles from Singapore) consisted of Hongkong Island, ceded to Great Britain in 1841, and the peninsula of Kowloon opposite Hongkong, acquired 17 years later. Hongkong's area is 32 square miles with a population of 1,026,445, swollen by refugees from China to almost two million in 1941. After the capture of Canton (90 miles from Hongkong) by the Japanese on Oct. 21, 1938, the Crown Colony was virtually isolated in Japanese-occupied territory. The plan to construct a first class naval base in Hongkong was abandoned as a consequence of the Washington Conference of 1922.

The tiny minority of Britishers in the Colony (the white population numbered 23,611) were apathetic and ill-prepared. Some 10,000 men, including Royal Scots, parts of the Middlesex Regiment, Winnipeg Grenadiers, Canadian Rifles, Rajputs, Royal Artillery, Engineers, Signal Corps men and auxiliaries, in addition to the small Hongkong volunteer defense force, were faced by two Japanese divisions poised to strike along the Taipo Road leading from occupied China into Kowloon. The Japanese had considerable air support, the British almost none. The Japanese could draw on reserves; the British had none. It was rumored that Chinese forces, 13 miles from the border of the Crown Colony, might come to the rescue of the besieged, but this was doubtful, for the Chinese had been unable to push the Japanese back in this sector since the fall of Canton. In any case, no Chinese help arrived.

The Japanese Air Force raided Hongkong on Dec. 7 and 8, 1941. The Japanese crossed the border of Kowloon on December 8 and took a British strong point on December 9. After suffering heavy losses from Japanese air attacks and superior firepower, the British fell back to the island of Hongkong on December 11, leaving only small forces behind to defend Devil's Peak. The retreat was hampered by riots of pro-Japanese natives against the British.

On Dec. 12, Hongkong came under artillery fire while raids continued. British counter-battery fire was greatly inferior to Japanese firepower. On December 12 and 17, the Japanese commanders asked the British commander to surrender, a demand which was rejected.

On December 18, the Japanese crossed the narrow straits in rubber boats and invaded the northwest corner of Hongkong Island. The British were not able to prevent small Japanese detachments, equipped with automatic weapons, rifle grenades, and light machine guns, from infiltrating to points from where the defenders could be harassed from the rear and communications disrupted. The main Japanese objectives were the island's water reservoirs. Four days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MIDWAY
MARCUS
HAWAIIAN IS.
WAKE
MARIANAS IS.
GUAM
PEARL HARBOR
PHILIPPINE IS.
MARSHALL IS.
CAROLINE IS.
GILBERT IS.
NEW GUINEA
SOLOMON IS.
SOUTH PACIFIC OCEAN
DARWIN
CORAL SEA
FIJI IS.
AUSTRALIA
NEW CALEDONIA

after the initial landing, some of the reservoirs were in Japanese hands; Victoria City (the island's capital) was under threat of investment; and the Japanese had made another landing. On Dec. 23, all water reservoirs were lost, light and power failed, and the exhausted British garrison was under overwhelming pressure by superior forces. On Christmas Eve, stores, installations, and ships in the harbor were destroyed to prevent them from falling into the victors' hands. On Dec. 25, 1941, 5,072 British, 1,689 Canadians, 3,819 Indians, and 357 other Imperials laid down their arms.

Japanese Conquest of the Philippines.— United States grand strategy aimed to hold the Philippine Islands during a defensive phase of the war against Japan, and to maintain communications with the islands from Hawaii. East of the Philippines, the defensive arc stretched 7,000 miles from the western tip of the Aleutians through the Hawaiian Islands, the Fijis, the New Hebrides, and New Caledonia to Australia. The Philippines also guarded the Dutch East Indies against attack from the northeast. The islands were anchors and outposts of defense, as well as potential offensive bases if the war could be carried to Japan proper. The Philippines were closer to Japan than any other major United States-controlled area and also close to China. Manila was 785 miles from Canton, and the northern tip of Luzon (largest island in the archipelago) was only 200 miles from Formosa.

It was just as important to the Japanese to conquer the Philippines as for the United States to hold them, because Japanese naval forces had to pass the islands on their way to Singapore.

Douglas MacArthur, formerly chief of staff of the United States Army, who held the rank of field marshal in the Philippine Army, was authorized to organize, train, and equip a citizen army of 400,000 and to create an air force of 1,000 planes. The United States Asiatic Fleet was based in the Philippines, with Cavite (near Manila) as its main stronghold. The Asiatic Fleet was to cooperate with the Pacific Fleet at Hawaii to keep sea lanes open.

When the war broke out, the Philippine citizen army numbered only 100,000, neither fully trained nor equipped. In addition, there were 11,000 United States Army regulars, National Guardsmen, and marines, 8,000 air force men, and 12,000 Philippine scouts on Luzon Island. None of the 80 airfields in the Philippines was underground. The army air force consisted of 35 B-17 Flying Fortresses, 107 P-40 fighters, and 108 miscellaneous craft, most of which were in Luzon at Nichols Field and Clark Field outside of Manila.

After the Pearl Harbor disaster, the shuttle service between Hawaii and the Philippines could not be maintained, and the United States Asiatic Fleet's surface units were withdrawn from Philippine waters. The navy's 30 PBY patrol bombers left with the ships.

On Dec. 8, 1941, at 4:45 A.M., it was learned in the Philippines that a state of war existed between the United States and Japan. A raid on Formosa by 17 Flying Fortresses from Clark Field was considered, but it was called off before the bombers reached their objective. The United States fighter air patrol failed to interfere with the subsequent Japanese air assault. From southern Formosa and from aircraft carriers, Japanese bombers took off to attack Luzon.

At 12:15 P.M., when only four P-40s were in the air, the raiders struck at Clark Field, destroying 15 out of the 17 Flying Fortresses and many fighter planes grounded for refueling. Within a few hours, the United States Philippine air force was greatly reduced. Lack of air reconnaissance permitted Japanese invasion fleets to reach the beaches without crippling losses.

On December 10, before dawn, one reinforced Japanese brigade went ashore five miles south of Vigan in northeastern Luzon. Eight U.S. Douglas A-20 bombers were all the depleted United States Air Force could muster to bomb the invasion fleet offshore. The bombers failed to return from their mission. On land, only one United States scout car met the invaders. Another reinforced Japanese brigade landed at Legaspi, on the southern tip of Luzon, losing two out of twelve transport vessels from air attack. Smaller forces invaded the northernmost part of Luzon Island at Aparri.

A Japanese seaborne pincer developed on December 22. Eighty Japanese transports, escorted by strong naval units, poured into Lingayen Gulf, the best landing ground on Luzon's west coast. United States-Filipino forces beat off the first wave of attackers, but, under heavy air cover and naval shelling, another landing was successful. The defenders tried to contain the bridgehead by throwing in their last reserves, but the advancing Japanese brigade from Vigan threatened the rear of the American and Filipino forces and additional Japanese forces swarmed ashore under cover of darkness. Within two days, five Japanese divisions and auxiliary troops landed at Lingayen Gulf, forcing the 1st Filipino Division, the 26th Cavalry Division, Filipino Scouts, and artillery to extricate themselves and fall back to the plain outside of Manila. Under cover of delaying actions, demolition squads carried out their destruction assignments.

The other arm of the pincer developed at Lamon Bay, where beach guard units could not hold superior Japanese forces. With the situation on Lingayen Gulf rapidly deteriorating, General MacArthur had to order a retreat to Bataan Peninsula, the best defensive area in Luzon, with its tip opposite the naval fortress of Corregidor. The general planned a stand in Bataan to await relief, provided it came on time

The Japanese from Lingayen and Lamon Bay advanced in the direction of Manila, spearheaded by light tanks and cyclist infantry. The objective was to capture the capital city and to prevent American and Filipino forces from reaching Bataan. The Fourteenth Army, under the command of Lt. Gen. Masaharu Homma, numbered 200,000 men, well equipped with armor and artillery and supported by 800 aircraft. Most of the Luzon air bases were soon under their control.

General MacArthur proclaimed Manila an open city, but this did not prevent the Japanese from inflicting damage upon the town and its inhabitants.

The 26th Cavalry Division and two battalions of the 51st Infantry Regiment virtually sacrificed themselves to give a force of 40,000 Americans and Filipinos an opportunity to reach Bataan with most of their equipment. Corregidor, site of MacArthur's headquarters, suffered its first bombing on December 29, and the raids continued thereafter.

The fortress island of Corregidor blocking the entry to Manila Bay is shaped like a pollywog. Its top, 600 feet high, is the head of the pollywog (some two miles in diameter), facing west into the China Sea. The middle part, with its great barracks and storehouses, is part way down toward the neck. The lower part forms a low neck connecting the head with the long, curving, rocky tail of the pollywog. A tunnel runs straight through the hill.

The Japanese entered Manila on Jan. 2, 1942. They also established themselves in force at Davao Gulf on the island of Mindanao and steadily extended their grip upon other islands. As long as Corregidor was not captured, however, the Philippine Islands could not be fully exploited as an offensive base by the Japanese, and General Homma had to concentrate on taking Bataan and Corregidor.

The defense line on Bataan ran from Manila Bay to Subic Bay. The former minor naval base of Mariveles was used for communication with Corregidor. Bataan Peak offered an excellent observation point. A tiny airfield at Sumai was available to a pitifully small air force. General MacArthur planned to hold positions paralleling the road across the peninsula from Olongapo to Orami. Comparatively inexperienced native troops manned the front line. Better trained and equipped units were deployed in rear defensive positions to a depth of five miles. Reserves consisting of one regiment of Filipino Scouts and the 31st United States Infantry Regiment were kept near Mariveles.

The Japanese showered leaflets upon the positions, urging the Filipinos to desert. Emilio Aguinaldo, leader of the Philippine insurrection in 1899, addressed the Filipinos by radio and called for cooperation with the invaders, but the loyalty of the Filipino soldiers to the United States remained unshaken.

On January 12, following a violent artillery barrage, the Japanese opened the attack on the entire 19 mile front. The defenders' right flank temporarily gave way, but a counterattack, launched by two Filipino divisions, drove the aggressors back two miles beyond their take-off position. This success could not be followed up because, if the defenders had moved beyond the peninsula, they might have been cut off by a Japanese thrust to their rear. One week later the Japanese attacked again. Landing parties harassed the defenders' left wing. By superb fighting, the seaborne invaders were wiped out, and the Japanese drive was stopped after it had regained the ground lost on January 12. On January 25, fighting subsided again.

Japanese air raids on Bataan brought heavy losses to the attackers. By February 10, 163 planes were downed, mostly by antiaircraft fire. There were no United States bombers left in the Philippines. Those which survived the first Japanese attacks were either transferred to Java or sent to Australia for repairs. By the end of February, three planes of the fighter force were left on Bataan, in addition to two training planes held together with bamboo, wire, and glue.

On Feb. 23, 1942, Douglas MacArthur, promoted to the rank of full general, was ordered to proceed to Melbourne, Australia, to assume a command—the Southwest Pacific area. On March 10, the general left Corregidor in a PT boat for an unoccupied spot on Mindanao, from where a B-17 took him to Australia.

Maj. Gen. Jonathan Wainright, MacArthur's successor in the Philippines, was in charge of a lost patrol, although the patrol's strength was still formidable. In addition to the defenders of Bataan, 25,000 Filipinos were mobilized in Mindanao, and 20,000 in the Viscayas. Relief from Australia was out of the question. The Japanese were in almost full control of the sea lanes, and the forces then gathered in Australia were small: 25,243 United States officers and men, in addition to Australian recruits under training and one brigade of the Australian 6th Division back from the Middle Eastern theater of war. The combined air forces had 250 planes ready for action and 187 in various stages of repair.

March was a month of comparative quiet on Bataan. Japanese reports told of the efficiency of American artillery fire. Conditions for the defenders, however, deteriorated rapidly. Supplies were dwindling; disease was spreading.

Lt. Gen. Tomoyuki Yamashita, conqueror of Singapore, came to Luzon to lead the Japanese drive. It opened on April 3, after an air bombardment and artillery barrage which forced the defenders to abandon advanced positions. In a five-day battle, the Japanese, using tanks, opened a salient three miles deep in the United States-Filipino center. On the eastern flank, along the coastal road to Mariveles, the American 2nd Corps was overrun. An attempt to drive back the Japanese failed and, on April 9, Japanese armor, followed by infantry, cut the only remaining road and routed the American 2nd Corps and the Filipino Corps. Straggling soldiers and marines fled to Mariveles and tried to reach Corregidor. Before the evacuation was completed (3,500 men reached the fortress), the Japanese occupied Mariveles and Sumai. The Americans and Filipinos in the center and the right flank faced encirclement. Exhaustion doomed attempts to break the ring, and the field commander of the Bataan forces surrendered on April 10.

The tunnel through the rock on Corregidor sheltered the garrison and the fugitives from Bataan. Sick and wounded men, nurses, and fighting men crowded its caverns. Food and ammunition were short, and the physical condition of the defenders was poor. The Japanese installed heavy caliber guns on the slopes of Mount Mariveles, and Corregidor suffered heavy shelling in addition to constant air attacks. Early in May, all of the island's antiaircraft installations were out of action and its batteries almost entirely silenced, but General Wainwright refused to heed a call for surrender.

Using 20 motor-driven armed assault barges, each containing one tank and a combat team with heavy infantry weapons, to spearhead a fleet of various troop-carrying craft, the Japanese launched their final attack on May 6. Although the tanks had trouble with the debris of barricades and entanglements, infantry reinforcements were able to press the defenders into the tunnel and to the top of the hill, where resistance was no longer possible. General Wainwright was forced to surrender.

The Japanese claimed that the surrender applied to all forces still fighting in the Philippine Islands. On May 10, Mindanao capitulated. The island of Cebu was already under control of the Japanese, who landed there on April 10 and took the island capital eight days later. Organized resistance on Panay Island ended on April 24, but

the Japanese did not report the complete occupation of Mindoro until November 1942.

Although resistance by regular forces ceased in 1942 guerilla warfare continued throughout the war, despite ferocious Japanese reprisals. Central Luzon, the Viscayan Islands, Panay, Cebu, Leyte, Mindanao, and the Negros Islands were guerrilla strongholds. Most of the guerrillas were native Filipinos, but some Americans who escaped capture joined them.

The march of the defenders of Bataan to prison stockades, referred to as "the death march," and their treatment in prison camps was horrifying. (General Yamashita and General Homma, responsible for what happened to the prisoners, were tried as war criminals after the surrender of Japan and sentenced to death. General Yamashita was hanged, and General Homma was shot on Luzon.)

Upon leaving the Philippines, General MacArthur is reported to have pledged: "I shall return." At the time this pledge was made, Allied fortunes in the Pacific were at their lowest ebb.

Conquest of Malaya and British Naval Disaster.—The Japanese threw their best available troops into the conquest of Malaya. They had undergone exhaustive training in areas where the territory approximated that of Malaya. They were under the command of Lt. Gen. Tomoyuki Yamashita. The British were not much inferior in numbers but were deficient in training and morale was low. In a coordinated blow on Dec. 8, 1941, the Japanese effected three landings on Malaya's east coast. Air Chief Marshal Sir Robert Brooke Popham (the British commander) was confident that meagerness of communications in that region would impede the Japanese advance. One landing was carried out near Kota Bharu, close to the Siam border. The RAF, with a small number of bombers and torpedo-carrying aircraft, attacked the Japanese invasion armada with some success (according to British reports), but failed to interfere with the progress of Japanese operations (according to Japanese reports). British land forces at Kota Bharu opposed the invaders, but Japanese naval shelling and air attack quickly softened the defenses. One hour after the beachheads were established, the Japanese Air Force heavily raided the RAF base, destroying its installations and driving the remaining planes away from the critical area. British ground troops and supply columns suffered heavy bombing and strafing. A counterattack failed to dislodge the invaders.

Inside Siam, in Krah Peninsula, the Japanese invaded Singora and Patani, 120 and 70 miles northwest of the border respectively. British Blenheim bombers, raiding the invasion fleets, were unable to prevent the landings. From Singora a good highway led across the Malayan border to Alor Star on Malaya's crucial west coast. Once the Japanese were established on its west coast, the defense of the peninsula was gravely endangered. Two British divisions faced the greater part of four Japanese divisions in the critical sector. The Japanese Air Force raided all Malayan airdromes within range, and reconnaissance planes penetrated as far as Singapore.

In Singapore, British Vice Admiral Sir Tom Phillips, in command of the recently arrived new 35,000-ton battleship *Prince of Wales,* the 32,000-ton battle cruiser *Repulse,* and four destroyers, decided to intercept Japanese landing fleets. These capital ships were the only Allied craft of their

kind in Asiatic waters and a vital factor in naval operations against Japan.

The flotilla left Singapore on December 8. Its objective was Kuantan on Malaya's east coast, about half-way between Kota Bharu and Singapore, where Japanese invasion vessels had been sighted. Admiral Phillips had no air protection when he left port. Already at sea, he radioed for land-based fighters to stand by to cover his ships, only to learn that there were none available. The British expected to create havoc among the Japanese transports and possibly to destroy one of the Kongo class battle cruisers reported in the vicinity. On December 8, it was learned that the British Fleet had been spotted by Japanese scout planes. Phillips decided to return to Singapore, leaving the Japanese free to carry out their landings at Kuantan, far to the rear of the defenders. On December 9, at 11:00 A.M., 150 miles from Singapore, Japanese long range torpedo-carrying aircraft, accompanied by horizontal bombers, attacked the British Fleet in waves. Both capital ships received several torpedo hits and sank. Of their complement of 2,925, 2,330 were saved by the escorting destroyers. Vice Admiral Phillips was among the casualties. This action not only hastened the fall of Malaya, but it also gave the Japanese a crushing naval superiority in Asiatic waters.

The defense of Singapore was not yet organized, and reinforcements were pouring into its harbor. The British command had to keep the front as far as possible from the fortress island. In the jungle, Japanese parties, armed with automatic weapons, infiltrated and rolled up British lines.

The Japanese moves were carefully planned and brilliantly executed. Rivers were easily crossed by flotillas of inflated rubber boats. Jungles which were almost impassable to the British were used to great advantage by the Japanese. Their midget tanks went where even a foot soldier moved with difficulty.

The Japanese frequently attempted and usually succeeded in landing troops behind the rear of the retreating British columns. Such landing operations, called *Höi Jöriku Sakusen,* were standard Japanese tactics.

On December 12, the Japanese drove into Kedah Province on Malaya's vital east coast, pressing back the British defenders. Native spies aided the invaders. On December 17, the British had to abandon Penang Island offshore. Numerous small craft left behind were effectively used for landing operations. Within one week, the attackers advanced 90 miles toward Taiping, on the way to the tin-mining city of Ipoh. Without air and armored support, the British suffered heavily. Ipoh fell on December 28. A Japanese landing forced the abandonment of British positions in Lower Perak. On January 7, after constant retreats, the British narrowly escaped a Japanese trap on the Slim River. Despite reinforcements from India, a general retreat had to be carried out toward Seremban on January 11. It continued down the Johore railway, and, on Jan. 20, 1942, the British realized that the entire peninsula would have to be evacuated.

Singapore was not ready to meet a determined attack. The Japanese advance had to be delayed at all costs. A defense line was improvised in the plain of southern Malaya. Two Japanese columns raced toward Singapore while other groups landed south of the Muar River. On January 31, the defeated British 3d Corps crossed the causeway into Singapore, sacrificing its rear guards. The causeway was dynamited but not effectively destroyed. The Japanese reached Johore Baru on January 31, and completed the occupation of the Malay Peninsula.

Between January 31 and February 5, the Japanese installed huge siege guns opposite Singapore, while reinforcing their tired divisions with two new ones. The British troops were either tired and demoralized by constant retreat or, if freshly arrived, were enervated by Singapore's trying climate. Deployment was hampered by Japanese artillery fire, bombs, and the influx of refugees which increased the number of civilians to more than one million. The RAF bases were under fire and almost destroyed. Japanese propaganda, directed at anti-British feeling among Indian soldiers, had some effect. The Australians, realizing that their native continent was in danger of invasion, were less inclined than usual to fight for a rather distant outpost of the empire. The mighty British guns of Singapore, installed to fight a seaborne attack, were of little use against an invader from Johore. Coastal forts were the only permanent fortifications in the critical area. Other defenses consisted of recently constructed field fortifications, trenches, and earthworks.

On February 5 at 6:00 P.M., Japanese siege guns opened fire. British guns replied, and the artillery duel raged for three days. Later a Japanese combat team of 5,000 picked soldiers gained a foothold on the northeastern corner of the island. After engineers repaired the causeway, reinforcements poured in, boosting the number of invaders to 30,000. Despite their numerical inferiority, Japanese spearheads penetrated the poorly organized defense lines. The defenders were chopped up into isolated groups; fighting was confused and not very violent. The Japanese captured the main water reservoir in the island's center. As a result of the loss of food, water, gasoline, and ammunition, it was impossible to continue the struggle. On February 15, when the Japanese reached the outskirts of the city of Singapore, the British offered to surrender. The papers were signed, unconditionally, on that day at 7:50 P.M. at the Ford Motor Factory of Singapore. Prisoners included 32,000 Indians, 15,000 British, and 13,000 Australians. A small number of British and Australian soldiers escaped to Sumatra in the Dutch East Indies.

The fall of Singapore doomed the Indies, and the door to the Indian Ocean was opened.

Pacific Island Campaign. — Methodically carrying out a carefully prepared plan, the Japanese set out to capture the 4,000-mile arc of islands ranging from the Malay Peninsula to Australia. The anchor of the Philippines was unhinged, and strategically important islands east of Sumatra and Java and north of Australia were invaded preparatory to the final drives aimed at Java, Sumatra, and eventually at Australia proper.

The pattern of attack was uniform. After establishing airplane bases within range of each succeeding objective, invasion fleets, protected by strong naval forces, made their way offshore close to the local airfields, which were then raided and quickly captured by special landing squads. Each captured airfield was then used as a base for the next invasion. In almost every case, resistance on land was rapidly overcome.

Borneo, 350 miles from Singapore and Sumatra, and 100 miles from the Celebes and Mindanao in the Philippines, was the first target of the Japanese assault.

On Dec. 17, 1941, the Japanese landed in Sarawak with no opposition. The capital of Kuching and the damaged oilfields were quickly captured. The few British troops in the region, falling back from Sarawak, joined the Dutch in western Borneo. Tarakan Island, off Borneo's east coast, offered no serious obstacle to a Japanese invasion. The Dutch oil center of Balikpapan in Borneo also fell to the invaders. Sambas and Pontianak on the west coast of Borneo were taken and Bandjermasin in the southwestern part of the island.

Celebes, west of Borneo, was the objective of a Japanese paratroop drive. With four huge peninsulas the island was difficult to defend. The Japanese established themselves on one peninsula within a week. Another invasion hit Celebes at Kandari.

On January 23, Japanese seaborne invaders seized Rabaul in New Britain and Kavieng in New Ireland. The waters around the islands came under Japanese control from the air, thus placing Allied shipping in an increasingly precarious position.

On January 25, the Japanese seized Lae, the newly established capital of the big island of New Guinea. The Dutch East Indies were already under attack, and the capture of Lae increased the threat to Australia. Rarely were the tiny garrisons able to oppose the landings, although the Royal Australian Air Force attacked the

invasion fleets. On New Guinea, however, the defenders at first succeeded in keeping the Japanese from the mountain barrier separating Lae and Buna from Port Moresby.

On February 1, a new threat to Port Darwin in Australia materialized when the Japanese seized Amboina in the Dutch East Indies. Japanese amphibious forces also attacked and seized Laha airfield at Ceram the same day.

There was little reason to believe that the Japanese would respect the neutrality of Portugese Timor, 350 miles northwest of Australia. The British and Dutch suggested that Portugal accept their protection of Timor. On January 18, before a reply was received, the Allies moved in despite Portugal's strong protest. It was then agreed that, after adequate Portugese forces arrived on the island, the Allies would withdraw. On January 20, the Japanese invaded Timor and captured its main settlements, air bases, and installations. The Allied troops were driven into the interior, where they conducted a modestly effective guerrilla campaign. The Japanese thus gained another base close to Australia.

A relief fleet of Australians and Americans from Port Darwin, escorted by the U.S.S. *Houston* and one destroyer, left Port Darwin for Timor on February 15. As Japanese naval units, including carriers, were reported close to Timor, the relief fleet returned to Port Darwin. On February 19, 72 Japanese high level bombers and 18 dive bombers obliterated docks, warehouses, and the airport of Port Darwin, set the city ablaze, and sank every ship in the harbor, including the U.S. destroyer *Peary*.

The Japanese would have met little resistance if they had attempted to invade northern Australia, but they had planned to gain control of the Coral Sea prior to an Australian invasion. During the second week of February, well protected naval convoys carried Japanese troops to Sumatra, a large island of the Dutch East Indies group close to Malaya. Japanese airborne invaders forced their way toward Palembang in the southeastern part of the island. The Dutch defenders fell back after burning oil wells and tanks.

A Japanese invasion attempt in the lower Celebes was also successful. On February 18, the Japanese went ashore on Bali. After an airfield was established there, all of Java was within bombing range.

Naval Operations in the Western Pacific.— The Allied naval situation in the western Pacific became extremely critical. Admiral Hart commanded one heavy cruiser (the *Houston*), two light cruisers (the *Boise* and the old *Marblehead*), 13 destroyers, 25 submarines, and various lesser craft. After the Japanese invasion of Luzon, Port Darwin was first considered as an operational base, but Admiral Hart subsequently chose Soerabaja in Java as his main port. The Dutch Naval Command under Vice Admiral Conrad E. L. Helfrich was established in Batavia, also in Java. The Dutch Navy numbered 3 light cruisers, 8 destroyers, and 15 submarines. After the loss of the *Prince of Wales* and *Repulse,* the British had to gather new forces in the critical zone.

The combined Dutch and British fleets were protected by tiny air forces. The Dutch had no factories and had been unable to obtain large deliveries from the United States, and the British needed most of their small air forces for the defense of the Asiatic mainland and Australia. The United States Asiatic Fleet had only 30 patrol bombers.

At the beginning of the second week of January 1942, Admiral Hart assembled Allied surface craft in the waters south of Borneo and Celebes. Allied submarines were active against Japanese transports off Malaya. The sinking of one 17,000-ton troopship and ten lesser craft by United States submarines was reported on January 15. Dutch airmen spotted a large enemy convoy heading toward Balikpapan on January 20, and United States submarines, lurking off the port, attacked the ships without conclusive results.

A convoy of 100 transports carrying 150,000 men was reported moving down Macassar Strait on January 23, escorted by 6 cruisers and 14 destroyers. After Dutch aircraft scored hits with light bombs on two cruisers, one destroyer and four transports, two United States cruisers and four destroyers were ordered to engage the convoy. On the way to action, the U.S.S. *Boise* struck an uncharted reef and suffered such damage that the ship had to proceed to India for repairs. Engine trouble reduced the *Marblehead's* speed to 15 knots, but the cruiser and the four destroyers intercepted the convoy. Three transports were sunk on January 23 and five more, the following day. A few Flying Fortresses, which had escaped to the Dutch East Indies from the Philippines, joined the action, which lasted for five days.

The last Allied convoy to Singapore suffered heavy losses from Japanese air attacks. The liner *Empress of Japan* was sunk, and other ships, among them the *Duchess of Bedford* and the U.S.S. *Wakefield,* were damaged.

Separate actions by Allied flotillas in scattered areas were ineffectual. Potential Allied operational zones shrank as Japanese domination expanded. It was decided to unite all available ships into one fleet to operate in waters adjoining the Dutch East Indies. The united force was assembled early in February. It consisted of vessels released from convoy duty to Singapore and most of the U.S. Asiatic Fleet. The U.S. cruiser *Houston* was the heaviest unit.

Air reconnaissance reported 3 Japanese cruisers, 10 destroyers, and 20 armed transports near Balikpapan. The Allied Fleet came under air attack in Macassar Straits. The *Houston's* after-turret was knocked out, and the *Marblehead* was severely damaged. Both United States cruisers had to return for repairs. The *Marblehead,* in a most hazardous voyage, later returned to the United States.

In Batavia, an attack upon a convoy coming down from the Molucca Sea was considered. Before the fleet left port, another Japanese convoy was sighted between the Anambas Islands northeast of Singapore and two more were signaled immediately thereafter: one near Banka Island east of southern Sumatra, the other on the move from Balikpapan.

Dutch Admiral Doorman chose to go for the Anambas convoy. His fleet was reinforced by the Australian cruiser *Hobart* and the British cruiser *Exeter,* two American and some British destroyers. One Dutch destroyer ran aground and was lost, another was left behind to pick up survivors, and Japanese air attacks inflicted slight damage upon the *Hobart* and two United States destroyers. The action was given up on February 15.

During the night of February 20, a successful raid took place in Bandoeng Strait, when Admiral Doorman intercepted the Japanese off Bali. The admiral had the Dutch cruisers and torpedo boats at his disposal, in addition to six United States and one Dutch destroyer. The Japanese lost two heavy cruisers out of six, two destroyers, and two transports. A Dutch light cruiser and one United States destroyer were badly damaged, and the Dutch destroyer was sunk.

A Japanese attack on Java seemed imminent. With Java in Japanese hands, the Allied fleet would have been bottled up in the Java Sea. As the loss of Java was considered inevitable, the rescue of the ships became a paramount objective.

On February 27, at 3:00 P.M., the Allied force left Soerabaja. At 4:00 P.M. contact was established with a strong Japanese fleet. The Japanese had two *Kongo* class battle cruisers, three heavy cruisers, two light cruisers, and thirteen destroyers ready for action.

Fire was opened at a range of 30,000 yards. Aircraft took an active part. Japanese submarines joined in with torpedo attacks. At 5:10 P.M., three additional Japanese cruisers came in sight with a destroyer escort.

Already the British cruiser *Exeter* was damaged, and one Dutch destroyer was sunk against the loss of one Japanese destroyer. At 5:30 P.M., a British destroyer went down. Admiral Doorman closed in to 18,000 yards. Hits were scored on Japanese ships, including one of the battle cruisers, but the damage inflicted by the lighter Allied guns was negligible, whereas Japanese shells had a telling effect upon Allied vessels.

Shortly after 6:00 P.M., Admiral Doorman ordered his fleet to withdraw under cover of a smoke screen to attack another Japanese convoy, reported by a United States Army bomber 25 miles west of Bawean Island. Before the convoy was reached, the fleet was ordered to turn west along the northern coast of Java. Dutch and United States destroyers went to refuel and take on more torpedoes. Two British destroyers remained with the cruisers.

Visibility was poor. At 9:25 P.M., one British destroyer was torpedoed and sunk. The other stopped to pick up survivors. Japanese submarines shadowed Doorman's forces. The admiral nevertheless decided to go after the Bawean convoy. At 11:15, shots were exchanged at 9,000 yards range with two Japanese cruisers. Within a few minutes, both remaining Dutch cruisers were torpedoed and sunk. Only the U.S.S. *Houston* and the Australian cruiser *Perth* were left.

It was agreed that the crippled British cruiser *Exeter,* accompanied by one United States and one British destroyer, should proceed to Tjilatjap. On March 1, the ships reported the approach of three Japanese cruisers. This was the last message received from them. The vessels were lost. The *Houston* and the *Perth,* accompanied by one destroyer, also on their way to Tjilatjap, were likewise attacked on the night of March 1 by superior Japanese forces off St. Nicholas Point. All three ships went down. The four remaining United States destroyers left Soerabaja under violent Japanese air attack on February 28 and succeeded in reaching Australia after a four-day run.

On the morning of March 1, the Allied Naval Command in the Dutch East Indies was dissolved. Only Allied submarines were left in the Japanese-dominated waters.

The Conquest of Java.—On February 26, there were 15 Allied planes available in Java, while the Japanese assaulted the island with hundreds of planes. On February 27, one British and one United States ship (both subsequently lost) brought in 59 P-40 fighter planes. This was some help to the defense of the island.

After landing at Bawean Island, 100 miles north of Soerabaja, on February 25, the Japanese swarmed ashore on March 1 and 2 on the Javanese beaches at Serang, Indramajoe, and Rembang with three divisions, tanks, and heavy equipment. Four more divisions were brought in on March 3.

Maj. Gen. Hein ter Porten, commander of the Dutch ground forces, tried vainly to get his troops to the invasion beaches in time to contain the landings. The extreme density of the Javanese population (817 to the square mile as compared to 43 in the United States), many of whom were on the roads, slowed down troop movements. The fighting led to high civilian casualties, which did not bother the invaders, but which the defenders were anxious to avoid. Japanese tanks caught Dutch troops on the march and cut through whatever lines were being formed. They raced through the narrow island, blocking attempts at organized resistance in the mountains.

Batavia fell on March 5, Bandoeng and bomb-scarred Soerabaja on March 7. From Bandoeng, Java's military headquarters, the radio broadcast: "Goodbye till better times! Long live the Queen!" It was an occupation in force rather than a campaign. On March 7, General ter Porten surrendered 97,000 Dutch troops, in addition to 5,000 British and Australians and a few Americans, the latter mostly air force men.

The Dutch East Indies were lost, 340 years after the Dutch East India Company was created, and with them 48.6 per cent of the world's rubber, 27.8 per cent of its tin, and 2.8 per cent of its oil. Including Malayan production, most of the world's rubber supplies were in Japanese hands. Only the rapid development of synthetic rubber production in the United States prevented a most serious armament crisis. The Dutch scorched earth policy devastated oil wells and refineries at Tarakan, Balikpapan, and Palembang, the naval bases of Soerabaja and Amboina, and harbor works in the Macassar district.

U.S. Pacific Carrier Task Forces.—On Dec. 30, 1941, Admiral Ernest J. King was appointed commander in chief of the U.S. Navy. On Dec. 31, Admiral Chester Nimitz became commander in chief of the Pacific Fleet. His most urgent task was to keep sea lanes open between the United States and Australia. Convoys to Australia moved slowly, often at 6 knots. The defense of Australia and the possibility of an Allied counter-offensive depended upon their arrival. As most of the heavy units of the Pacific Fleet were still out of action, and as the United States was faced with the necessity of giving the fleet an extended range to offset the superior numbers of Japanese craft, carrier task forces were organized, each of which was built around a heavy aircraft carrier.

There were two such task forces in early January 1942; one, under Vice Admiral William F. Halsey, consisted of the carrier *Enterprise,* three cruisers, and six destroyers; the other, under Rear Admiral Frank J. Fletcher, was

composed of the carrier *Yorktown,* two cruisers, and four destroyers.

On Jan. 9, 1942, the task forces were ordered to raid the southern Marshall and northern Gilbert Islands. The Japanese had strong naval bases on the Marshalls. The purpose of the raid was to block the harbors by sinking ships and to destroy enemy aircraft and essential installations. A shuttle patrol of 12 planes, operating between Canton in the Phoenix and Suva in the Fiji Islands, reported Japanese moves. On January 25, the U.S. forces left Samoa to raid Roi, Kwajalein, Wotje, Jaluit, Mili, and Taroa in the Marshalls, and Makin in the Gilberts. United States carrier-based planes, attacking Kwajalein on January 31, sank two submarines and two transports and damaged one light cruiser, three large oilers, two cargo vessels, one steamer of about 20,000 tons and one gunboat. Damage was also inflicted upon shore installations. At Taroa, hangars, gasoline dumps, batteries, and grounded planes were hit. Wotje was bombed and shelled. Military installations on Jaluit and Makin were wiped out. One 8,000-ton transport was sunk at Jaluit, and one seaplane tender of equal size destroyed at Makin. The raids cost the Japanese a total of 73,000 tons of shipping, 35 aircraft, and considerable damage to vessels and installations.

Although the effect could not be compared with Pearl Harbor, or what happened later in the Java Sea, this action was the first successful United States naval thrust. It was also a test of the effectiveness of carrier task forces which altered the traditional concepts of naval warfare. As a result, carriers were given priority over battleships in the gigantic American shipbuilding program.

On February 11, plans were made to raid Wake Island, then in the process of being heavily fortified by the conquerors, and Eniwetok Island, guarding the approaches to the great Japanese base at Truk. Admiral Halsey's force sailed out of Pearl Harbor to attack Wake on February 14, but the attack on Eniwetok was called off. Two light patrol vessels, three aircraft, seven out of ten huge gas tanks, and other installations were destroyed on Wake Island. Proceeding to Marcus Island, 975 miles from Japan, carrier-based planes were launched 125 miles from the target on March 4. One United States plane was lost in a heavy AA barrage, but a number of fires were started and various installations damaged. The raid gave evidence of American ability to strike far behind the so-called limit of enemy sea domination.

In February 1942, another strong task force was formed under the command of Vice Admiral Wilson Brown, consisting of the carrier *Lexington,* four heavy cruisers, and ten destroyers. Admiral Brown's first objective was Rabaul on New Britain. On February 20, before the planes could be launched, the task force came under heavy Japanese air attack 225 miles from its objective. Although the *Lexington* was undamaged and 18 Japanese planes were shot down, the raid was broken up.

The Japanese continued to build up Rabaul. They consolidated their conquests by occupying all of New Britain and New Ireland and by invading Bougainville, in a thrust directed at the Solomon Islands.

In a raid on Lae and Salamaua, in New Guinea, Admiral Brown's task force was joined by Admiral Fletcher's carrier, two United States cruisers, one Australian cruiser, and six destroyers. Due to Japanese air opposition, the warships themselves did not come within firing range. But 51 planes from the *Lexington* and 52 from the *Yorktown* took off and reported the following results: five transports and cargo ships, one light cruiser, and one destroyer sunk; one heavy cruiser believed sunk; one heavy cruiser, one seaplane tender, two destroyers, and two gunboats severely damaged.

The Doolittle Raid.—On April 18, 1942, the main Japanese islands experienced their first raid. The prevailing strategic situation, and the short range of early 1942 model planes, did not permit effective bombing, but the fact that the daring action succeeded in carrying the war to the Japanese capital bolstered morale in the United States, bewildered by Allied reverses. The people of Japan, despite continued cheerful news from all theaters of war, began to realize that they were facing a formidable opponent. The raid on Japan was a joint army-navy operation. The new aircraft carrier *Hornet* carried 16 Army B-25 medium bombers. Capt. Marc A. Mitscher commanded the carrier and Col. James C. Doolittle the bombers.

The *Enterprise,* four cruisers, and eight destroyers escorted the *Hornet.* The fleet was sighted by Japanese patrol boats and radio-equipped deep sea fishing vessels 700 miles off Tokyo Bay. Bombers taking off at that distance from their target could not hope to return to the carrier. Nevertheless, it was decided to launch the bombers immediately, while the fleet returned to its bases. After carrying out their mission, the planes were to attempt to reach friendly territory on the Asiatic mainland. Loaded to capacity with fuel, the planes could carry only small bomb loads. They dropped their missiles on Tokyo, Yokohama, Nagoya, and Kobe, staying 30 seconds over the capital. The results could not be clearly observed.

Of the 80 men of the plane crews, 64, including Doolittle, eventually returned to the United States via China, five reached the Russian Maritime Province and were interned, eight were captured by the Japanese, and the fate of two was not learned. With many destructive bombings of non-military targets to their record, the Japanese denounced the raid as inhumane and reported that the United States captives would be tried and executed. Two of the American airmen were actually beheaded, arousing violent indignation in the United States.

The Loss of Burma.—None of the British campaigns during World War II was more criticized than the defense of Burma. The charges included official inefficiency, lack of interest, and lack of intelligent organization. There was actually a lack of understanding among authorities in London and India as to where the responsibility lay for the defense of Burma. It is hard to understand why the British did not accept Generalissimo Chiang Kai-shek's urgent proposal, in December 1941, that Chinese troops be assigned to reinforce the garrison of Burma. After having given Malaya priority over Burma, the British government tried to bolster its forces in Burma when Singapore was about to fall. The result was a striking example of "too little and too late."

In December 1941, British Gen. Jack Smythe, commanding in Burma, could muster only the 1st Burma Division and the 17th British Division

with little armor and 150 aircraft. Later in the campaign, some reinforcements joined the British forces, among them one Indian division. The 7th British Armored Division, with 114 tanks, arrived in Rangoon when Burma's capital city and main harbor were already under attack.

The Japanese gradually massed a total of 5 divisions, 450 planes, and a tank corps at the Siam-Burmese border. Their troops were thoroughly trained in jungle warfare and were also expert in setting up road blocks. The British troops were inadequately trained and equipped. Tommy guns, very effective weapons in jungle warfare and employed in large numbers by the Japanese, were rarely used by the British.

The Japanese waited until the Malayan campaign had progressed far enough to safeguard their southern flank. Then the British 17th Division, holding the small appendage of Burmese territory ranging southward along the Gulf of Martaban in the east of the country, was attacked. During the night of January 16, a Japanese column of two battalions made a thrust in the coastal area of Tenasserim Province toward Tavoy and Mergui. Outflanked and out-maneuvered, British flank-guards in that area were evacuated by sea to Rangoon. Tavoy was occupied by the Japanese, and another Japanese column headed for Paan, on the eastern bank of the Salween River, 40 miles north of Moulmein. A third attacked the 16th Brigade of the British 17th Division near Kawkareik. Japanese forces facing the British 16th Brigade were rather small, but their fighting skill, equipment, and air support were superior, and the British were driven back toward Moulmein.

The Japanese columns converged on Moulmein, only 200 miles from Rangoon by road and less than half that distance by air, to sever the southeastern land appendage from the rest of Burma. Neither the British airmen's tenacity nor the assistance given by American Flying Tigers from China could prevent the Japanese air force from maintaining supremacy. The Flying Tigers had 18 planes in flying condition. On January 31, the Japanese crossed the Salween river in inflated rubber boats, penetrated the screen, and forced the evacuation of Moulmein without a fight.

The defenders fell back toward the Sittang River, farther to the west. So disorderly was the retreat of the tired troops that fast Japanese columns, penetrating through rear guards, outraced a part of the British forces east of the river. There was no potential defense line covering Rangoon west of the Sittang. On February 25, British authorities ordered Rangoon evacuated and set afire. Matériel for China, including 980 trucks, was destroyed, as well as ships in the harbor. Jails and insane asylums were opened. Criminals and lunatics joined with numerous well organized fifth columnists in creating a state of chaos.

The British then concentrated at Pegu, on the railway linking Rangoon with Mandalay. The Japanese, after crossing the Sittang River, virtually trapped the British Army in Burma by cutting both railroads and highways running through the Irrawady and Sittang River valleys and establishing road blocks. The 7th Armored Division ferried the isolated groups out of the trap. The Japanese entered Rangoon on March 8, 1942.

After the fall of Rangoon, Gen. Sir Harold Alexander took over command in Burma and accepted the Chinese offer of assistance. The Chinese, expecting effective air cover for their forces, were disappointed by the RAF's inability to provide it. The Fifth and Sixth Chinese Armies, 55,000 poorly equipped but battle-hardened troops, rushed into Burma. General Alexander intended to hold a line running from Toungoo on the Sittang River to Prome on the Irrawady River. The Japanese foiled his plan by infiltrating to the rear of Toungoo and setting a road block. On March 19, United States Gen. Joseph W. Stilwell, chief of staff of the Chinese theater of war, was appointed commander of the Chinese forces in Burma. Stilwell attempted a general attack on the ground and in the air, in which the British were to join. Conditions were most unfavorable for attack, but General Stilwell realized that, with no effective means available to stop Japanese infiltration tactics, defensive action was bound to lead to disaster.

A "Burmese Freedom Army," 4,000 men trained by Japanese agents, joined the Japanese. The Burmese harassed the British right flank and rear. They served as guides to the Japanese, and so intimidated those Burmese who were still loyal to Britain that many became collaborators with the invaders or refrained from any action.

An attempt by Stilwell to drive into the flank and rear of the Japanese forces investing Toungoo failed, and a retreat had to be ordered again. Japanese road blocks ranged from well concealed machine guns to solid obstacles of huge felled trees and wrecked cars protected by machine guns, trench mortars, and light field artillery. Trench mortars, of which the Japanese had many and the Allies very few, proved highly efficient. The Allied retreat led through the Salween, Sittang, and Irrawady river valleys. There were no roads outside the valleys. Burmese collaborationists, however, repeatedly led Japanese infiltrating parties over unmapped trails behind the Allied forces. In the third week of April, heavy rains started in central Burma, converting roads into quagmires. This gave the British some hope that the Japanese, still 150 miles from Mandalay, would not reach the city before the beginning of the monsoon season, during which major operations were virtually impossible.

Mandalay was the chief supply center of the retreating armies. A Japanese incendiary raid on April 4 set the city ablaze, and fifth columnists sabotaged the fire fighting system. The city burned for 27 days. Transportation broke down in the rear of the Allied armies, looting and sniping increased, and native ground crews and helpers left air bases.

On April 15, a Japanese drive from Chiengmai in Siam, supported by armor and planes, smashed into the Burmese Shan States, engulfing the thinly spread Chinese defenders. The invaders drove toward Lashio, terminus of the Burma Road, far to the rear of the staggering Salween River front. On April 22, they took Taunggyi, 175 miles south of Lashio. On April 26, they were 30 miles from the city, which fell on April 28.

A prolonged defense of Mandalay became impossible after the fall of Lashio, and, on May 1, its smoldering ruins were in Japanese hands. This sealed the fate of Burma. All the Allies could attempt was to save as many of their shattered forces as possible. Generals Alexander and Stilwell agreed that the 38th Chinese Division and

the remnants of the British troops should cross the Ara bridge and march in the direction of India. There were 13,000 British and 35,000 Chinese left. The flight from Burma continued for months. Natural obstacles and bad weather contributed more to the hardships of the defeated forces than enemy action. Many men were lost in the jungle and many died of exhaustion, malnutrition, and disease. Groups of stragglers arrived in India from June until November of 1942.

The victors were free to choose between an attack on India and a drive along the Burma Road through China's backdoor. British-Indian defenses centered at Imphal, capital of Manipur State. The Chinese rushed forces to hold the Burma Road, but their land lifeline was cut, and supplies were desperately needed. China's chances of continuing to fight seemed slim.

Japanese Penetration of the Indian Ocean. —Following the fall of Singapore and the Dutch East Indies, the Japanese Navy could sail at will into the Indian Ocean through the Straits of Malacca and the Straits of Sunda. Ceylon was the key point the British had to hold. If the Japanese had attacked Ceylon in early March, they might have captured or at least neutralized the base, but they waited too long and the British rushed land forces, aircraft, and anti-aircraft guns to Ceylon.

Diverting ships from convoy duty, the British assembled substantial naval forces southeast of Ceylon under the command of Admiral Somerville, who had been recalled from the Mediterranean. Late in March 1942, the British noted indications that the Japanese were about to attempt an operation in the Bay of Bengal. At least two aircraft carriers, three *Kongo* class battle cruisers, and many smaller craft were reported ready for action.

On April 5, Japanese aircraft raided Colombo, suffering a loss of two thirds of the attacking planes without inflicting serious damage. British Blenheims failed to detect the Japanese carried, but Japanese reconnaissance planes sighted two British heavy cruisers under Somerville's command. Both were sunk late in the day by Japanse fighter aircraft carrying a single large bomb each. The Japanese next caught and destroyed the old carrier *Hermes* at Trincomali, and sank nearly 100,000 tons of British merchant vessels in the Bay of Bengal. They then returned to their bases to refuel and recondition their ships, giving the British a sorely needed breathing spell.

ALLIES FIGHT GERMANY BY SEA, LAND, AND AIR

In the months before Pearl Harbor, the United States Atlantic patrol kept most of the German submarines away from the western sector of the shipping lanes. This fact, coupled with improved British tactics, reduced tonnage losses to an average of 200,000 a month in late 1941. Another factor was the German Navy's decision to keep a substantial number of submarines out of action in order to have reserves available for a large-scale submarine attack on American shipping when the United States entered the war. The number of German submarines available when war was declared on the United States was estimated at 300, of which no more than 100 were at sea on Dec. 7, 1941. Immediately thereafter, the German High Command threw most of its available U-boats into a drive against shipping in the western Atlantic. On Dec. 28, 1941, a squadron of submarines, based on the Biscayan Gulf in France, sailed for the American coast. They scored their first success on January 14, sinking the tanker *Norness* 100 miles east of New York City. The next day the *Coimbra* was sunk in the same area, and the tanker *Allan Jackson* went down off North Carolina on January 18. German attacks focussed on tankers in an attempt to reduce United States oil supplies to an extent which would cut down production of planes, tanks, and other motorized equipment, and prevent United States intervention in Europe. During the first 60 days following the Pearl Harbor attack, more tonnage was lost off the United States east coast than Britain lost all over the world during the preceding 5 months. By the end of January 1942, ships were being sunk within sight of New Jersey beach resorts. A blackout was ordered in cities along the United States east coast. A small number of Italian submarines joined the Germans but were not very effective.

Antisubmarine devices and tactics had not been adequately developed in the United States. Until well into 1942, the United States Navy lacked shore-based, wheeled aircraft, and the building of small escort vessels, MT boats, and sub-chasers lagged behind the construction of larger craft. The British came to the assistance of the United States by making available all the data they had gathered concerning submarine warfare and giving full details of countermeasures. A number of experienced British naval officers went to the United States, and 30 corvettes and antisubmarine craft of the Royal Navy joined the United States Navy. Convoys were formed along the United States Atlantic coast. This was done reluctantly, as it reduced the average speed of ships. A convoy was forced to travel at the pace of the slowest ship in it, and fewer trips could be made. Despite the British contribution, there was a shortage of escort vessels. The first east coast convoy left port on May 14, 1942. Army patrol bombers were added to the navy's seaplanes and dirigibles (blimps). Old four-stacker destroyers, small cutters, subchasers, converted yachts, minesweepers, and tugs worked on convoy duty.

On Dec. 21, 1941, United States Secretary of the Navy Frank Knox claimed that, up to that day, American naval forces in the Atlantic had sunk or damaged about 14 enemy submarines. At least three sunk and four more damaged were reported as the United States score for January and February 1942. Subsequently, data of submarine sinkings were withheld from publication. Allied commercial shipping losses in 1942 rose above 7,000,000 tons compared with a construction total of 6,825,000 tons. Considering the great number of vessels laid up for repairs, available allied shipping space declined substantially in 1942. Losses were at their peak in the middle of the year, with upward of 800,000 tons a month sunk or damaged. After October 1942, losses fell below the 600,000 ton mark. Yet, on Jan. 19, 1943, a United States Navy spokesman said: "We are not winning the battle of transportation." As long as the battle of transportation was not won, no decisive victory on land or in the air was possible. Relatively safe transportation and a vast amount of shipping space were needed to carry men and matériel to the various theaters of war.

Losses suffered in the Caribbean Sea, added to losses suffered on the United States east coast, constituted a formidable total. There, too, tankers were the principal targets of German attacks. Wolf packs concentrated close to the oil fields of Maracaibo and the refineries at Curaçao, and U-boats created havoc in the passages around Cuba and San Domingo. The Antilles Air Command (U.S. Army) contributed some old B-18 bombers to fight the menace. The Navy's Caribbean Command, under Rear Admiral John Hoover, established bases at Guantanamo, Curaçao, and Trinidad. A small number of British corvettes and two Dutch vessels, joined by Brazilian craft after that country declared war on Germany and Italy on Aug. 22, 1942, assisted United States craft escorting Caribbean convoys. In July, the tide began to turn in the Caribbean Sea, and U-boat losses mounted. In the fall of 1942, the Allies gradually regained control of that area. Liberator B-24 bombers were particularly successful in the later phase of the struggle.

The Germans used an increasing number of aircraft in the battle of transportation, and their major surface units added to the threat against Allied shipping. The mere presence of these craft forced the Allies to keep capital ships on convoy duty.

The German battle cruisers *Scharnhorst* and *Gneisenau* and the heavy cruiser *Prinz Eugen,* bottled up in French harbors and under frequent air attacks, were ordered to join the bulk of the German Navy in Norwegian waters. On Feb. 2, 1942, British Intelligence reported steam trials and the arrival of 10 escort destroyers in the French harbors, indicating an imminent dash by the German ships toward safer bases. The British Admiralty had very few battleships available early in 1942 and did not want to expose these craft to an engagement in the Channel close to German airfields. The RAF was assigned to disrupt the German plans for escape by an operation called "Fuller." On February 12, the German ships succeeded in making the Channel run under cover of fighter aircraft. Failure of "Operation Fuller" was attributed to a breakdown in the night patrols of the RAF, weakness of available forces, failure to fly a strong morning patrol on that day, poor weather conditions, and German jamming of radar reception.

Late in February, the Germans assembled the super battleship *Tirpitz,* the battle cruiser *Scharnhorst,* the pocket battleships *Admiral Scheer* and *Lützow,* and the heavy cruisers *Prinz Eugen* and *Admiral Hipper* in Norwegian fjords, and 300 to 500 bombers—many of them torpedo-carrying Heinkel III's—on northern Norwegian airfields.

Four of the newest British battleships did convoy duty on the shipping lane to Murmansk, where the Germnas were preparing to stop Allied supplies to Russia. At the same time, the Wehrmacht prepared for another attempt to win in the east. Late in December 1941, one German pocket battleship and one heavy cruiser had intercepted a Murmansk-bound convoy but were driven off. During the dark season in Arctic waters from November to February, shipping was comparatively safe, but the situation became critical during the period of long daylight. In March, the *Tirpitz* lurked close to the Murmansk lane but, under attack by British torpedo bombers, had to return to Norway. On May 20, an Allied convoy left Iceland for Russia, and lost 50 per cent of its ships en route. Another convoy, leaving Iceland on June 29, lost 32 ships out of 38. Not only were many lives lost in these disasters, but also a great quantity of supplies urgently needed by the Red Army. These attacks were carried out mostly by submarines and airplanes.

In the late spring of 1942, the Germans revived and improved their wolf-pack tactics in the Atlantic. In addition to increased air reconnaissance to spot targets, the usual type of 520 and 740 ton U-boats were supplied by large, cruiser-type submarines carrying reserve stores, including torpedoes, to keep the attacking craft longer at sea than ever before. Wolf-packs were arrayed in a diagonal line across the anticipated path of a convoy, spreading over hundreds of miles and keeping the ships under attack from four to six days.

The First Russian Winter Offensive.—In a speech delivered to his Reichstag on Dec. 11, 1941, Hitler announced that "the advance of the German forces might be hampered or stopped by winter conditions." He reported German losses in the east during the period prior to December 1 as 162,314 killed, 577,767 wounded, and 33,334 missing. United States official circles estimated the figure at 1,380,000 killed and 2,820,000 wounded. On December 21, the German führer announced that he now combined in his hands the leadership of all armed forces with the supreme command of the army. Field Marshal Gen. von Brauchitsch was dismissed. In a frantic appeal to the German population, Joseph Goebbels called for warm clothes for the troops on the eastern front. Lack of warm clothing was aggravated by the record cold during the winter of 1941–1942. The temperature dropped to 61 below zero as compared to a minimum of 13 below during Napoleon's retreat in 1812.

When the Russian armies hit back, late in November and early in December 1941, the situation became critical for the Wehrmacht. Had the Russian drive gained momentum, the German armies might have collapsed. Some German units showed signs of panic and disintegration. But after the Red Army failed to exploit its initial advantages in full, German officers regained control of their men and forestalled disaster by rushing reserves to staggering sectors. On December 21, Hitler had reason to believe that the Wehrmacht would eventually regain the initiative.

Due to enormous losses in men and matériel, the Soviet counteroffensive was not as strong as the Russian High Command had hoped. The Russians were handicapped by poor communications. The Wehrmacht controlled most of the railways in a semicircular line with a radius of 110 miles around Moscow. The Germans also controlled a transverse line from Bryansk to Vyazma and two reasonably good highways, one linking Moscow and Kiev, the other running parallel to the Moscow-Smolensk railway. The Russians had only three railroad lines and no first class highways to the rear, greatly hampering the deployment of troops and transportation of heavy matériel. Russian ski troops and large bodies of mounted cavalry, superlatively mobile even on roadless territory, were effective in the pursuit of a routed enemy but of limited value in the assault of positions manned by determined defenders. The Russian High Command failed to gain adequate "elbow room" for transportation,

although 100,000 square miles of the lost total of 527,000 were recovered. The success of the Russian counteroffensive was therefore not decisive.

The Germans claimed that their carefully planned "hedgehog" system frustrated the Russian drive. It is true that, after capturing Orel, Kaluga, Vyazma, and Rzhev, the Wehrmacht had built up and defended these cities as strong bases, but this was a normal procedure, especially since cities afforded shelter for freezing soldiers and blocked enemy communications. In reality, the hedgehogs were no innovation, and the praise given by the Germans to Field Marshal Gen. von Kluge as their inventor was decidedly exaggerated.

Two exposed salients—remnants of the pincers that failed to close behind Moscow—existed in the German lines on both flanks of the central front.

The southern German salient, in eastern Tula Province, thrust toward the Yaroslavl road. On Dec. 9, 1941, the Germans were hit hard there by Red ski troops and cavalry. The panzers were hampered by engine trouble due to extreme cold. The outskirts of Tula were cleared of Germans, and Venev, Epifan, Mihailov, and Yelets were captured. In five days, the Germans lost 30,000 men killed, 658 tanks, 4,878 trucks, and 397 guns. After heavy street fighting, Kalinin fell on December 15.

After eliminating the German wedges, Russian operations were carried out frontally, and the lack of good communications became a serious handicap. The winter offensive developed into a series of actions on a much smaller scale than previous German offensives. Although this was due to prevailing circumstances and not to lack of strategic planning, the High Command of the Wehrmacht underestimated the enemy and believed that hazardous operations could be carried out against the Russians without much risk.

The Russians did not capture many German prisoners. German propaganda warned that capture meant torture and slavery in Siberia. Many German soldiers had shown great cruelty in Russia and had much to fear from Russian investigation. According to Russian reports, an order was found in Klin, signed by Field Marshal Gen. von Reichenau calling for the "merciless annihilation of the cunning and cruel enemy." On Jan. 12, 1942, a Russian note sent to all governments having diplomatic relations with the Soviet Union stated that the liberation of Russian territory had disclosed universal robbery, devastation, and massacre by the invaders.

After clearing the Germans from Tula, the Reds thrust toward Kaluga, entering there on December 26. A German counterattack momentarily recovered the devastated city but, on Dec. 30, 1941, the Russians again took Kaluga.

In an effort to keep springboard positions for another assault on Moscow, the Wehrmacht dug in for the defense of Mozhaisk (another hedgehog), but it fell to the Russians on January 18.

In the central sector, the Germans concentrated on defending the key points of Bryansk, Smolensk, Vitebsk, and Velikie Luki. If the Russians had succeeded in capturing those cities, they would have had communication advantages in central Russia. The Red offensive reached Kholm in a move to cut the railway linking the German besiegers of Leningrad with the armies in the central sector. Lack of matériel prevented the Russians from scoring a complete victory in the northern and central sectors.

During January and February, Marshal Timoshenko's army groups in the south pushed toward Kharkov, bypassing German hedgehogs at Taganrog, Stalino, and Artemovsk. After capturing Losovaya, the Russian drive on Kharkov came to a halt. An effort to take Dnepropetrovsk also failed. An attempt to reinforce the garrison of Sevastopol by landing in Evpatoria was equally unsuccessful.

On the Leningrad front, the German siege continued. On February 22, a Russian advance on the south shore of Lake Ilmen virtually encircled the German Sixteenth Army, but the Germans held out until thaws forced the Russians back from marshy ground.

In March, the Germans staged local counterattacks all along the front. Their planes returned to the air again, and increasing numbers of Wehrmacht divisions were rehabilitated and reformed. Early in April, the Russian offensive faded out.

The number of German divisions remained at 200, but their average strength was reduced by one third, and artillery losses could not be fully replaced. The Wehrmacht had to rely more and more on heavy infantry and automatic weapons. The equipment of the panzer divisions was reduced from 400 to 250 tanks. The Luftwaffe also showed a diminution of strength, due rather to increased RAF activities in the west and the growing number of aircraft engaged in the battle of transportation than to losses suffered on the eastern front. Even allowing for the troops of satellite states, German fighting strength in 1942 was about 25 per cent below the 1941 level.

Russian casualties ran somewhat higher than those of the Germans. The Red Army lost many tanks and planes, as their armor and air force had fought incessantly. Russian domestic production lagged behind the German, and Allied supplies could not fully make up the difference. Russian manpower was numerically greater than Germany's, but the Germans compensated for it by using millions of persons in conquered territory as slave laborers. Transportation advantages also remained in German hands, and German organizing abilities, highly important in the regroupment of huge armies, rated higher than the Russian. The Russian loss of fighting strength was proportionately no smaller than the German.

The Wehrmacht High Command realized that offensive operations could not be carried out all along the 2,000-mile front. With the strategic situation in front of Moscow changed in Russia's favor, the Germans decided to focus their main efforts in the southern and central sectors. The central move, referred to as the Volga drive, aimed at penetrating far to the southeast of the Russian capital to cut off the Red armies from the Ural industries. The southern drive, into the Caucasus, was to bring the Russian oilfields (the richest were at Baku on the Caspian Sea) under German control. From Baku, northern Iran faced invasion. A German drive through Iran could lead to India to meet or, as the Germans preferred, to outrace the Japanese. Cut off from their oil, industries, and most of their communications, the Russians would have been unable to carry on.

Before starting major operations, the Wehrmacht had to eliminate the fortress of Sevastopol

and recover Kerch, the gateway to the Caucasian foothills. The principal Russian hope lay in attempting to disrupt the German timetable, to stem the Wehrmacht's advance, and to inflict as many casualties as possible upon the enemy until the strain on German communications and exhaustion of the troops would bring the advance to a halt. The outlook was not bright for the Red Army, despite its winter successes.

Crimean Campaign and Battle for Kharkov.—Sevastopol's garrison of 75,000 was isolated from other Russian land forces. It was also without air support, as all Crimean airfields were in German hands. The Russian Black Sea Fleet, though obsolete and rather small, was still superior to naval forces the Axis could muster in the Black Sea. With German aircraft based nearby, and the best remaining Red naval base at Batum more than 400 miles away, the Red Fleet could only keep loose contact with the beleaguered garrison. On the easternmost tip of the Crimean Peninsula, at Kerch, three Russian divisions held a precarious bridgehead.

On May 7, 1942, the German Twelfth Army turned against this bridgehead with eight German and five Rumanian infantry divisions, two German panzer divisions, and substantial Luftwaffe detachments. The Red divisions, hemmed in an ever narrowing space, had to fall back across the straits into Taman Peninsula after six days of fighting. The fighting strength of the former defenders of Kerch was greatly reduced and available reserves hardly adequate for a successful defense of the gateway to the Caucasus.

With huge German forces massed west of Kharkov, Marshal Timoshenko decided to take a calculated risk to forestall the German offensive. He ordered a drive aimed at Kharkov, and as far beyond the city as possible, in order to disorganize the Wehrmacht's deployment. Timoshenko did not have enough men or equipment to carry out an ambitious offensive, but he relied on the element of surprise and believed that, even if the Germans resisted strongly, he could improve his own positions. Timoshenko's offensive opened on May 12. Pressure was exerted chiefly against the outer defenses of Kharkov along the upper Donets River, and from Losovaya along the railroad linking Kharkov and Poltava. In four days of slow advances, the Russians captured Merefa and Krasnograd and penetrated the defenses of Kharkov. A wedge was formed in the triangle Krasnograd-Losovaya-Merefa. The Wehrmacht, throwing some of its ample reserves into the critical area, counterattacked on May 17. In an effort to extricate his forces, Timoshenko lost 80,000 prisoners and some of his matériel. The Wehrmacht launched improvised attacks against the Red armies to hamper their regroupment for defense. All Russian offensive attempts ended by June 1. Ten days later, the German Seventeenth Army not only recaptured all the ground previously lost in the Kharkov sector, but succeeded in establishing a bridgehead across the Donets at Izyum.

On June 5, after careful preparation, Field Marshal General Mannstein attacked the defenses of Sevastopol with outposts at Belbek Valley and Balaklava 20 miles away from the city. Sevastopol suffered constant air attack and its forts were heavily damaged. The defenders' courage was worthy of the highest praise. Lack of matériel, however, doomed the garrison. Contesting every inch of ground with bayonets, the Russians were pressed back; the city, reduced to a shambles, could not be defended. On July 1, the German Twelfth Army completed the conquest of Sevastopol and, with it, of the Crimean Peninsula. A small group of the defenders made their escape by sea to the Caucasus. The Twelfth Army was still fighting for Sevastopol when, on June 22, 1942, first anniversary of the attack on Russia, the Wehrmacht opened its second great offensive in the Soviet Union.

British Debacle in North Africa.—Late in May 1942, the British Eighth Army held a line running straight south from the Bay of Gazala. Its northern sector was manned by the 1st South African Division, the center by the British 50th Division, and the southern flank—fading into the desert at the Bedouin well known as Bir Hacheim—by a Free French brigade. The British 1st and 7th Armored Divisions were kept to the rear, close to the sea, as a mobile counterattacking force. One New Zealand division garrisoned Tobruk, and the 4th Indian Division was on its way to the front.

British equipment, though improved, was still not adequate. The production of British Churchill tanks, the only British tank type matching the German Mark 3 and 4, had been temporarily slowed down while changes in design were made. United States General Grants were already available in substantial numbers, but still more were needed. The new British 6-pound antitank guns could not be shipped to the Middle East in quantity until midsummer. In the air, the development of the fighter bomber proved to be the answer to the German Stukas. The Germans had gained strength in armor and had also brought in 90 more 88-mm. cannon.

Rommel attacked during the night of May 26. His plan, which was risky, was to have both German panzer divisions and the Italian Ariete Division sweep through the desert past Bir Hacheim toward Tobruk to envelop the British position. The armor would have to travel a long distance, and supply columns could not keep up with the initial drive. If the push failed to reach its objective within the three day period for which the attackers carried supplies, the tanks would be immobilized and probably lost. A British counter-move against Axis lines deprived of armor might have led to their annihilation.

The Ariete, with 70 tanks, on the northern wing close to Bir Hacheim, was badly battered by French 75-mm. guns and lost 50 per cent of its vehicles. The German armored divisions swept through the desert without opposition. The 21st, in the center, attacked "Knightsbridge," a fortified and mined compound behind the British lines. The 15th, on the right wing, aimed at the airfield of El Adem. The Germans thrust deep into the British rear to within one mile of the main supply dump at El Duda, but the panzers were turned back after a sharp armored engagement. The Eighth Army's armor showed considerable fighting strength, and the RAF, although hampered by sandstorms, played an important part in the battle. Rommel's supplies ran low, and a determined British counterattack could have led to a German rout, but no counterattack developed.

In an effort to avoid disaster, Rommel tried to open a gap in the Eighth Army's lines north of Bir Hacheim, through which the panzers might retreat by a shorter route. He succeeded by using Italian infantry as sappers and laborers.

The British 150th Brigade, manning the critical sector, had no armored support and was overrun by the panzers. Quickly throwing infantry into the gap created by the 150th Brigade's defeat, Rommel established a wedge in the British position which isolated the French at Bir Hacheim and opened a shorter route to the panzers when the attack was resumed. British inactivity gave the commander of the Afrika Korps an opportunity to rally his forces. His next aim was to dislodge the French from Bir Hacheim, which would further expose the British Eighth Army's southern flank.

On June 8, Rommel ordered the 90th Light Infantry Division, the 155- and 210-mm. guns, and a large part of his dive bombers to attack the French. The RAF carried out fruitless raids against German spearheads far to the rear of the French Brigade. June 10 saw the Germans in control of Bir Hacheim. Remnants of the French forces made their way through enemy lines to join the British. Rommel, under greatly improved conditions, resumed his original plan for a drive of encirclement toward Tobruk. British armor was still intact when it was caught in a German trap.

On June 13, under cover of sandstorms, Rommel grouped his armor in a semi-circle close to his 90th Division, placing 88-mm. guns in front. Then he ordered the 90th to send out radio calls for aid. The British, hearing the calls, rushed the bulk of their armor to annihilate the "distressed" German infantry. They ran headlong into prepared German gun emplacements and tanks. Before the British could recover, only 70 of their 300 tanks were left.

Nothing but hasty retreat could save the British Eighth Army from encirclement and annihilation. No mobile engagement was possible before the depleted armor was replenished. Two infantry divisions were hemmed in on the former Gazala line. Three to five parallel lines of vehicles moved, bumper to bumper, on a road built only for two. The South African Division fled along the coastal road, while the 50th made its way through the desert, already dotted with German and Italian camps. The RAF worked in 20-minute sorties to protect the jammed areas from German attack. As the Libyan airfields were overrun by the advancing Axis forces, sustained air cover could not be provided for any length of time.

The British decided to hold Tobruk to delay the victor's advance. To reinforce Tobruk's garrison, three brigades were left behind with 80 field guns, a small number of antitank guns, and a few tanks.

Rommel immediately attacked the fortress, throwing most of the Afrika Korps and practically all of his Italian forces into the battle. Stukas and Savoia Marchettis bombed gaps through the minefields. The RAF, moving its bases, could not counter effectively. Forty German tanks penetrated the fortifications through a gap. In their wake, the German 90th Light Infantry, the 15th Panzer Division, the Ariete Division, and the Trieste Celere Division entered the fortress and annihilated small defense forces on its perimeter, including all the tanks that had been mustered. The Coldstream Guards attempted a counterattack but were engulfed. During the night, more Axis units poured through other breaches. Early in the morning of June 14, the confused resistance collapsed, and Tobruk, with 28,000 prisoners, was in the hands of the Axis armies.

Rommel immediately began his preparations for a decisive battle. In three days and nights of frantic labor, the panzers were reconditioned for a lightning drive into Egypt. It was an endurance race carried out in blistering heat. The Germans hoped to reach the Nile Delta before its defenses could be organized. Axis soldiers were promised leisure in Egyptian cities and urged to the limit of their physical strength. Mussolini came to North Africa with a large escort to make a triumphal entry into Alexandria and Cairo. The former Italian ambassador to Egypt prepared to take over the "protection" of Egypt in the name of the Axis powers. The fifth column was busy inside Egypt. The Germans printed invasion money.

General Auchinleck did not attempt a major stand in western Egypt. An earlier plan to hold Mersa Matruh was abandoned, too late, however, to prevent the capture of 6,000 more men when Axis forces entered the settlement on June 27. Reinforcements were on the way from Palestine, and 18 ships loaded with men and supplies sailed through the Red Sea. Small Eighth Army groups with considerable firepower, spread widely over the area of Rommel's advance, acted as rear guards. The RAF, established at bases deep inside Egypt, attacked the Axis columns.

The planned British defense line ran from El Alamein, 55 miles west of Alexandria on the Mediterranean, straight south to the eastern end of the Qattara Depression, an impassable stretch of land. Its flanks were safe and its length of 40 miles could be held by relatively small forces. To reach El Alamein, Rommel had to pass through a narrowing strip of land shaped like a bottleneck, with the sea to the north and the Qattara Depression to the south. In case the El Alamein line could not be held, the British planned rear guard actions all through Alexandria, where French warships were interned. An unsuccessful effort had been made to obtain the Vichy government's consent to remove these vessels. If Alexandria should fall, a newly organized "Delta force" was to defend the Nile Valley. General Headquarters was prepared to move from Cairo to Gaza, Palestine.

On July 1, Rommel's army faced the El Alamein line, manned by the remnants of the British Eighth Army—its losses amounted to 80,000 men—plus New Zealanders from Palestine and the gradually arriving 9th Australian Division. The German commander, promoted to the rank of field marshal general, could not wait to reorganize his exhausted men, nor could he wage a prolonged battle with soldiers on the verge of collapse. He had to win a quick victory, or else another plan would have to be worked out to reach the coveted goal.

Without much armored support (many German tanks had broken down on the strenuous trip) and with even less assistance from the air, as Luftwaffe bases were not yet established in forward areas, Rommel began an attack on the British front which lasted from July 1 to July 5 without breaking through. German attacks had to be discontinued after July 5. Alexandria and the Nile Delta were saved. A local British drive created a five mile-long salient along the coast, including a ridge and railroad station. Attempts to dislodge Rommel in other sectors failed.

General Auchinleck was relieved of his com-

mand. His appointed successor, General Gott, was killed in his plane on the way to Cairo. Lt. Gen. Sir Bernard Law Montgomery took charge of the reorganized Eighth Army. Gen. Sir Harold Alexander assisted in the revision of British desert strategy. Prime Minister Winston Churchill came to Egypt twice. The British armor was also reinforced by new, all-welded United States General Sherman and British Churchill tanks, United States fighter squadrons, and improved British antitank guns. British, Australian, South African, New Zealand, Indian, and Polish units built up the Eighth Army's strength beyond that of Rommel's forces.

The easy repulse of several German thrusts in September showed the Axis commander that the scales had tipped against him, but Rommel decided to hold his strategically unfavorable position. In a press conference in Berlin he boasted: "It may be relied upon: what we have, we keep!" Keeping what the Axis held in Egypt meant keeping the army at the top of a bottleneck which was likely to become a death trap in case of an enemy breakthrough. A retreat to Mersa Matruh would have improved Rommel's position, although it would have meant the abandonment of a part of the Axis conquests.

Occupation of Madagascar. — Although aware of the potential menace of the 241,096-square mile island of Madagascar (populated by 3,979,936 people, of whom 25,255 were French) under control of the Vichy government, the Allies were not fully convinced that action was necessary until April 1942. Gov. Gen. Armand Annet was having Allied sympathizers rounded up while Axis agents infiltrated the island. The Union of South Africa thereupon severed relations with Vichy France. British expeditionary forces gathered in South Africa. Early in May, it was reported that two ranking Japanese naval officers, members of their country's delegations to Berlin and Rome respectively, were negotiating with Vichy Premier Pierre Laval about Madagascar.

The British moved at once. During the night of May 4, naval forces, including one carrier and several cruisers, covered the landings of South and East African troops near the naval base of Diego Suarez in northern Madagascar. The United States government informed Vichy that the British move had its full support. The French resisted but were speedily defeated, and the base was occupied on May 7. One German freighter and two scuttled Italian merchant vessels were in port. The proximity of Japanese submarines was proved when, on May 30, Japanese undersea craft attacked the British Fleet off Diego Suarez without inflicting major damage.

Prolonged efforts to induce Governor General Annet to agree to a peaceful establishment of British control failed. During the negotiations, operations were confined to the occupation of the Comores Islands off Madagascar on July 9, 1942. On Sept. 10, the British drove on Tananarive, capital of Madagascar. Almost 75 per cent of the Vichy French troops, when captured, asked to be admitted to General deGaulle's Free French forces. Despite natural obstacles, the invasion army reached the capital in two weeks. On November 5, an armistice confirmed British control. Five days later, General deGaulle's committee appointed Gen. Paul Le Gentilhomme as high commissioner of Madagascar. The British turned over the administration to General Le Gentilhomme on December 14.

The Air War over Western Europe.—In 1942 there came a change in the strategic aspects of the air war over Western Europe. In the spring of that year, Prime Minister Churchill estimated that at least 600,000 to 700,000 men and six or seven armored divisions, with many thousands of vehicles, were needed to carry out an invasion of the British Isles. With the Wehrmacht heavily engaged in Russia, such numbers were not available, and under no conditions could Germany muster the shipping space needed to transport so huge a force. German bombing of Britain was therefore no longer intended to pave the way for an invasion. Its main purpose was to prevent men and matériel from reaching Britain, to hamper British production, and to interfere with the organization of invasion armies in Britain.

The British directed their air offensive against German production, German transportation, anti-invasion fortifications under construction, submarine bases, and plants engaged in the production of submarines and their accessories.

In 1942, the scale of the British raids surpassed that of the earlier Luftwaffe attacks on Britain. American support had not yet reached major proportions. In March, the RAF raided Essen, Cologne, Düsseldorf and other Ruhr cities. On April 17, the British bombed diesel engine plants working for the German Navy at Augsburg. This raid was followed by attacks on U-boat assembly plants in several cities. Mines were laid in German and German-controlled coastal waters. The Luftwaffe also laid mines to impede British shipping. U-boat bases at Lorient, St. Nazaire, Brest, La Pallice, and Bordeaux were bombed as often as weather conditions permitted.

In April, no more than 300 RAF planes were sent on a single mission. On May 30, Cologne was hit by 1,100 planes. Approximately 3,000 tons of bombs devastated one twelfth of the city's built-up area. On June 1, 1,036 planes hit Essen, site of the Krupp armament plant, and on June 25, 1,000 were over Bremen. On July 8, major raids hit U-boat yards at Danzig, previously considered beyond bombing range, and on July 9, Wilhelmshaven was bombed. Retaliatory German raids damaged a number of historic British buildings.

On July 4, United States Army Headquarters in Britain issued its first communiqué on an American air raid when United States crews, manning British planes, carried out a small attack on German airdromes in Holland. On July 7, 1942, Maj. Gen. Carl A. Spaatz was appointed commander of the United States Air Force in Europe under the direction of Lt. Gen. Dwight D. Eisenhower. The first American air raid on French territory took place on July 26.

ALLIED OFFENSIVE IN THE PACIFIC

The Japanese drive in the Pacific lost its lightning speed in the spring of 1942 but did not stop. Japanese invaders of Pacific islands established secure encampments close to the shore and worked on the construction of naval and air bases which were gradually put into operation. Supply bases were built up, and substantial land forces concentrated near zones of planned expansion. In April 1942, Japanese ships, planes, and men were massed in the East Indies and the Marshall

Islands. Harbors on the islands of Buka and Bougainville in the northern Solomons were occupied without opposition. On May 1, the conquerors moved to Tulagi and Guadalcanal, increasing the threat against Allied supply lines to Australia.

Battles of Coral Sea and Midway.—Two United States carrier task forces (Rear Admiral Frank Fletcher with the *Yorktown* and Rear Admiral Aubrey Fitch with the *Lexington*) were operating in the critical, South Pacific area. Only aggressive warfare could prevent the Japanese from severing vital shipping lanes.

On May 4, the *Yorktown* carrier group sank 12 Japanese supply ships south of Guadalcanal after they were unloaded. Three days later, Japanese forces headed toward New Caledonia and eastern New Guinea. Two Japanese carriers, escorted by battleships, cruisers, and destroyers, were ahead of the transports going to New Caledonia. In a surprise attack on the morning of May 7, planes from Admiral Fletcher's task force caught the carrier *Ryukaku* with its planes on deck and sank the vessel and one escorting heavy cruiser. Japanese planes detected and sank the 18,250 ton United States tanker *Neosho* and its escorting destroyer *Sims* but failed to locate the carriers (the *Lexington* had joined in *Yorktown*) until late in the day. That night, another Japanese force of two carriers and two battleships, plus several cruisers and destroyers, was reported on the move from the Marshalls toward the east side of the Solomons. On May 8, at 8 A.M., United States reconnaissance planes established contact with this fleet 200 miles away from the American vessels. During the previous night, both forces came within 30 miles of each other, still beyond gun range. The engagement fought in the Coral Sea actually took place without the ships exchanging a single shot. United States planes left the carrier *Syokaku* in sinking condition and damaged another of the Ryukaku class. The United States carriers came under attack by 105 Japanese dive bombers and torpedo planes. The *Lexington* was hit by two torpedoes and five heavy bombs (the official account reported five torpedo hits), and the *Yorktown* by one 1,000-pound bomb. Fires on the *Lexington* were under control, but the ignition of gasoline fumes in burning compartments subsequently led to the loss of the ship. In addition to the carrier, a tanker, and a destroyer, the United States lost 20 aircraft and almost 500 men. Japanese losses amounted to two aircraft carriers, one heavy cruiser, two destroyers, and several transports and lesser craft sunk, one carrier heavily damaged, about 100 planes lost, and 3,000 to 4,000 men killed. The engagement was a victory for the United States, and the hostile fleet returned to its bases without attempting any landings.

Japanese preparations in the Marshall, Caroline, Mariana, and Bonin islands indicated an impending move eastward, while the main United States strength was concentrated in the south. A new United States island base was established on Suva, where there was a good airfield with two squadrons of fighters. Another airbase on Canton Island, within bombing range of Japanese establishments in the Gilberts, was completed late in May.

The Japanese planned to attack Midway Island, which they had failed to take in December 1941, and, after the conquest of the island, to make another assault on Hawaii. On June 3, 1942, a Japanese fleet train was sighted 700 miles west of Midway and attacked by Flying Fortresses and torpedo-carrying naval Catalinas. The pilots reported ten big transports, with probably 30,000 to 40,000 men on board, four heavy cruisers, and four destroyers.

The U. S. carriers *Hornet, Enterprise,* and *Yorktown* assembled under the command of Admiral Fletcher, who had his flag on the *Yorktown.* Rear Admiral Spruance was aboard the *Enterprise* and Rear Admiral Mitscher on the *Hornet.* On June 4, at 5:45 A.M., a Catalina pilot reported additional Japanese forces north of Midway, divided into two groups: the first, 200 miles north of the island, was composed of three carriers (the *Kaga,* the *Akagi,* and the *Soryu*), four heavy cruisers, and ten destroyers; the second, 50 miles astern, was composed of one carrier (the *Hiryu*), two battleships, four heavy cruisers, and ten destroyers. The previously located Japanese train continued toward Midway. Fleet oilers and loaded supply vessels, escorted by two more destroyers, followed the fleet.

Admiral Fletcher intended to penetrate the gap between the Japanese units. From the base at Midway 36 fighter planes were ordered to stand by for the defense of the island, while 53 bombers and torpedo planes took off from Midway to attack the hostile fleet. They hit the *Soryu* and one heavy cruiser at considerable loss to themselves.

Each of the United States carriers had 75 planes. At 7:00 A.M., June 4, the *Hornet* and the *Enterprise* launched their aircraft against a Japanese force of 5 carriers, 4 battleships, 9 cruisers, and 34 destroyers. All Japanese vessels converged on Midway. At 10:15 A.M., American dive bombers and torpedo planes (*Yorktown*-based craft held in reserve) hit the Japanese fleet. Within a few minutes, the *Akagi,* the *Kaga,* and the *Soryu* were crippled, and two battleships were damaged.

While Japanese Zero fighters (armed with machine guns and 20-mm. cannon) fought the United States bombers, Japanese Baukegi 97 dive bombers scored hits on the *Yorktown.* Fires broke out, and the signal system was damaged. Admiral Fletcher transferred his flag to the cruiser *Astoria.*

In the late afternoon of June 4, the *Hiryu* was sunk. The opposing fleets were never less than 100 miles apart. Controversial reports of remaining Japanese forces accounted for some confusion in the United States command during the night of June 4 and the morning hours of June 5. Later that day, the Japanese were in full retreat, but the United States command underestimated the losses suffered by the enemy. Two Japanese heavy cruisers, the *Mikuma* and *Mogami,* collided at night. The *Mikuma* was sunk by United States carrier-based planes on June 5, and more Japanese ships were reported damaged. The *Yorktown,* after another attack by torpedo bombers, had to be abandoned by its crew on June 4. Efforts to save the carrier continued until June 7. Torpedo hits by a Japanese submarine finally sank the *Yorktown* and also a destroyer doing salvage work.

By nightfall of June 6, contact with the Japanese surface fleet was lost. Fuel was running low on the United States carriers. If Admiral Fletcher had had two or three battleships, he might have annihilated what was left of the Japanese fleet, but the Japanese transports escaped.

The Battle of Midway, in which ships did not come within sight of each other, was the turning point of the Pacific naval war, a fact that was not realized until much later. The Japanese lost 4 aircraft carriers, one cruiser and 3 destroyers, against one United States carrier and one destroyer. Plane losses were 275 Japanese and 100 American. Midway put an end to Japanese carrier supremacy and paved the way for United States superiority. After Midway, the outcome of the war at sea depended on shipbuilding capacity. As Japanese naval power decreased, their hold on the islands was bound to shrink. The number of land forces operating in island campaigns depended upon the capacity to supply them. After June 6, 1942, Japanese production began to fall far short of requirements. Japanese progress in the vicinity of Australia neared its end. Relieved of the most dangerous threat in the Far East, the Allies were able to gather strength in the Atlantic and to send more assistance to North Africa and Europe.

Aleutian Campaign.—While decisive battles were taking place in the South Pacific, the Japanese attacked northwestern American possessions. The seizure of the remote Aleutian Islands would probably not provide a springboard for an invasion of Alaska, Canada, or the United States west coast, and it would be difficult to establish air bases capable of carrying out a blitz on America. But the psychological effect of Japanese conquests in the Aleutians would be considerable. The Japanese also hoped that substantial American forces would be directed to the north.

Late in May 1942, the Aleutians and Alaska were alerted. At Dutch Harbor, in the Aleutians, and Kodiak, the aircraft strength was 23 PBY's. There was no garrison in Kiska to protect the local weather station. Umnak and Cold Bay, the only military installations in the 1,000-mile island chain, each had an airstrip and some P-40 fighter planes. The garrisons were disguised as fishing canneries.

On June 3 and 4, 1942, Dutch Harbor was raided by 28 Japanese planes from two small carriers, and 43 persons were killed and 50 wounded. Fighters from Umnak accounted for a few Japanese aircraft. On June 7, Japanese forces occupied Kiska and Attu, western outposts of the Aleutians.

Lt. Gen. Simon Bolivar Buckner was in charge of United States Army defenses in the Aleutian-Alaska sector. Rear Admiral John W. Reeves commanded navy installations. By Sept. 14, 1942, a new United States Army air base had been established at Adak, 250 and 400 miles east of Kiska and Attu respectively. The construction of another on Amchitka was begun on Jan. 12, 1943. The Japanese built an airstrip on Kiska. Amchitka-based United States planes and Kiska-based Japanese planes raided each other on a minor scale.

After the conclusion of the Solomons campaign, the United States Navy dispatched some available units to patrol waters between the Japanese-owned Kuril Islands and the Aleutians to prevent Japanese reinforcements from reaching Attu or Kiska. On March 27, 1943, Rear Admiral McMorris, commanding a small United States naval task force of one heavy cruiser, one old light cruiser, and four destroyers, met a Japanese fleet of medium-sized troop-transport vessels, two heavy cruisers, two light cruisers, and six destroyers 180 miles west of Attu and 70 miles south of the Russian Komandorskie Islands. In a four-hour, running battle, both sides suffered damage, but no ships were sunk. Before the United States Army planes belatedly arrived, the Japanese ships had turned away.

With the beginning of the spring season, United States bombing of Kiska and Attu was stepped up. A substantial invasion fleet, including one small carrier, battleships, cruisers, and destroyers, assembled in Cold Bay. Maj. Gen. A. E. Brown, commanding a force of 12,000 men, was in charge of invading Attu, 60 miles long and up to 20 miles wide. The main Japanese camp at Attu was situated at Holtz Bay. There were smaller installations at Massacre Bay, Chichagof Harbor, and Sarana Bay. On May 11, American landings were effected at Holtz and at Massacre Bay. On May 17, United States troops controlled Holtz Bay. At Massacre Bay the Japanese, well entrenched on stiff slopes, put up furious resistance. The United States 11th Army Air Force (commanded by Maj.Gen. William O. Butler) supported the invaders. On May 28 and 29, the Japanese counterattacked, the collapse of which ended organized resistance. On May 30, 1943, Attu was held by United States forces. Japanese losses were 2,350 killed, and 24 prisoners. United States losses amounted to 552 killed, 1,140 wounded.

The recapture of Kiska, garrisoned by about 7,800 men, was expected to be a difficult operation. On July 6, 1943, a fleet of three heavy cruisers, one light cruiser, and four destroyers shelled Kiska, and bombing and shelling continued thereafter to soften up the island's defenses. On August 12, an invasion fleet of 94 vessels, including capital ships and modern assault craft, assembled in Adak harbor; 29,000 Americans and 5,000 Canadians formed the invasion forces. On Aug. 15, 1943, after a violent air and naval bombardment, Allied troops went ashore. They found no enemy. Undetected by the Allies, the Japanese had evacuated the garrison by surface ships and submarines.

United States-British Agreements on War Strategy.—In July 1942, British and United States representatives conferred in London. The agreement which followed, according to the official communiqué, covered the entire field of the war in every part of the world and also dealt with necessary productive and administrative measures required to implement strategic decisions. Special operations under this decision were submitted to the Combined Chiefs of Staff Committee in Washington, D.C. It was decided to open a major offensive in the western theater of war first. In the Pacific, land operations were to be carried out on a smaller scale.

Safe bases for the massing of large forces existed in the British Isles. Such bases would have to be built in the Pacific before an all-out drive could be started. It would also be necessary to wait for the completion of additional ships in order to eliminate the Japanese Fleet. The Joint Chiefs of Staff Committee approved a plan to block Japanese designs for future offensives in the critical Pacific areas and to ease the pressure on Australia by attacks on the Solomon Islands and New Guinea.

Russia did not take part in the conference, but urgent Soviet requests for the early opening of a second front influenced the decisions. It was necessary to keep the Soviet Union in the war. Lend-lease aid to Russia was speeded up. One

third of the total goods and services delivered under the act went to Russia in 1942 (about as much as to Great Britain), despite grave transportation difficulties.

The Solomon Island Campaign.—Vice Admiral Robert L. Ghormley of the United States Navy, with headquarters in New Zealand, was in command of the southwestern Pacific areas east of longitude 160°, including the Solomons, when operations against the islands were planned. General MacArthur's zone lay west of the meridian. Later, in the spring of 1943, MacArthur was given strategic command of all South and Southwest Pacific areas. Expeditionary forces, assembled to invade the Solomons under the command of Maj. Gen. Alexander A. Vandegrift, United States Marine Corps, included one division of marines and the 1st Raider Battalion. Their transport train was protected by a naval force under Rear Admiral Kelly Turner. Vice Admiral Fletcher's task force stood by to repulse long-range Japanese interception.

Main Japanese installations in the Solomons were known to exist on the small islands of Tulagi, Gavutu, and Tanambogo, and on the big island of Guadalcanal (80 miles long and up to 30 miles wide, with mountains ranging up to 8,000 feet). On Tulagi, a naval and seaplane base was under construction. An air strip on Guadalcanal's north coastal plain was nearing completion. The strength of the Japanese garrison was estimated at 10,000 men, most of whom were on Guadalcanal. Constant naval and air cover was essential to keep invading land forces reinforced and supplied. This limited the number of ground troops engaged and led to high naval losses.

Between Aug. 7, 1942 and Feb. 10, 1943, Japanese naval losses were as follows:

	Sunk	Damaged
Battleships	2	7
Carriers	1	4
Cruisers	11	31
Destroyers	22	51
Transports	24	13
Total	60	106

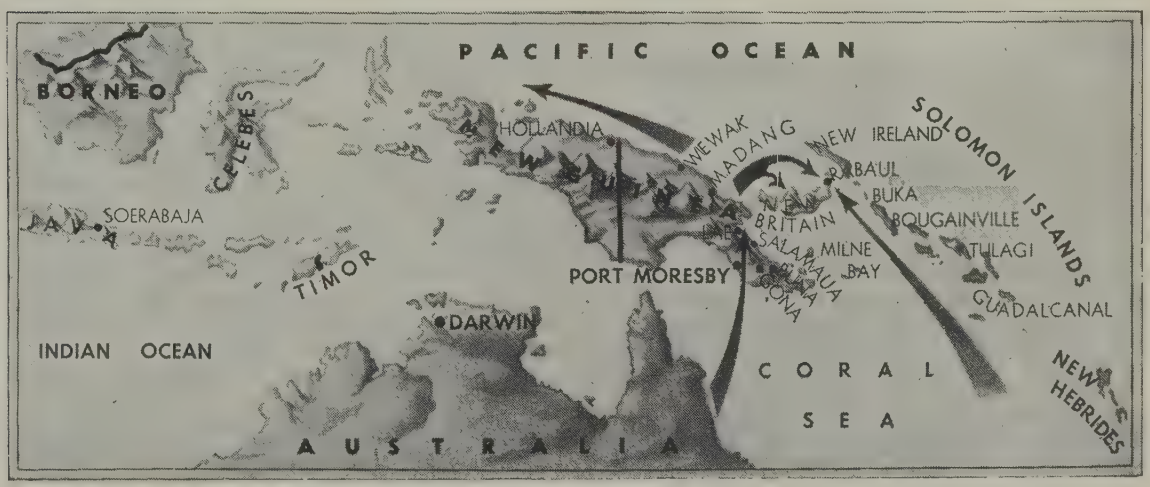
The Japanese also lost many lesser craft and 797 planes (mostly naval). In the same period, the United States lost 2 carriers, 6 heavy cruisers, 2 light cruisers, 15 destroyers, 4 transports, and some small vessels, but no battleships.

The campaign for the control of the Solomons developed into one of the greatest battles of attrition fought at sea and in the air.

On Aug. 5, 1942, through the Coral Sea sailed a United States fleet of 69 ships, including the carriers *Saratoga, Enterprise,* and *Wasp,* the new 35,000 ton battleship *North Carolina,* twelve United States cruisers, and three Australian cruisers, in addition to transport and supply vessels. In the early morning of August 7, the fleet was divided into two parts, the larger part heading for Guadalcanal and the smaller for Tulagi, Gavutu, and Tanambogo.

After one and one half hours of violent naval barrage, United States marines went ashore on Tulagi and Guadalcanal without encountering strong opposition, but stiff resistance was met at Gavutu and Tanambogo. This opposition was soon overcome. The marines were supported by the navy's heaviest guns, whereas the Japanese had no artillery. At nightfall of August 8, Tulagi, Gavutu, Tanambogo, and Makambo Island east of Tulagi were captured. Eighteen hundred Japanese were killed, most of them on Tulagi and Gavutu. None surrendered. A force of 20 to 30 Rabaul-based bombers raided the invasion fleet during the second day of the battle, sinking one 10,000 ton transport. On Guadalcanal, the marines landed near the airstrip, and the Japanese fell back seven miles to the west. The Americans completed capture of the airstrip on August 19. Fighting was restricted to skirmishes for the first eight days of the invasion.

On August 8, two Japanese task forces were sighted, one heading for Rabaul, the other for Guadalcanal. The latter force was expected to reach the vicinity of Savo Island around 2 A.M., August 9. To cover both sides of Savo, three Australian cruisers, and one United States cruiser, escorted by three destroyers, went to the south; three United States heavy cruisers and three destroyers moved to the north of the island. The crews were too fatigued to be properly alert. Although the Japanese vessels arrived almost exactly when and where they were expected, the Allies were caught off guard. To the north of Savo, all three United States heavy cruisers (*Astoria, Quincy,* and *Vincennes*) were lost to gunfire and torpedoes. To the south, the Australian cruiser (*Canberra*) was sunk, and one United States cruiser and two destroyers were damaged. Under the impact of the disaster, Admiral Fletcher ordered his carriers out of the area.



Partly unloaded transports also left. The Japanese force came to within 15 miles of United States transports but did not attack.

On August 20, Henderson Field (the airstrip on Guadalcanal) got its first United States planes: 12 dive bombers and 19 fighters. The marines held a beachhead three miles wide and one to two miles deep. It was attacked daily by bombers from Rabaul and shelled nightly by destroyers and submarines. During the night of August 21, 900 Japanese soldiers who landed from destroyers at the mouth of the Tenaru River east of the beachhead were annihilated. But Japanese equipment had been improved, and the odds were no longer in favor of the marines.

A major Japanese force was on the move from the Marshalls and the Carolines. Three carriers, two battleships, twenty cruisers and destroyers escorted transport and supply vessels; the armada spread out in a great arc north of Guadalcanal. Admiral Fletcher had two carriers, the *Saratoga* and *Enterprise,* ready for action, in addition to other ships. At 12:45 P.M., August 24, planes took off from the *Enterprise* and sank a light Japanese carrier of the *Ryuzyo* class. Guadalcanal-based United States planes joined in this action, and one Japanese cruiser and five transports were sunk. Eighty Japanese planes attacked the *Enterprise* and the *North Carolina,* 71 of which were downed. A hit set the *Enterprise* ablaze, but the fire was brought under control.

The great Japanese counter-invasion attempt failed, but small Japanese transports continued to land troops and supplies on Guadalcanal while Japanese submarines lurking offshore make it hard to reinforce the marines. On September 15, the 14,700 ton United States carrier *Wasp* fell victim to a Japanese submarine attack.

On September 13 and 14, the marines repulsed strong Japanese attacks at "Bloody Ridge," but the pressure increased and the marines had to retreat yard by yard. On September 16, the Japanese came within rifle shot of Henderson Field. American reinforcements of men and artillery, landed two days later, prevented the loss of the airfield.

A naval engagement was fought on the night of October 11 between a United States task force of two heavy cruisers, two light cruisers, and four destroyers, and a Japanese force of three heavy cruisers and six destroyers, escorting four transport vessels off Guadalcanal. It led to the almost complete annihilation of the Japanese squadron. The United States lost one destroyer, and the light cruiser *Boise* was seriously damaged. The next night, Japanese warships, including two battleships, shelled Henderson Field, inflicting heavy damage upon its already depleted airforce. Two and one half Japanese regiments landed east of the marines' position. The first American army unit, the 164th Infantry, reached Guadalcanal on October 13. General Vandegrift asked urgently for naval and air support and for one division of troops to regain the lost initiative. The situation on the beachhead remained extremely critical, although the American lines held firm during heavy fighting from October 23 to 27. The Japanese gathered considerable artillery strength and armor, offsetting the only American advantage.

The arrival of reinforcements permitted General Vandegrift to open two drives on November 3. A mixed force of marines and army troops under Brig. Gen. E. B. Seebree, attacking from the west, killed between 3,000 and 4,000 Japanese troops in one week. A push across the Matanikan drove the Japanese farther from Henderson Field. Reports that Japanese transports had been sighted on their way to Guadalcanal caused General Vandegrift to halt his offensive to await the outcome of naval actions.

Succeeding Ghormley, Admiral William F. Halsey took charge of operations early in November. The carrier *Enterprise* and cruiser *Boise* had joined the fleet. The carrier *Hornet* and the battleship *South Dakota* were also in action. The Japanese fleet had been strengthened, but again ships did not come within gun range. The U.S.S. *Hornet* (which had carried the Doolittle raiders to Tokyo) and one destroyer were lost in furious air attacks, and the *Enterprise* and *South Dakota* were damaged. The Japanese lost one carrier and one battleship, and three heavy cruisers were badly damaged.

Air attacks on November 11 and 12 heralded a renewed Japanese drive. An American convoy succeeded in unloading men and matériel on Guadalcanal. Escorting vessels were engaged by two columns of Japanese ships, including two of the *Kongo* class. The Americans lost two light cruisers and four destroyers, and one heavy cruiser suffered hits. On November 13, planes from Henderson Field, assisting the ships, destroyed one of the Japanese battle cruisers. United States warships accounted for one light Japanese cruiser. Another Japanese light cruiser was subsequently attacked and sunk by Tulagi-based PT boats. Still more Japanese were under way. One force, including one carrier, two battleships, one heavy cruiser, and ten destroyers, was off New Georgia. A Japanese transport train of 12 ships, supposed to be carrying about 35,000 men, moved toward Guadalcanal, 200 miles away.

The Japanese suffered heavily in three days of air and sea engagements with a United States task force. The United States force included two battleships, four destroyers, and all available planes. Eight of the Japanese transports were sunk, and only 2,500 Japanese reached shore. Hits were also scored on three Japanese battleships, eight heavy cruisers, six light cruisers, and twelve destroyers, most of which were sunk. A last Japanese attempt to reinforce the Guadalcanal garrison was made on November 30. The convoy was intercepted and severely mauled, with the loss of one United States cruiser. No Japanese soldiers were landed.

On December 7, the marines on Guadalcanal were replaced by army units under the command of Maj. Gen. Alexander Patch. The marines had fought continuously for four months, suffering heavy casualties, but holding their own even under very adverse conditions. No Japanese heavy naval units remained in the vicinity of Guadalcanal, but air attacks on the Americans continued from outside airdromes, one of which, established at Munda in late December 1942, was raided by United States naval vessels on Jan. 5, 1943.

On Jan. 30, 1943, the United States heavy cruiser *Chicago* was sunk by Japanese dive bombers off Guadalcanal, and a United States destroyer went down in the same waters on February 1. These were the last United States naval losses in the Solomons campaign.

The Japanese forces on land were isolated, and their supplies ran low. Late in January, the Americans began to force the Japanese to retreat. Another United States landing was carried out south of Cape Esperance to catch the exhausted defenders between two arms of a pincer.

An attempt by 20 destroyers to rescue what remained of the Japanese forces was unsuccessful. Organized resistance came to an end on February 10, the pincers closed, and the Guadalcanal campaign ended in a complete American victory. The Japanese gave their losses as 16,743, not including naval and air personnel and troops aboard destroyed transports. Total Japanese casualties were at least four times that number.

The Battle of the Solomon Islands gave a foretaste of things to come. Transportation decided the outcome of the war in the Pacific. After the collapse of their long-range transportation, Japanese garrisons on occupied islands, if not dislodged by seaborne attack, were doomed to starvation.

The Battle of New Guinea (Papuan Campaign).—The Japanese landings at Lae and Salamaua on March 8, 1942, and at Finschhafen, 65 miles from Salamaua, on March 10, were not contested by Australian land forces based in the Dutch East Indies and Australian-mandated New Guinea, inhabited by 1,000,000 rather primitive people. The Australians concentrated for the defense of Port Moresby and subjected the invaders to bombing raids, one of which sank one cruiser and six transports. During 1942, the Allies were never able to send more than 31 land-based planes on a single mission over New Guinea.

Established on the northern shore of New Guinea, the Japanese threatened Allied shipping in the Coral Sea and secured their right flank for a drive to the southeast of Australia. Control of Port Moresby, on the southern coast of the islands, would have provided a springboard for the invasion of Australia. In order to open the sea route to Moresby, the Japanese had to establish themselves at Milne Bay, easternmost point of New Guinea. To reach Port Moresby by land, they had to drive across the 13,000-foot Owen Stanley mountain range, site of the world's wildest jungle regions.

Japanese warships sailed from Lae and Salamaua toward Milne Bay to scout Allied positions. Resistance was confined to air opposition. During the spring and early summer of 1942, Japanese air raids hit Port Moresby but failed to destroy its airfields. A land drive from Lae and Salamaua to Port Moresby started on March 19. Even superlatively trained Japanese jungle fighters could not penetrate the wilderness and its crocodile-infested waters. Late in May, the Japanese understood that they would have to use the Kokoda Trail leading from Buna and Gona across the Owen Stanley Mountains to Port Moresby. In July, Japanese troops went ashore in Buna and Gona. New Guinea was within the zone of command of General MacArthur.

Early in August, scouts reported that a Japanese amphibious attack on Milne Bay was imminent. Two Australian fighter squadrons and one Australian brigade were dispatched to the area. On August 25, Japanese transports, under the protection of bad weather, arrived at Milne Bay. Due to Allied air opposition, only 1,500 Japanese reached the shore. The escorting cruiser and one destroyer were damaged, and one large transport and six barges were sunk. Japanese counterblows in the air extended as far as Port Darwin in Australia. The invasion was repulsed.

At Buna and Gona 2,500 Japanese carried out the initial landings, but there were reinforcements estimated at 50,000 men in Rabaul, New Britain. The Japanese were not able to throw more than 15,000 men into the battle for the mountain trail. The Japanese Navy was too busy in the Solomons to take an active part in the New Guinea campaign. This fact, as well as supply troubles on land, restricted Japanese striking power.

The Japanese jungle fighters' ration consisted of some rice and vitamin tablets, to be supplemented by food levies on native villages. Natives were forced to carry supplies for the Japanese. Snipers, with green-painted skull, face, and torso, were equipped with one-man flame throwers and miniature mortars, spearheading the advance. Again the Japanese masterfully employed infiltration and outflanking tactics. Manifold tricks were used to locate Australian positions and to catch them between crossfires. Carrying many times the weight of Japanese food supplies, Australian soldiers were constantly on the alert for Japanese sniping. A daily total average of 300,000 lbs. of supplies was dropped by parachute to the Australians in places marked with white tape stretched across treetops. Between 10 and 50 per cent of them were lost.

The Japanese overland drive from Gona and Buna had a successful start. The Australians were pressed back in a ferocious man-to-man struggle, losing Kokoda on July 21. On September 9, 1942, the Japanese, pouring through a pass 6,500 feet high across the ridge of the Owen Stanley Mountains, arrived in the region of the Myola Lakes, 75 miles from their starting point. Seven days later, the Australians lost Iorabaiwa Ridge, only 32 miles from Port Moresby. The Japanese, however, could no longer find native supplies, and their stores were gone. Not even minimum requirements reached the troops. Australian artillery, using 25-pounders, decimated Japanese ranks. Bombing and strafing, dysentery and malaria further depleted the ranks of the exhausted Japanese.

United States forces, trained in Australia, reached Port Moresby by transport plane at the rate of 300 to 400 a day. Gen. Edwin F. Harding was in charge of American field forces. Australian reinforcements also poured in, and 13-ton tanks arrived. After one week of violent fighting, the Australians recaptured Iorabaiwa Ridge on September 25. The fleeing Japanese were unable to make a stand until eight miles from Kokoda.

The Allied plan, drafted by Generals MacArthur and Blamey, laid emphasis on organization of supplies. Jeeps, native carriers, and planes contributed to rapid transportation. Japanese infiltration and outflanking tactics were studied and improved upon by the Allies. The Japanese were forced to abandon Kokoda on Nov. 3, 1942.

A last ditch stand was attempted in a beachhead from three miles below Buna to a point 17 miles beyond Gona. Its maximum depth was two miles, and in some sectors Japanese lines ran along the shore. The main body of the Allied troops laid siege to Buna. Smaller Australian forces captured Gona on November 24, and moved on seven miles west of Buna. At that time, the attackers of Buna were 1,300 yards from their goal. Japanese marines, taller and stronger than average Japanese soldiers, reinforced the garrison. The defenders had artillery, mortars, and machine guns, and fought with savage determination.

On December 3, Buna's defenses were infiltrated, and the Japanese beachhead split. The remnants of the defenders of Gona were wiped

out, and the Japanese at Buna were hemmed into a tiny fringe of coastal jungle. On December 14, Buna was in Allied hands. Some Japanese continued to fight, and an attempt was made by Japanese cruisers and three destroyers to supply the men. Mopping up operations continued through Jan. 22, 1943, when 725 Japanese were killed and 117 captured at Sanananda (the only prisoners captured in what was referred to as the Papuan Campaign). The Japanese suffered more than 15,000 casualties. Allied losses were about half as large. The threat to Australia was materially reduced, although the Japanese remained entrenched at Lae and Salamaua.

DESERT VICTORY

When General Bernard Montgomery was appointed commander of the British Eighth Army, its strength had about reached its peak. The army then consisted of eight infantry divisions (the British 44th and 50th, the 51st Highlanders, two South African, one Indian, one New Zealand, and one Australian divisions), plus the 1st, 7th, and 10th Armored Divisions. Stronger forces could hardly be deployed between the Mediterranean and the Qattara Depression.

Field Marshal Gen. Erwin Rommel's army received numbers of Mark III and IV tanks and 88-mm. guns but few German infantry reinforcements. The Wehrmacht's High Command needed most of its divisions in eastern Europe, and growing Allied strength in Great Britain had led to the creation of a German mobile reserve army, concentrated close to main traffic centers, to be dispatched to regions threatened by Allied invasion. The German commander considered Italian infantry a poor substitute for German foot soldiers.

Rommel did not expect an early British attack. German Intelligence failed to observe the concentration of British striking forces, and Luftwaffe reconnaissance was equally negligent. Cardboard dummies of tanks and trucks were mistaken for actual columns, and the real vehicles, well camouflaged, were overlooked. Rommel spent most of the early fall of 1942 in Germany, leaving General von Stumme in charge of operations in Africa. German positions were arranged in a pattern which Rommel termed "a devil's garden." In front of the main line ran another, less fortified position, connected with the stronger one by slightly irregular trenches. These trenches were supposed to draw attackers into a trap of cross fire and minefields. Von Stumme deployed his infantry evenly, and Italian battalions were partly sandwiched between German units, called "bodice clasps." Armor was held in reserve positions.

In the early evening hours of Oct. 23, 1942, Montgomery told war correspondents: "The campaign starts tonight. My objective is to move the Germans from North Africa. It may take some time, but this is what we are going to do. I think the battle may well be the turning point of the war."

To sever the Axis artery of retreat, the strongest British forces were concentrated in the highway and railroad sector. Montgomery's sappers and engineers were to open the drive by cutting gaps in the Axis minefields. After the breakthrough was achieved by infantry forces, armor would pour through the breaches to inflict the final blow. When Montgomery addressed the war correspondents, the RAF was already in action, destroying German dive bomber bases at Daba and Fuka and hammering at enemy positions.

On October 23 at 10:00 P.M., a furious 20-minute barrage by 800 guns paved the way for a British push. The British dented the Axis line in the coastal sector. Their advance was slow, however, and General Stumme dispatched the 15th Panzer Division and Italian infantry to counterattack, holding back substantial forces to ward off possible threats in other sectors and to frustrate landings in the rear of the Axis left wing (there were British naval feints near El Baba). Axis counterattacks collapsed, and the British continued to gain ground in night assaults. Their armor was not heavily deployed.

Rommel was back in Africa on October 27. Before his return, General Stumme was killed by a stray bullet and temporarily replaced by Lt. Gen. Wilhelm von Thoma. Rommel hurriedly redeployed the bulk of the Italian and German divisions against the British wedge which was forming along the coast, shaped like a finger, pointing westward. The German commander hoped to squeeze the British finger and then to open a counter-drive along the coast. He rallied his armor, recalling the 21st Panzers from the south, in the vain hope that British armor would attack prematurely and be caught between German pincers. The Axis center and southern wing were almost bared. Owing to faulty reconnaissance, British forces in these sectors were much stronger than the field marshal general had presumed.

Heavy Axis counterattacks failed to dislodge the British wedge. General Montgomery seized the opportunity to attack south of the main coastal highway, and British infantry breached the scantily manned defenses, rushed through the gap, enveloping the panzers to the north. When an Indian division assaulted the Trento and Trieste divisions, the Italians broke. The British 7th Armored Division poured through their scattered lines and, in a wide enveloping move, wheeled northward toward the coastal road and the main Axis supply dumps near Daba. Rommel ordered von Thoma to rally whatever troops he could organize for a defense of his vital line of retreat, but the covering troops, including General von Thoma, were captured.

On November 3, the Axis defeat became a fact, and Rommel could hope to salvage only enough troops to make a stand farther to the west. German troops seized whatever Italian transportation and armor remained intact, abandoning their allies. The Afrika Korps thereby succeeded in escaping complete annihilation. The Italians surrendered by the thousands. Total Axis losses at El Alamein, much higher than British casualties, amounted to 75,000 men, 1,000 guns, and 500 tanks. The RAF hammered at the retreating Germans, and British advanced columns raced on as swiftly as supplies and demolitions permitted. The railroad track was blown up in 40 places by the retreating Germans between El Alamein and Daba, and 67 times more between Daba and Mersa Matruh. On November 23, just one month after the battle began, the British occupied Bengasi.

Montgomery decided to attack El Agheila, but violent storms hampered British deployment. The German 90th Light Infantry Division and the remnants of the 15th and 21st Panzer Divisions, reinforced by a few battalions of panzer grenadiers, were in positions close to El Agheila. On December 12 and 13, the German commander split his infantry into small groups, attaching tanks

to each group, and succeeded in leading his forces through the screen of the advancing New Zealanders before Montgomery's frontal attack got under way. The Eighth Army was again in pursuit, without having annihilated the Afrika Korps. After an advance of 1,000 miles, communication lines were badly stretched, and the RAF had to prepare advanced bases before continuing its support of the ground troops.

British delay raised Italian hopes that the defense of Tripoli, a city of 150,000 and the pride of their vanishing colonial empire, might be successful. The Italian chief of staff, Gen. Ugo Cavallero, after inspecting the district reported in Rome that the situation was virtually hopeless. Rommel was not inclined to risk his forces for Tripoli. He preferred to join other German troops in Tunisia. On Jan. 23, 1943, British armor entered Tripoli. Ten days later, Prime Minister Churchill, Field Marshal Alexander, and General Montgomery reviewed the victorious Eighth Army. Advancing 1,600 miles, it had conquered all that remained of the Italian colonies in Africa, but more battles were ahead to reach the goal proclaimed by General Montgomery on the eve of El Alamein. A continued British drive faced the strong Mareth Line, a system of fortifications built along the frontier between Tunisia and Tripoli to protect French territory against Italian attack.

In early February 1943, extensive changes took place in the Allied command. Maj. Gen. Dwight D. Eisenhower became commander in chief of all Allied forces in Africa, with Field Marshal Alexander as his deputy. Sir Henry Maitland Wilson took over as commander in the British Middle East, and Air Marshal Arthur Tedder became head of Allied Air Forces in the Mediterranean.

Allied Landings in Africa. — When the United States entered the war, it was planned to move United States troops into the United Kingdom. The arrival of American forces in Britain was delayed by lack of men and shipping space and by the urgent necessity of sending 25,000 men to the South Pacific to stem the rising Japanese tide. Late in January 1942, the first convoy of United States troops reached North Ireland. It was not until early that summer that the United States forces in Great Britain exceeded one division in strength. During the month of June, United States Headquarters and an organization for the European Theater of Operations (including North Africa) were set up, with Eisenhower in command.

Early in 1942, a major drive in the southern Mediterranean was planned to coincide with a British offensive from Egypt and Libya. Control of the Mediterranean was necessary before an invasion of southern Europe could be attempted. It was also important to keep Axis submarines out of Vichy-dominated Morocco and Dakar.

In July 1942, an Allied invasion of French western North Africa was definitely decided upon. The operation was called "Torch." Meanwhile, in April 1942, Admiral William Leahy, United States ambassador to Marshal Pétain's government in Vichy, reported to Washington that he did not encourage any hope of a change in Vichy policy. He felt it was inadvisable to give any hint of the prospective invasion to Vichy. Gen. Charles deGaulle's loyalty to the Allies was beyond question, but previous experiences showed that he did not enjoy the confidence of French officers loyal to Vichy.

General Eisenhower, who distinguished himself as a diplomat as well as an organizer and strategist, was faced with the problem of finding Frenchmen willing to cooperate. Under Eisenhower's orders, American Gen. Mark Clark went to North Africa by submarine and gathered the important information that General Alphonse Juin, commanding the Algiers Garrison and Army Corps, was ready to work with French Gen. Henri Giraud, recently escaped from a German prison camp, who was anxious to join the Allies. So great was the need for secrecy that the Frenchmen supporting the Allies were not told of the invasion until four days prior to the date set for it. A British submarine, flying the American flag, cruised along the French Riviera and took General Giraud on board two days before "D-day." The general was transferred from the submarine to a seaplane and arrived at Gibraltar the next afternoon.

Three Allied task forces were formed. One of them, entirely American, sailed from the United States east coast and was to make landings at and near Casablanca on the west coast of Morocco. The second, also American, sailed from Great Britain escorted by British warships. It was to land in the vicinity of Oran in western Algeria. The third, American and British, sailed from Britain to the port and city of Algiers. The combined strength of all the task forces amounted to 107,000 men.

The American task force, formed in the United States under Maj. Gen. George S. Patton Jr., was composed of the 3rd Infantry Division, the major part of the 9th Infantry Division, and the 2nd Armored Division. Its transport train assembled at sea on Oct. 24, 1942. Rear Admiral Henry K. Hewitt was in charge of the convoy. After a successful landing, Patton's task force was to join the second American force at Oran. The latter, under the command of Maj. Gen. Lloyd R. Fredenhall, consisted of the 1st United States Infantry Division and part of the 1st Armored Division. General Fredenhall's troops were to seize Oran and surrounding air bases, and to establish contact with the eastern task force under the command of British Lt. Gen. Kenneth A. N. Anderson. Gen. Mark Clark, as Eisenhower's lieutenant, went with the Anderson army, formed of British commandos, infantry units, and two United States regimental combat teams from the 9th and 34th Infantry Divisions. This force was to carry out a lightning thrust into Tunisia. The second and third task forces left Great Britain on October 25. Their convoys, 850 transports and warships, concentrated at Gibraltar. Axis agents at Spanish La Linea and Tangier watched the ships. In less than a quarter of an hour, Berlin learned every detail except the destination. Axis submarine flotillas were alerted.

November 8 was D-day. At 1 A.M., in a broadcast to the French people, President Roosevelt asserted that the Allies sought no territory and asked for cooperation. Pétain was informed of the Allied decision to liberate France. The marshal's government, headed by Pierre Laval, countered by breaking relations with the United States. The Spanish government was told that operations under way were not directed against the Spanish people, Spanish possessions, or the Spanish government. General Eisenhower announced that General Giraud would be responsible for civilian and military affairs in French North Africa. Giraud broadcast pleas for French cooperation in which General deGaulle joined, despite his personal disappointment and unfriendly relations with Giraud.

Algiers surrendered to the Allies on November 8. Oran followed two days later. At Casablanca, Patton's task force ran into determined French opposition. Heavy fighting close to Spanish Morocco could result in Spanish-American incidents which the Allies were most anxious to avoid. Attempts to negotiate with French commanders were futile, and General Patton announced that he would open the assault on November 11.

In Algiers, the Allies found Admiral François Darlan, who was not acceptable to Britain because he had been one of the leading anti-British personalities in Pétain's cabinet and was considered responsible for the refusal of the French Fleet to join the British in June 1940. Darlan asked to be appointed as the highest authority in French North Africa in return for his support. A provisional deal with the admiral, made by Clark with Eisenhower's consent, stunned the British Cabinet. It led, however, to the cessation

of resistance in Casablanca. After November 11, when the Germans moved into unoccupied France, Pétain was no longer a free agent, and Admiral Darlan became his legal successor in the eyes of many French officers in North Africa. This changed the British government's attitude, and Darlan's appointment as head of a provisional government for French North Africa was no longer opposed. General Giraud was compensated with an assignment as commander in chief of French ground and air forces in that region. Admiral Darlan was assassinated six weeks later.

On November 13, General Eisenhower and British Admiral Cunningham, the latter in charge of Mediterranean naval operations, arrived in Algiers for parleys with General Clark, Admiral Darlan, General Giraud, and other ranking French officers. The French informed Allied negotiators that they would accept Darlan's leadership only. Darlan was recognized as the supreme French authority in Northwest Africa. French West Africa, including the key base at Dakar, joined the Allies on November 24.

In Tunisia, the small French garrison failed to resist German infiltration, and French Resident General Esteva's attitude was controversial. The "Darlan deal" thus fell short of its objective of keeping the Axis completely out of French North Africa. President Roosevelt, in a press conference on November 17, said that "the present arrangement in North and West Africa is only a temporary expedient, justified solely by the stress of battle." An appeal issued by Darlan, urging the French fleet in Toulon to join the Allies, had no effect.

German Occupation of Continental France.—The Vichy government discharged Darlan and called upon its African forces to resist the Allies. Following an emergency meeting between Vichy Premier Laval and Adolf Hitler, a message from the German führer was broadcast to the French people on the morning of November 11 stating: "to prevent further British-American aggression against French territory, German troops have moved into unoccupied France." Pétain's protest was dismissed as a "legal formality." The German march into France was carried out almost without incident. Italian troops occupying Corsica, however, had considerable difficulty in subduing local patriots. According to the Laval-Hitler deal, the French Fleet and the naval base of Toulon were to be left under French control. On November 17, Pétain ceded most of his powers to Laval, who appealed unsuccessfully to his countrymen to create an African Falange and to assist Hitler in his drive to conquer French North Africa.

Admiral Jean de la Borde, commander of the French Fleet, did not refuse to join the Allies because of anti-British or pro-German feelings, but because his vessels were not ready to sail. Axis submarines kept Toulon under guard, and German long-range guns were aimed at the ships. On November 27, in a letter to Marshal Pétain, Hitler claimed that de la Borde had issued orders on November 12 not to fire at Allied forces if they attempted to land. Hitler also announced that von Rundstedt would occupy Toulon to prevent French naval vessels from leaving. Before the Wehrmacht could act, French sailors and soldiers, under the fire of the infuriated Germans, scuttled and blew up most of the ships. Only 25,000 tons out of 220,000 tons of warships fell into German hands.

The Tunisian Campaign.—There were no Axis troops in Tunisia when the Allies landed in North Africa, and Tunisia was a vital objective for both sides. If the Allies could occupy it first, the retreating Afrika Korps would be trapped, and the war in Africa would be practically over.

The Axis had several advantages in the race for Tunisia. The Germans and Italians, operating from Sicilian bases, controlled the air over Tunisia as long as there were no Allied bases in Algeria and the desert air force was still far away. Axis land forces in southern Italy and Sicily outnumbered the Allied invaders of North Africa and could be safely transported across narrow waters as long as they were protected by an air umbrella. But if the Allies were to occupy the key cities of Tunis and Bizerte, Axis landings would be bound to fail.

General Anderson's so-called British First Army amounted actually to slightly less than one division in strength. The skeleton British forces and a few United States units were reembarked from Algiers for Bougie. They landed there on November 11, and parachutists, ahead of the main column, occupied Bône on November 12. French troops from Algiers were called upon to cover the southern flank of the Allies advancing along the coast, and to take airfields in the region of Tebessa and Gafsa, the latter being inside southern Tunisia.

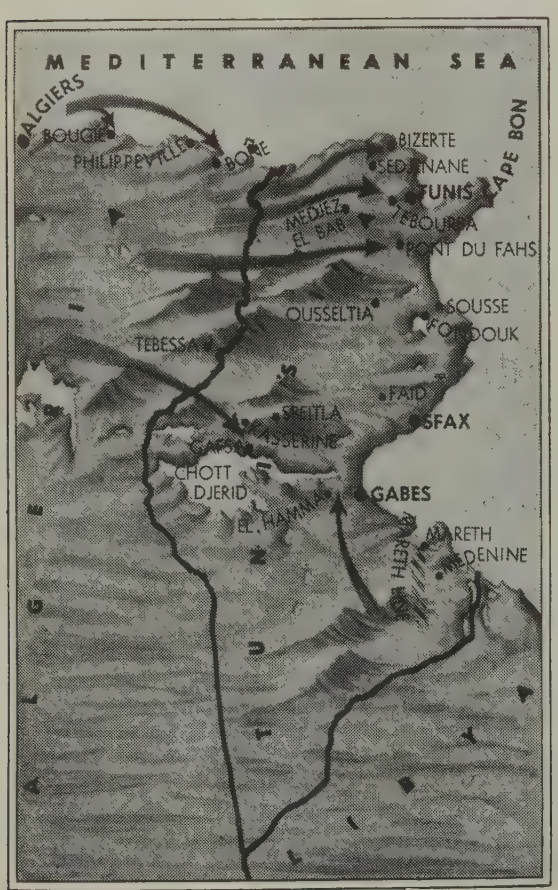
German General Nehring, arriving in Tunis by plane, organized an improvised German force. Ju-52 troop carriers brought in German panzer grenadiers by air. On November 18, Nehring asked that all French military and naval installations in Tunisia be handed over to him. Although Resident General Esteva refused the demand, no resistance was offered to the subsequent German seizure of military assets at Tunis and the big naval base of Bizerte, including the only French all-weather airfields in North Africa. Bombers, fighter planes, and troop carriers poured into these airfields. The Luftwaffe in Sicily concentrated its raids on Algerian harbors. German reinforcements also arrived by ship. The 10th Panzer Division, refitted after service in Russia, was sent into Tunisia. Colonel General von Arnim assumed command.

On November 25, the Allies pushed through the village of Tebourba in the direction of the hills of Djedeida, only 12 miles from the city of Tunis, where the advance was halted. Von Arnim counterattacked, making use of his 88-mm. cannon, heavy mortars, tanks, and the Luftwaffe's supremacy. In seven days of fighting, the Allies were pushed back toward Medjez-el-Bab, 20 miles west of their farthest point of penetration. Allied progress toward Bizerte was stopped by German infantry, tanks, and artillery at Jefna, 32 miles southwest of the naval base. To the south, where United States parachutists and French infantry were operating in the Gafsa-Sbeitla area, the Germans were able to prevent the Allies from reaching areas important to the regroupment of Rommel's army after it retreated to Tunisia. Early in December, the Allied attempt to overrun Tunisia had definitely failed. Arnim's army, three divisions strong and constantly reinforced, held a solid bridgehead covering Tunis and Bizerte. The bridgehead extended beyond Sousse, Sfax, Gabes, and the Mareth Line on the coast, and inland from Medjez-el-Bab to Ousseltia and the Tunisian border southwest of Kasserine toward

the salt lakes of Chott Djerid. The salt lakes lay between the onrushing British Eighth Army and Allied North African invasion forces. German short wave broadcasts beamed to the United States sarcastically bemoaned the fate of the poor inexperienced American boys whom the superior German soldiers were forced to kill.

While the British Eighth Army regrouped opposite the Mareth Line, Rommel's and Arnim's forces regrouped in Tunisia. The 15th and 21st Panzer Divisions were reformed, and their equipment now included the 56-ton Mark VI Tiger tank, protected by 4-inch armor and carrying an 88-mm. cannon and two heavy machine guns. The German 90th Light Infantry, augmented early in February by German parachutists, the Hermann Göring Division, Young Fascists, San Marco Marines, Bersaglieri, and the reorganized Ariete and Trieste divisions, increased the strength of Axis forces in Tunisia to 250,000 men. The German High Command, fully aware of the possible consequences of Allied victory in Africa, was anxious to prevent or at least to postpone it indefinitely.

Rommel, Arnim's senior in rank, chose to launch a blitz attack against Allied invasion armies while holding the Mareth Line with a screening force. Kasserine Pass was a critical spot in the Allied line. If the Germans could penetrate Kasserine Pass, the road to the vital communication hub of Tebessa would be open. With Tebessa lost, communications between the Allied forces in northern Tunisia and in southern and central Tunisia would be severed. Moreover, flanking drives from Tebessa toward Bône, Philippeville, and Bougie would threaten Algiers. Tebessa had to be won before Montgomery was ready to attack.



On February 14, Rommel threw his best troops into the drive at Kasserine Pass. At Sbeitla and Sidi bou Zid, American guns were overrun, United States armor fell back, and United States infantry, deprived of cover, had to give ground. Many prisoners were taken by the Germans. Faid, Gafsa, and Fériana, including two forward airfields, were taken, and the Germans poured through Kasserine Pass. On February 21, they were 21 miles beyond the gap and almost within sight of Tebessa. The British 6th Armored Division and the Guards were rushed into the breach. The Allies suffered substantial losses, most of which were borne by the United States 1st and 34th Divisions, but the Germans, too, were weakened. The Allied air force, growing in strength, bombed and strafed Rommel's legions, and ground resistance stiffened. Before reaching Tebessa, Rommel broke off his attack. To prevent the Allies from pressing the pursuit, Arnim launched heavy drives against the British in the Medjez-el-Bab sector. The drives gained ground in the direction of Beja but did not seriously endanger the Allied line.

While the British Eighth Army finished its preparations for attack, and Rommel withdrew to Fériana and Gafsa, the invasion forces and their French supporters regrouped. Three British divisions were deployed in the north, two French divisions in the center, and two American divisions in the south. Additional forces, mostly American, were moving toward the front.

On March 5, 1943, Rommel told his troops that, if they failed to capture British supply dumps at Medenine and to force the Eighth Army to withdraw, the days of the Axis in North Africa were numbered. In a surprise attack on March 6 against Montgomery's forces, the Germans pressed from Mareth toward Medenine. The offensive failed. German armor sustained heavy losses in British tank traps.

Montgomery's offensive opened on schedule. The General planned to breach the Mareth Line close to the coast, where it was strongest. The 50th (Northumbrian) Division, assigned to the task, was to penetrate Wadi Zigzau. A flanking drive by New Zealanders around the opposite end of the Mareth Line was aimed to hit the Germans from the rear.

During the night of March 16, a shattering barrage paved the way for the Northumbrians' attack. In three days of heavy fighting, the British advanced to the Wadi. On March 22, counterattacks, in which the 15th Panzer Division was engaged, stopped the 50th Division. On March 24, the British lost their foothold inside the Mareth Line, but the New Zealanders' advance, overcoming unexpectedly strong Italian resistance, reached El Hamma, beyond the salt lakes and 20 miles southwest of Gabes, after a 200-mile march. When Rommel switched his panzers to attack the New Zealanders, Montgomery threw in most of his tanks to counter the German blow while the 51st and the Indian divisions attacked the Matmata Hills, running parallel to the sea toward El Hamma. The hills were cleared with the aid of the desert air force, and the panzers suffered defeat at El Hamma. On March 27, the inland anchor of the Mareth Line was unhinged, and the German armor retreated to Gabes. Again Rommel used all the vehicles he could gather for

the transportation of the Germans and left the Italians behind.

Meanwhile United States forces moved toward Gafsa, El Guettar, and Maknassy. After the thrust at Maknassy was halted, the Americans concentrated on El Guettar, where General Patton's 1st Division was only 75 miles from the nearest Eighth Army forces. On March 23, the 10th Panzer Division counterattacked at El Guettar, but was repulsed with the loss of 40 per cent of its tanks. The U.S. 9th Division joined the American drive. On April 7, 1942, southeast of Gafsa and 20 miles inland, patrols of the 9th established contact with the Eighth Army. The Battle of North Africa entered its final stage.

In the north, the British First Army opened a drive toward Longstop Hill, main obstacle on the road to Tunis, on April 9. Progress was slow, but it prevented von Arnim from reinforcing the southern sector of his box-shaped front. After the fall of the Mareth Line, Rommel left North Africa, and Arnim took charge of all Axis forces. Field Marshal Alessandro Messe was the Italian field commander.

On April 8, the remaining bolt positions in front of the Eighth Army crumbled, and the British wheeled rapidly northward. The British 6th Armored Division, equipped with Sherman tanks, British Guards, and Hampshires joined the Americans and French in the sector of Fondouk in order to break through toward Kairouan and the coastal plain beyond. The Allies by now had many more tanks than the Germans, and this region was an ideal maneuvering ground for them.

According to Gen. George Marshall's report, the desert air force and the United States 9th Air Force under Gen. Lewis M. Brereton provided a classic example of the best strategic and tactical use of air power. The air forces not only supported the advancing Allied armies but also pounded enemy reinforcements still pouring into Tunisia. During a two-week period, 147 Axis transport planes and 31 Axis vessels of various sizes were destroyed or damaged by air attack.

Fondouk, Kairouan, and Sousse fell to the Allies. Thirty miles north of Sousse, the Axis made a stand in a rocky area where tanks were of little use. New Zealanders, Guards, and Indians attacked but made little progress against determined Italian resistance. After three days of preparatory thrusts, the Allies again attacked Longstop Hill. The slopes were heavily mined and fortified, but the hill was taken on April 27.

The United States 2d Corps (three divisions) advanced into the sector north of Medjez-el-Bab around Sedjenane, and the French, using British tanks and United States trucks and jeeps, drove into the Pont du Fahs gap. Three British, one Indian, and one armored divisions, mostly drawn from the Eighth Army, pushed through the Medjerda Valley. On May 3, the United States 1st Armored Division broke into Mateur, 20 air miles from Bizerte. Four days later, the Americans captured the naval base and, on the same day, the Medjerda drive reached Tunis. The trapped Axis forces surrendered on May 9.

Fanning out from Tunis, British forces raced through Cape Bon Peninsula, brushing aside remnants of Axis armor. The French 19th Corps, after taking Pont du Fahs, joined with the Eighth Army, reduced to three divisions in the process of regroupment, in another drive for Cape Bon. What was left of the Axis armies, threatened from flank and rear, made a disorganized retreat. German morale was low during the last days of the battle, but discipline remained firm. Entire units, under the command of their officers, marched in perfect order into prisoner-of-war cages. The last shot was fired on May 12, 1943. Colonel General von Arnim was among the 252,145 prisoners taken in the general surrender. The last Axis general to capitulate was Italian Field Marshal Messe. United States casualties in North Africa amounted to 18,558, of which 2,184 were killed.

The Casablanca Conference.—From Jan. 14 to 26, 1943, parleys were held in Casablanca among President Roosevelt, Prime Minister Churchill, and the Combined American-British Chiefs of Staff. Agreements reached in the military field covered the coming invasion of Sicily, air operations over Europe, ship tonnage allotments, convoy movements, and naval dispositions. Operations in the South and Southwest Pacific and the problem of sending war matériel to China were discussed.

Reverse lend-lease, an innovation adopted at Casablanca, was disclosed in the official report by General Marshall on Aug. 8, 1943. This agreement bound the other Allied nations to furnish supplies, services, facilities, and patent rights to the armed forces of the United States without cost. The most important single contribution of reverse lend-lease in the war effort was its saving in shipping requirements. Reverse lend-lease also reduced the demands on the United States for raw materials, productive facilities, and manpower. In the fiscal year of 1943, 1,500,000 tons of various goods were provided to United States forces stationed in the United Kingdom in addition to large quantities of construction materials. In Australia and New Zealand, American forces obtained almost all of their food requirements locally. In the Middle Eastern theater, the British provided United States forces in the area with all maintenance requirements. No other contributions by allied nations were listed in the report.

General Giraud and General de Gaulle met in Casablanca, but the meeting did not improve relations between the two. The most momentous decision taken at Casablanca was the acceptance of the formula that the war would be terminated only on the basis of unconditional surrender by the Axis. When adopted, this decision had not been made by the United Nations but by the two powers represented at the conference. Its scope was widened nine months later at the Moscow Conference when it was included in the Declaration of General Security issued by the representatives of the United States, Great Britain, the USSR, and China.

It was claimed by advocates of a negotiated peace with the Axis powers that the unconditional surrender formula prolonged the war. This claim, however, was not justified by events. The Casablanca decision did not keep Italy in the war in 1943. After a brief inquiry, it was accepted by the Japanese in 1945. The Germans sneered at the formula when it was made public. The Reich still believed in victory.

THE CONTINUED RUSSIAN OFFENSIVE 1942–1943

The Red Army deployed strong forces to the north of well fortified Voronezh. In the south, Rostov was built up as an anchor for the Red lines. Strong Russian forces were massed in and to the north of Rostov

Between the Rostov and Voronezh sectors, however, Red armies were disorganized by Marshal Timoshenko's unsuccessful drive. Thorough regrouping was needed to stem a German offensive. To gain a decisive victory, the Wehrmacht would have to pierce the Russian center before it was consolidated, and then eliminate both anchors.

Between June 15 and 20, 1942, strong German concentrations were observed in the triangle of Orel-Bryansk-Kursk and on the railroad system around Stalino. Field Marshal Gen. Fedor von Bock, temporarily suspended from command after his failure to take Moscow, was again in charge of the German drive in that sector. His group was made up of 40 German infantry divisions, 17 Rumanian, Hungarian, and Italian infantry divisions, 18 panzer divisions, and 8 motorized divisions. To the south, Field Marshal Gen. von Schwödler's army group prepared to attack after the arrival of some of Mannstein's divisions from the Crimea.

On June 22, Bock's attack from the Donets bridgehead at Izyum opened before the Russian center could regroup. The Wehrmacht's tactics were again based on the Luftwaffe-panzer-motorized infantry team. More than 2,500 German planes were in action, outnumbering the opposing Red Air Force. The Germans captured the railroad junction and supply base of Kupyansk. Three days later, another blow fell at Kursk. The German Second Tank Army and von Weich's army, overcoming Russian resistance, advanced toward the Don on July 1. On July 2, the center of the Russian southern armies was pushed back when von Bock's third thrust opened between Byelgorod and the Oskol River and gained ground rapidly.

On the left flank of the attacking Germans, the battle did not develop according to the Wehrmacht's plan. The German panzers, followed by motorized infantry, bridged the Don at Voronezh and penetrated into the western part of the city only after most stubborn fighting, which did not disorganize Russian lines. Between July 6 and 7, their slow advance was halted by Russian counterattacks, supported by new tanks and mobile guns. Ten days of violent struggle followed. The Germans were unable to resume their advance and were forced to yield some ground. Panzer losses were high, and von Weich's army suffered substantial infantry casualties. Von Bock called on satellite divisions to dislodge the Russians from Voronezh, but their attack was repulsed, and the original plan was changed. Narrowing the scope of his operations, he abandoned efforts to take Voronezh, concentrated on the southern sector where progress continued and the Russians abandoned Rostov.

The Red Army High Command made a momentous decision. The central southern armies could not be reorganized without giving up much valuable territory. Time was more important than space. The Red forces maneuvered out of Rostov were intact. Some of these troops were pulled back to the approaches of Stalingrad; others were dispatched to prepare the defense of the Caucasus along the Kuban River. Vital farming and coal mining areas were scorched, and oil resources came within range of the German drive.

Late in July and during most of August, von Bock's campaign was reminiscent of the earlier blitz. Only momentarily delayed by Russian rear guards, the German Fourth Tank Army and the German Sixth Army drove on Stalingrad. A lull continued at Voronezh. If the Germans should fail to take Stalingrad and to stage a flanking attack on the Russian Army in the Voronezh sector, they would be outflanked themselves by this substantial force. Von Bock took the risk because of his confidence that he would reach his goal. Besides, despite the speed of the advance, time was running short, and Bock dreaded another winter campaign.

The Siege of Stalingrad.—Russian forces concentrated at Stalingrad. Battered divisions of Timoshenko's central group and the undefeated troops from Rostov arrived. The city's strategic importance was due to its geographical position on the Volga. The river was a vital artery for supplies from the Caspian oil regions and lend-lease goods coming in from Iran and, equally important, for communications between Russian Caucasian and Transcaucasian forces and Red armies farther to the north. The loss of Stalingrad, situated on the west bank of the river, would have hampered but not completely cut off Volga traffic. Large islands used as stepping stones would permit emergency shipping on the Volga, even with the city in German hands. A railroad line, linking Astrakhan on the northern shore of the Caspian Sea with the interior of Russia, ran east of the Volga. Once they were established in Stalingrad, the Germans would have been able to bomb the railroad and the remaining shipping lanes incessantly.

In the summer of 1942, von Bock's intention to make Stalingrad a base for a continued drive to knock the Soviet Union out of the war, before the Western Allies could build up sufficient strength for an attack on the European continent, increased the importance of the city's fate. Most of the defending Russian forces, numerically almost equal to the onrushing German and satellite troops, were deployed in the western approaches of Stalingrad. Strong points were established on the edge of the city. The residential sectors in the west and the center were adapted for block-by-block defense. The eastern industrial section, along the river including steel and cement buildings, was to become the nucleus of the improvised fortress. Long-range artillery was established on the Volga islands and to the east of the river.

A delay in the German advance was needed to complete preparations. Substantial Red forces contested German crossings of the Don in the eastern section of its big bend. The impact of the onrushing Wehrmacht shattered the Russian lines. The Russians suffered heavy losses and had great difficulty in preventing a breakthrough and consolidating their lines in the outskirts of the city.

The Germans massed armored forces southwest of Stalingrad. Russian armor thrown into the battle beyond German-occupied Kotelnikovski was unable to stem their advance. German tank groups, ranging from 100 to 250 vehicles backed by two to three infantry divisions, hammered the Soviet lines. Von Bock's columns northwest of the city crossed the Don at Kalach and advanced to within 10 miles of Stalingrad.

Between September 9 and 12, the Germans methodically pressed through the western outskirts of Stalingrad toward the main railway station in the center of the city. Soviet mobile reserves stationed east of the Volga staged nightly counterattacks. German bombs reduced most residential sections to rubble, but heaps of rubble covering intact cellars proved to be ex-

cellent shelters for the defenders. Russian morale was high. The German soldiers, too, were confident, and their command was determined to take the city at almost any price. The strategic value of Stalingrad was overshadowed by the moral importance of its capture or successful defense. It was widely and wrongly assumed that the fall of the city might bring the Russian campaign to a close.

After September 15, the battle did not rage block by block but actually building by building and floor by floor. On September 22, the Germans reached the center of the city and on September 26 invested the factory district. A serious crisis developed the next day when the Iron Heights, commanding the river, were captured by Wehrmacht units. Russian Lt. Gen. Vassilii Chuikov, in charge of the staggering defenses, called on a guard division, stationed east of the Volga. After crossing the river, the guardsmen retook the Iron Heights on September 29.

German shock troops reached the Volga's right bank north of the Orlovka factory district, while small gains were hammered out inside the city in the region of the main railroad station, the tractor works, and the steel works.

October 4, 7, and 14 were considered by the defenders to have been their hardest days. In a broadcast, Hitler boasted that no power on earth could dislodge the Germans from Stalingrad. More soberly worded, a German official communiqué stated: "With the attainment of the strategic objective, i.e. the capture of the nucleus of the city and the breakthrough to the Volga, the rest of the city no longer has to be stormed. It will be systematically laid waste by heavy artillery and Stukas."

Actually, the original German strategic ambitions went far beyond the capture of Stalingrad, and not even the capture was fully achieved. Traffic on the Volga continued, and although most of the city was captured, it offered no base for another offensive. Once again the German drive lost momentum, while the shaken Russian lines remained unbroken. Another recoil was to be expected. The German lines in and around Stalingrad formed a precarious wedge, increasingly vulnerable to Russian flank attacks.

On October 14, immediately after repulsing the German assault, the Red armies were in no condition to block a planned German retreat beyond the Don bend. Such a retreat would have created a fair defensive position for a winter campaign. But the Wehrmacht could not voluntarily withdraw from a place where—according to the führer and supreme commander—"no power on earth could dislodge it." Colonel General von Paulus (later promoted to field marshal general) took charge of German and satellite forces in the Stalingrad sector.

In the extreme south, the necessity for abandoning Rostov called for changes in the Soviet defense plan. Farmlands and oil regions had to be sacrificed before the German drive could be stopped. The Caucasian Mountain range runs across an isthmus between the Black Sea to the west and the Caspian Sea to the east. Its foothills along the Black Sea coast were not insurmountable to a determined drive by substantial forces. A two-pronged drive, north and south of the Caucasian range, would not only threaten Russian oil supplies but also the northern approaches to the British Middle Eastern lifeline. A Soviet Transcaucasian Army was in readiness to defend the vital regions. Beyond the Russian border, tiny British forces were hardly capable of holding the Middle East if the Russians were overrun.

On July 27, troops of Field Marshal General Mannstein's army swept beyond the Don past evacuated Rostov, with General von Kleist's panzer army spearheading the advance. Other units of von Mannstein's army, including Rumanians, crossed the undefended Kerch Straits. The Wehrmacht occupied Voroshilovsk on August 4 and reached the Kuban River, between Nevinnomissk and Kropotkin, the next day. Russian troops at Krasnodar, threatened from the east, prepared to abandon the city. The Wehrmacht came in sight of the Maikop fields, source of a relatively small part of Caucasian oil production. On August 8, Soviet troops wrecked and evacuated the Maikop installations.

After many successes, on August 20 the Wehrmacht entered Krasnodar. It was a difficult problem to supply the numerous German panzers with fuel, as stores and refineries had been wrecked, and transportation was poor. Many German tanks ran dry, and on August 25, the German drive came to a complete halt for lack of fuel.

After reaching Novorossisk on September 10, the southern prong of the German drive bogged down in the face of stiff resistance by advanced units of the Red Transcaucasian Army. The northern prong seized the terminal of the Sukhumi military highway, and German Alpine Chasseurs planted the swastika at the top of Mount Elbrus (18,564 feet), the highest Caucasian peak.

In late September and early October, no more than two of von Kleist's divisions on the Terek River could continue the drive to the Grozny oilfields, because of lack of fuel. The season was too advanced for a continuation of the offensive, but in the Caucasus, as at Stalingrad, German considerations of prestige prevailed over those of safety. Instead of taking up defensible positions to the rear, the German armies attempted to drive across the Caucasian range late in October, far to the east of their deadlocked forces at Novorossisk. Nalchik was occupied by German motorized troops and Rumanian infantry, but further progress was halted by Russian resistance.

A German advance toward Ordzhonikidze, terminal of the Georgian road, ran headlong into Soviet forces preparing a counterblow. The Wehrmacht suffered a severe defeat at Ordzhonikidze. The Mannstein Twelfth Army, the Seventeenth Army, the First, and most of the Second Panzer Army reeled back in disorder, abandoning much matériel.

Official reports of losses were propaganda claims on both sides. The Russians put German casualties at 450,000 a month. The Germans reported the total of Russian prisoners since June 22, 1941, as 4,909,412, plus Soviet losses of 28,622 tanks, 24,750 planes, and 44,461 guns. Actually, casualties in the summer of 1942 seem to have been below those suffered and inflicted in the first summer campaign. They were, however, at least as hard to bear in view of the heavy strain on manpower and production.

By Nov. 7, 1942, Russian preparations for a winter offensive in the Stalingrad sector were complete, and the Wehrmacht was in full retreat in the Caucasus. Marshal Stalin, in a public address, again urged the establishment of a second front in Europe as "no less needed by our Allies than by us." He made it very clear that

Russia did not feel that Allied landings in French North Africa were adequate to the occasion. The situation of the German armies, according to Stalin, would be very bad if a second front could divert 60 German and 20 satellite divisions.

The Dieppe Raid.—Small units were selected from young British soldiers, including some men from the small Allied countries, trained in warfare to combine primitive ruses with modern weapons. These men were called commandos. Later, similar units, called rangers, were formed in the United States Army.

The commandos occasionally raided the coast of occupied France during the winter of 1941–42. A spectacular action took place on Feb. 27, 1942, when commandos, outwitting the SS (German Elite Guards) at Bruneval, France, destroyed a radio detecting station.

On March 28, a combined land and sea commando raid was successfully carried out at St. Nazaire. Submarine pens in St. Nazaire's harbor had not been demolished by RAF bombs. The old destroyer HMS *Campbeltown,* steaming into port past German vessels, rammed the lock gates. Five tons of high explosives with time fuses were under the deck. Commandos swarmed ashore and inflicted damage on installations and docks before the garrison recovered from its surprise. French civilians assisted the Britishers, some of whom escaped capture by making their way to Spain. The explosive charges blew up with devastating effect while a German commission was on board the *Campbeltown.*

Russian calls for the opening of a second front in Europe could not be met in the summer of 1942, but a costly effort was made to induce the Wehrmacht's command to rush men and supplies to the west which otherwise might have reached the German armies in the east.

On August 19, 1942, before dawn, a force of 5,000 Canadians and 2,000 British, plus a few United States Rangers and Free French soldiers, was shipped to the French coast in barges protected by British corvettes, Free French destroyers, and Polish destroyers. An air umbrella was provided by 1,000 planes, most of them from the RAF, but including some United States Army Air Force craft, and Polish, Czech, Norwegian, and Free French pilots. The goal was Dieppe on the Channel coast. A 3:30 A.M., a German tanker escorted by five trawlers sighted the approaching armada. The surprise element was eliminated, but the Allies continued on their way. Their equipment included light artillery and tanks; heavy naval guns were not available. The Germans were alarmed in time to man their defenses, including pillboxes, road blocks, and a heavily fortified sea wall. The Luftwaffe intervened in strength. Allied preparatory bombing failed to destroy German airbases and wrecked only a few of the coastal guns.

A withering fire met the attackers. Many of their tanks did not reach shore and those which did were destroyed before they could open fire. While the fight was under way, the British Broadcasting Corporation radioed a repeated warning to the French patriots: "This is not an invasion! Do not help them! It's only a raid! Do not betray yourselves to the Germans!" The fortified Casino in the lower town was occupied by the raiders, but because of unabated German fire and dive bombing, their position rapidly deteriorated. After nine hours, the raid collapsed. Canadian casualties amounted o 170 dead, 633 wounded and 2,457 missing. The other Allies suffered less, but a total of more than 50 per cent of the raiding force was lost. The survivors were evacuated to Britain, leaving most of their equipment behind. The Allies lost 98 planes against 92 for the Germans. The paramount lesson of the ill-fated raid was that an invasion could only be carried out with full control of the air and overwhelming firepower.

Russian Winter Campaign. — Saratov became one of the most important centers for Russian reserves preparing a counterdrive against the Germans in the Stalingrad area. The railroad between Astrakhan and Saratov carried supplies where German air interference was negligible. In the Stalingrad sector, von Paulus had four panzer, three motorized, and fourteen infantry divisions, with substantial artillery and technical troops. Six German divisions held bolt positions in the region of the great Don bend. The defense of Luftwaffe bases and their approaches on and beyond the right bank of the Don was entrusted to satellites—Rumanians, Hungarians, and the Italian Eighth Army under General Gariboldi. Satellite forces also covered the two railroads linking Stalingrad with the west. Most German panzer divisions were in the process of reconditioning. Many Luftwaffe squadrons were transferred to the Mediterranean theater in November 1942. Twelve German infantry divisions from Russia moved to the west to prevent an invasion of southern Europe if the Allies should win the race for Tunisia.

The Russian winter offensive was organized by Marshal Georgi K. Zhukov, in cooperation with Generals Konstantin Rokossovski, Andrei I. Yeremenko, and Filip I. Golikov, with Gen. Alexander M. Vassilevski acting as chief of staff. The plan was to cut through the flanks of the German Stalingrad wedge, to encircle von Paulus' army, and to open a breach through which the Red offensive could carry on in the west.

The offensive opened on Nov. 19, 1942. On November 21, Rokossovski's armor crossed the Don at Kalach and reached the railway, 45 miles west of Stalingrad to the rear of Field Marshal Gen. Friedrich von Paulus' forces, within 24 hours. Gen. Nikolai F. Vatutin's forces virtually annihilated the Rumanians on Paulus' left wing and on November 22, broadened the Russian front along the northern railroad.

South of Stalingrad, supplies had to move across the Volga River, which was not solidly frozen when the drive began. The Red Army pierced the Rumanian lines on November 20 and cut the southern Stalingrad railway in three places within two days. Until November 25, the Rumanian Army of 8 infantry and 7 cavalry divisions lost 65,000 prisoners. Yeremenko from the south and Rokossovski and Vatutin from the north pressed toward a junction west of Stalingrad.

There was still a chance for Paulus to pull out of the city and break through in the direction of Kotelnikovski until November 27, when the Russian pincers came close enough to a junction to trap retreating German forces. The Germans, still holding on, hastily improvised a covering force to the west.

On November 28, the Russian ring closed around Stalingrad. Twenty-one German and two Rumanian divisions, all of them understrength and some of them parts of the defeated armies north and south of the city, were trapped. Land

communications were severed, and German supplies ran low.

Field Marshal General von Mannstein was put in charge of a reserve force of 150,000, including three German panzer and two Rumanian cavalry divisions massed in the Kotelnikovski sector. Mannstein planned a drive against Russian vanguards 30 miles west of the Stalingrad ring, in the early days of December. Paulus was to attack in the opposite direction, but his push started prematurely. When Mannstein launched his drive on December 10, the attempt by Paulus to break out had already failed. Mannstein advanced toward Abganerovo, but he did not break through.

On December 16, the Russians regained the initiative. General Vatutin's right flank successfully attacked on the upper Chir River, and the Red Voronezh group opened a major offensive. On December 17, General Golikov's mobile forces crossed the Don, captured Kantemirovka, and routed the Italian Eighth Army. General Mannstein hurled reserves into the breach opened by the Italian defeat, but the Germans were unable to continue the offensive toward Stalingrad or to prevent another Italian disaster. Gariboldi's army disintegrated, losing 60,000 prisoners. Russian armor engaged Mannstein's panzers on December 24. After three days of fighting, Kotelnikovski fell to the Russians, and Mannstein lost 25,000 men killed and captured in addition to 500 tanks. Red forces, advancing toward Tsimlyanskaya through the lines formerly held by the Italian Eighth Army, took Chertkova and encircled Millerovo.

In six weeks of fighting in the Stalingrad and Don sectors, the Germans and their satellites lost approximately 300,000 men, 2,000 tanks, and 4,000 guns. The remnants of Paulus' army were doomed. Twenty-five divisions of German troops marching back from the Caucasus had to be reorganized before joining the battle on the main front.

The German High Command decided (this decision was taken by professional officers rather than by Hitler who remained silent for a long period) to shorten the front and to abandon areas the defense of which could lead to disaster. German bulges at Demyansk and in the Rzhev-Vyazma sector were gradually evacuated without Russian interference. Two new German forces of 40 divisions were formed: one to hold a line running along the Dnieper River from Kiev to Kremenchug if the Russian offensive should penetrate that far; the other to open a counter-drive when Soviet communications became strained.

The Russians entrusted the liquidation of the Germans in Stalingrad to Generals Rokossovski and Chuikov. Two representatives of the supreme command, Marshal N. N. Voronov and General Vassilevski, acted as their advisers. On January 8, Paulus rejected a demand to surrender his exhausted garrison of 80,000 fighting men and an almost equal number of auxiliaries. A Russian assault, opening from the south on January 10, tightened the strangling vise; on January 20, the Russians inside the city joined the drive from the east. Five days later, Paulus' fighting forces were reduced to 20,000. On February 2, at 4 P.M., the remaining defenders surrendered, including their commander and 23 German and Rumanian generals.

The victorious Soviet armies from Stalingrad were unable to join the battle for the Donets in time to win an even more spectacular victory. During January, inadequacy of transportation still impeded the advance of Gen. Ivan I. Maslennikov from the Caucasus. The Russian Caucasian Army lost contact with the enemy. General Yeremenko tried to seize Rostov before German Caucasian forces could pivot through the city. Mannstein, organizing defenses east of Rostov, succeeded in halting Yeremenko's army at Salsk. On January 22, Gen. Rodion J. Malinovski's forces pressed against Rostov from the east in cooperation with Vatutin's army, which crossed the Donets River at Kamensk. In the extreme south, a Russian column recaptured Maikop on January 30 and pushed on toward Krasnodar.

With the fall of Krasnodar, however, the Wehrmacht's hold on the Caucasus shrank to a relatively narrow region of little offensive value, opposite the Kerch Straits and extending southward to the city of Novorossisk. The Russian High Command decided to postpone an attack on this remaining bridgehead until operations in the north had reached their objectives: Rostov, Kharkov, and Smolensk.

Vatutin crossed the frozen Donets near Izyum on February 5. On February 10, Russian armor penetrated Lisitchansk, and Vatutin's forces were established in Chuguyev. Krasnoarmeisk fell to Soviet troops on February 13. On February 14, portions of the armies of Generals Malinovski and Yeremenko entered Rostov, but the bulk of the German Caucasian armies had already passed safely to the west.

Generals Golikov and Vatutin won spectacular successes. On January 16, the hedgehog of Rossosh was captured with 17,000 prisoners, many of them Italians and Hungarians. Three days later, the railway town of Valuiki fell to Vatutin's troops, and remnants of three Italian divisions surrendered. On January 23, Golikov's men routed the German and Hungarian forces between the Voronezh and the Don rivers. Three days later, seven German and Hungarian divisions were almost annihilated at Kastornoya. Surrender of two more Italian divisions foiled an Axis attempt to rally along the Oskol River.

Vatutin reached Kupyansk on February 3 and continued toward Kharkov to attack the city frontally. Golikov captured Kursk on February 7 and opened a flanking drive from the northwest. The Germans threw mobile SS (Elite Guard) shock troops into the defense of the city, but they were in hasty retreat toward Poltava, on February 16, leaving Kharkov in Russian hands.

On January 12, in the Leningrad sector, Soviet armies under Generals Leonid A. Govorov and Kyril A. Meretskov assaulted the German vise. Schlusselburg and a strip of land 10 miles wide, south of Lake Ladoga and the Neva River, were recovered. A specially organized offensive group under Marshal Timoshenko pushed toward Demyansk and the Rzhev-Gzhatsk-Vyazma salient on February 15. Rzhev was occupied March 3, Gzhatsk March 6, and Vyazma, March 11.

In the subsequent advance on Smolensk, defended by German Field Marshal General von Kluge, the Soviet forces crossed the upper Dnieper at Kholm-Zhirkovski on March 14. Counterattacks by panzers and infantry were repulsed, but the Russian drive lost momentum and broke down east of Smolensk's outer defenses. In the last days of March, thaws set in and the offensive could not be resumed.

Weather conditions of the winter of 1942–1943 did not favor the Russians. During February, unseasonable thaws and heavy rains hampered their operations from Voronezh to the Caucasus.

Soviet lines were thinned out by the advance. Infantry fell dangerously far behind armor, and Gen. Markian M. Popov's tanks were immobilized in seas of mud. Other Russian columns at Poltava and Krasnograd were no better off. Parts of Yeremenko's forces were immobilized in the Caucasus, and by the middle of February, General Maslennikov was still inching ahead in the Kuban River valley.

Rokossovski's army could not be expected in line before spring. There were no Russian heavy caliber guns in advanced areas. Northwest of Rostov, Russian spearheads ran into formidable German defenses centered at Stalino. Beyond Kharkov and Kursk, a screen of Russian armor spread over a sector of almost 200 miles, but the infantry and artillery were unable to keep up, and fuel supplies were running short.

Mannstein's forces in the Stalino sector united with a newly created German offensive group, increasing their armored strength to nine panzer divisions. On February 26, all of the armor and 12 of the infantry divisions were hurled against Red vanguards at Stalino and on the Dnieper River in an attempt to break through between the Donets and Kharkov. The Russians fell back to the eastern bank of the Donets, but their lines were not pierced. In March, Mannstein opened another drive supported by Kluge's panzers and SS troops from Poltava. Sudden frost hardened the ground, aiding armored operations, and three prongs closed in on Kharkov from the west, north, and northwest. The Red Army evacuated the prize city on March 15. Mannstein was not able to continue his offensive because of the changing weather and the strength of the still intact Red forces, and by April 1943, the eastern front was generally quiet.

Casualties suffered by German and satellite troops during the second eastern winter campaign, in which the Wehrmacht lost about as much space as it had conquered in the previous summer drive, were estimated at 1,200,000 men. Russian losses were probably slightly less. Soviet sources reported that the Germans lost 5,000 aircraft, 9,000 tanks, and 20,000 guns. These figures seem high, but Wehrmacht losses greatly exceeded those suffered by the Russians.

Prime Minister Churchill estimated German strength in Russia after the winter campaign at 190 divisions (plus 50 or 60 divisions in occupied countries). These divisions were under full strength and no longer first-rate fighting forces. Second-rate German troops, including militia units, filled the gaps. Satellite forces were even more depleted. The Wehrmacht, in the summer of 1943, had no more than 50 per cent of its 1941 strength and about one third those who set out to conquer Russia.

Russo-Polish Crisis.—On Feb. 21, 1943, Gen. Wladyslaw Sikorski, premier of the exile Polish government in London, disclosed that his government had protested to Moscow against intervention in the internal affairs of the Polish state, such as the dropping of parachutists in central and eastern Poland to organize communist cells. Another Russo-Polish controversy arose at about the same time. After marching into eastern Poland in September 1939, the Russians had removed approximately 1,300,000 people from occupied areas to the interior of Russia, mostly to Siberia. Insisting that these persons were Polish citizens, the Polish government asked to arrange relief for them under its control and offered to provide the necessary funds. Prime Minister Sikorski pointed out that Poland had a right to its frontiers of Sept. 1, 1939. On March 2, 1943, the Moscow radio replied by broadcasting a statement from the official Tass news agency, charging the Polish government with imperialistic tendencies. According to Moscow, the persons removed were Soviet citizens. On March 8, a pro-Soviet group of Poles in Moscow proclaimed that Poland should give up its claims to territory annexed by Russia. Another argument arose over the execution by the Russians of two Polish-Jewish trade unionists, Henryk Ehrlich and Victor Alter. Soviet authorities declared that the execution was justified, while the Poles insisted it was arbitrary.

On March 30, 1943, Premier Sikorski, emphasizing his government's desire for a rapprochement with Russia, called upon the great powers to stand by their pledges and protested against plans to reduce Polish sovereignty and territory. The German government aggravated the crisis by suddenly announcing the discovery of mass graves in the Katyn forest near Smolensk, containing the bodies of 10,000 Polish officers allegedly slaughtered by the Russians. The Russians charged the Germans with the massacre. On April 18, the Polish Cabinet requested its representative in Switzerland to ask for an investigation of the Katyn murders by the International Red Cross. Moscow denounced this step as helpful to the Germans and severed relations with the Polish government in London on April 26, 1943.

The pro-Russian Poles in Moscow who had been responsible for the proclamation of March 8 were organized into a Union of Polish Patriots under the sponsorship of the Soviet government. This step was disclosed on May 12, 1943. It led ultimately to the creation of another Polish government, adhering to Soviet political and economic principles and opposed to the London government in exile. American and British attempts to restore relations between Russia and the Sikorski government produced no results. On June 16, Premier Stalin declared that the USSR would assist in the creation of a strong and independent Poland in every way. But Russia showed a firm determination to deal exclusively with the Union of Polish Patriots in matters concerning Poland.

Premier Sikorski was killed in a plane accident on July 4, 1943. His successor was Stanislaw Mikolajczyk, leader of the numerically strong Polish Peasant Party. Three members of that party, three Socialists, two Christian Democrats, two Nationalists, and three Non-partisans were included in his Cabinet, to represent political trends in Poland prior to the invasion. The Soviet government refused to deal with this Cabinet.

Growing Partisan Strife in Yugoslavia.—Gen. Draža Mihajlovic's Chetniks, men under his command, joined by popular elements, were loyal to King Peter and his government in exile, in which their leader was minister of war. A rival group of Partisans led by Marshal Tito (Josip Broz) looked to Moscow rather than to the government in exile for guidance. Moscow's aid to the Yugoslav resistance movement went exclusively to Tito.

General Mihajlovic's strategy was based

upon the assumption that the Allies would land at Salonika for a drive toward the Danubian basin. He husbanded his men and scanty equipment to support this drive, and confined his activities to surprise attacks upon Axis communications and attempts to gain control of areas from where the Chetniks could open the way through the vital Vardar and Morava river valleys as soon as the Allied armies were on the move. The Partisans, by contrast, engaged in continuous action to keep pressure upon the occupation powers and to gain control of large areas, regardless of their strategic location, preparatory to the establishment of postwar control of the country. The Russian-based Partisan radio claimed local successes, while General Mihajlovic insisted that his men deserved credit for some of these actions. Complete verification of claims and counter-claims was impossible. Hostility between the rival factions led to serious clashes between Chetniks and Partisans. In November 1942, Tito's men met in Bihac, a town in Bosnia, where an "Anti Fascist Assembly for the People's Liberation" and a Communist-dominated executive committee was set up. The Partisans subsequently called themselves the People's Army of Liberation.

Until May, 1943, British support went exclusively to the Chetniks, which caused friction between Great Britain and Russia. U.S. mediation led to the dispatch of a British military mission to Tito's headquarters, then at Jajce, while the Russians continued to recognize Tito only. The British then urged the Yugoslav government in exile to make changes in the cabinet to pave the way for a reconciliation between the rival factions. Subsequent changes had no such effect.

In the fall of 1943, King Peter urged General Mihajlovic to wage a more active campaign. The general reported that the Chetniks had wrested substantial areas from the German during the month of October. This was denied by his rivals. Mihlajlovic, stunned by Allied reluctance to invade the Balkans after the surrender of Italy, saw his pattern of strategy destroyed.

Coinciding with the Teheran Conference, Tito formed a government of his own on Nov. 29, 1943. He became prime minister, minister of war, and chief of the armed forces with the rank of a marshal. In a statement of policy, Tito reserved the right to review all treaties and commitments made by the government in exile, adding that he would not recognize any further obligations undertaken by King Peter's government. The Partisan leader asked for recognition of his Cabinet as the legal government of Yugoslavia.

On December 15, General Mihajlovic charged his rival with aiming to establish a minority dictatorship. The Communists had previously had no substantial following in Yugoslavia, and Tito assumed much greater power than the king enjoyed constitutionally. On December 22, Tito's government declared the government in exile deprived of its rights and forbade the king to return to his country. It also demanded that General Mihajlovic be tried for conspiring with the enemy to destroy the Partisan forces. On Dec. 8, 1943, a British government spokesman said that more British aid was going to Tito than to Mihajlovic because the Partisans were fighting much more actively. The next day, Secretary of State Cordell Hull stated that the U.S. government would help both the Partisans and Mihajlovic and leave the choice of a future government to the Yugoslav people. The Russian government announced that a military mission would be dispatched to Tito's headquarters.

In December 1943, the Allies controlled the Adriatic Sea and seaborn supplies were reaching Yugoslavia in far greater volume than before. The balance of power switched in Tito's favor. This gave Tito the opportunity to increase his power to the point where the Yugoslav people no longer had a free choice of government.

Although communism was and remained unpopular, growing numbers of men joined Tito's forces in order to expedite the liberation of the country. The Chetniks supplies approached exhaustion. Lack of food and ammunition led to the discharge of many who wanted to remain with Mihajlovic, who continued to aid the western Allies. But district Chetnik leaders got out of control. The organization split and gradually dissolved. A number of regional commanders eagerly fought Tito, whom they considered a greater enemy than the invaders. Their actions frequently coincided with German operations against the Partisans. This created the impression of outright collaboration and later occasionally led to it. Such acts, however, were not in accordance with Mihajlovic policy. Late in 1943 and early in 1944, according to a statement by Capt. George S. Musulin of Pittsburgh, Pa., nearly 500 Allied airmen who had parachuted into Yugoslavia (mostly American), were saved by Chetniks. The same officer quoted General Mihajlovic as having told him: "Only a fool could believe such an accusation" (of having conspired with the enemy) "in view of the 100,000 Serbs under my leadership who died fighting the Nazis."

Strife in Greece.—In Greece, two factions of anti-Axis underground forces were engaged in a feud: the *ELAS* (Greek People's Army of Liberation) and the *EDES* (National Democratic Greek Army). The *ELAS*—its most prominent leader was Colonel Seraphis—was organized by the *EAM* (National Liberation Front), a small but extremely active and courageous group which included communists. It had a remarkable record of sabotaging the main Greek railroad lines. The *EAM-ELAS* asked for representation in the Greek government and did not want the king to return to the country before a plebiscite was held to determine the fate of the monarchy.

The *EDES,* under the command of Col. Napoleon Zervas, was a well armed group led by professional officers. It operated chiefly in southern Epirus. The *EDES* was loyal to the king and regarded the *ELAS* as composed of Russian-sponsored rebels. The *ELAS* countered by charging Zervas with dealing with the Germans. The British dispatched military missions to both groups and endeavored to reconcile them. Acting upon a British suggestion, a deputation from the *EAM-ELAS* went to Cairo to present their demands to King George, who evaded the issue while *EAM* and *EDES* battled among themselves. The political tendencies of the *EDES* moved gradually toward right wing extremism.

Czechoslovak-Soviet Rapprochement.—Since 1940, parleys had been held between the government in exile of Czechoslovakia and Poland concerning a future of Czechoslovak-Polish coalition to which other neighboring countries might be admitted upon request. After the severance of relations between the London Polish government and the Soviet Union, the Czechoslovaks discontinued these negotiations. President

Beneš insisted that no federation program was feasible among the small Central European states except with the prior approval of both Great Britain and the USSR. No objections was raised by Britain. He therefore made the point that the restoration of friendly relations between the London Poles and the Russian government must precede resumption of the talks. In a broadcast to his countrymen on June 24, 1943, Beneš, in an effort to dispel fears that close ties with Russia might jeopardize Czechslovakia's relations with the United States, asserted that friendly collaboration between the United States and the Soviet Union during and after the war was absolutely certain. On October 12, the Czechoslovak government announced its desire to conclude with a mutual pact of assistance with the USSR. The matter was discussed at the subsequent Moscow conference between Motolov, Eden, and Hull. Motolov insisted upon concluding the pact with the Czechoslovak government immediately, while the United States and British representatives called it calculating to discourage progress toward a new world order. Beneš went to Moscow and a 20-year Czechoslovak-Russian mutual assistance pact was signed there on Dec. 12, 1943. It led to the extension of communist influence in the Czechoslovak government. Despite previous recognition of Czechoslovakia's pre-Munich frontiers, Russia obtained the cession of the Carpatho-Ukrainian province in eastern Czechoslovakia after the end of World War II.

The French Regime.—From Aug. 11 to Aug. 24, 1943, President Roosevelt and Prime Minister Churchill conferred in Quebec. Canadian Prime Minister Mackenzie King acted as host to the conferees, who included Secretary of State Cordell Hull, Foreign Secretary Anthony Eden, and American and British military and political advisers. Dr. T. V. Soong was present as a representative of Generalissimo Chiang Kai-shek.

France was one of the main topics on the Quebec agenda. On March 18, 1943, a pro-Allied committee in French Guiana ousted the pro-Vichy administration. A dispute arose between Generals Giraud and deGaulle as to whose appointee was to govern the colony. United States influence was favorable to Giraud. On June 3, a merger of the opposing factions was formally achieved in Algiers in the Committee of National Liberation. Rivalries persisted within the committee, with deGaulle's influence growing. The committee obtained very limited recognition in Quebec. President Roosevelt recognized it as "administering those French overseas territories which acknowledge its authority." A British statement, couched in more diplomatic terms, followed the United States pattern. The USSR called the Committee "the Representative of the State interests in the French Republic and leader of all French patriots fighting against Hitlerite tyranny." Roosevelt made it plain that the United States did not recognize the committee as the government of France on Aug. 26, 1943, when he declared that the French people were to select their own government and their own officials to administer it.

Unlike most other conquered nations, France had no legal government, since that of Marshal Pétain and Pierre Laval could not be considered as such. This had an adverse effect upon the country's political stability after its liberation by the western Allies.

The Moscow Decisions.—Between Oct. 19 and 30, 1943 parleys were held in Moscow among Cordell Hull, Anthony Eden, and Vyacheslav Molotov and their staffs. China was not represented at the conference but was invited to adhere to the Declaration of General Security made at Moscow.

The declaration emphasized the determination of its adherents to continue hostilities against the Axis powers with which the signatories were at war until such powers surrendered unconditionally. The signatories pledged themselves to secure the liberation of Allied peoples, to ensure a rapid and orderly transition from war to peace, and to maintain peace and security with the least possible diversion of the world's resources for armaments. They further reiterated their intention to continue united action for the organization and maintenance of peace, to cooperate in all matters relating to the surrender and disarmament of the enemy, and to take precautions against violations of terms by the enemy. The participating powers recognized the necessity of establishing, at the earliest practicable date, a general international organization based on principles of the sovereign equality of all peace-loving states and open to membership by all such states, large or small, for the maintenance of international peace and security. Pending the establishment of a system of general security, they agreed to consult with each other and, as occasion requires, with other members of the United Nations, with a view to joint action on behalf of the community of nations." They also agreed that, "after the termination of hostilities, they will not employ their military forces within the territory of other states except for the purposes envisaged in this declaration and after joint consultation."

Another part of the declaration concerned the status of Italy following the country's surrender. After the destruction of fascism, the Italian people were to be given the opportunity to establish democratic institutions. Anti-fascism elements were to liberalize the Italian government, and freedom of speech, of political belief, of the press, and of public meetings should be restored. Institutions and organizations of the Fascist regime were to be suppressed and Fascist elements removed from office. Political prisoners were to be released and Fascist chiefs and other war criminals placed under arrest. The right of the Italian people to choose their own form of government was confirmed.

A third part of the Moscow declaration dealt with Austria. The annexation of that first victim of German aggression was declared null and void, and the signatory powers promised that, after its liberation, Austria would be established as a free and independent state.

A fourth document—subsequently signed by Roosevelt, Churchill, and Stalin—warned that German officers, men, and Nazi Party members responsible for atrocities in occupied territories would be sent back, after the end of the war, to the countries where they had committed their crimes to be judged and punished according to the laws of the liberated countries. Those whose offenses had no particular geographical localization would be punished by joint decision of the Allied governments.

An Advisory Council for matters relative to Italy was created, composed of representatives of the United States, Great Britain, the USSR., and the French Committee of National Libera-

tion. It was also decided to establish a European Advisory Committee in London to study European questions.

The First Cairo Conference.—President Roosevelt and Prime Minister Churchill met Generalissimo Chiang Kai-shek and Madame Chiang Kai-shek in Cairo between Nov. 22 and 25, 1943. The results of these discussions was summed up in the statement that Japan should be stripped of all the islands in the Pacific it had occupied since 1914, and that all territories stolen from the Chinese, such as Manchuria, Formosa, and the Pescadores, should be restored to the Republic of China. Japan was also to be expelled from "all other territories which she had taken by violence and greed," and Korea was to become free and independent. Russia assumed no obligation under the declaration, but the term "all other territories" could be interpreted as including what Japan had taken from Russia since 1905.

The Teheran Conference.—From Cairo, the president of the United States and the British prime minister proceeded to Teheran (called the "capital of our Ally, Iran" in the announcement) to meet Marshal Stalin. President Roosevelt, at Stalin's invitation, resided in the Russian Embassy during the conferences, which lasted from Nov. 28 to Dec. 1. The official communiqué summing up the results on the conference emphasized the determination of the participants to cooperate in war and in the peace to follow. Complete agreement was reported to have been reached regarding the conduct of the war. "No power on earth," the communiqué stated, "can prevent our destroying the German armies by land, their U-boats by sea, and their war plants from the air."

The invasion of France in 1944 was finally pledged by the Western Allies in Teheran. Russia had repeatedly insisted that Allied landings in Italy did not satisfy the Soviet desire for the establishment of a second front. The USSR was anxious to have the United States and Britain concentrate in the western part of the European continent. The Teheran Conference resulted in a long step toward the division of Europe into spheres of influence. Russian predominance in Poland, Rumania, Bulgaria, and Yugoslovia was clearly established.

The Second Cairo Conference.—Returning from Teheran, Mr. Churchill and Mr. Roosevelt stopped in Cairo again from Dec. 4 to 6, to meet President Ismet Inonu and Foreign Minister Menemenicoglu of Turkey. The Turkish government was disturbed about the prospect of concessions to Russia at Turkey's expense. Soviet nationalism was expected to press czarist claims for Russian domination of the Dardanelles. The official report on the meeting failed to mention that topic. It emphasized the "strength of the British-Turkish alliance and the firm friendship between the Turkish people, the United States, and the USSR."

AN ATTACK UPON FORTRESS EUROPE

During the two years preceding July 1, 1943, enlisted strength in the United States Army increased by five million men. The officers corps grew from 95,000 to 521,000. The air force in 1943 numbered 182,000 officers and 1,960,000 enlisted men. After more than two years of undisputed control of western and central Europe by the Axis, Allied invasion plans were ready.

German propaganda reassured their people that an impregnable wall had been built to protect every potential landing area. But the transformation of Europe into a fortress could not possibly be completed within the lifetime of a single generation. The German boast that they had garrisons and equipment for the entire perimeter of Europe was not true. Certain coastal regions, such as those along the English channel, were heavily fortified, but other areas were not, especially in southern Europe.

Stepping Stones.—Both for military and political reasons, the opening assault on Europe was directed against islands covering the approaches to Italy. Pantelleria ("Mussolini's unsinkable aircraft carrier"), Lampedusa, and Linosa were to be eliminated as obstacles to an Allied invasion of Sicily and Italy. Pantelleria had an area of only 45 square miles. Its steep rocks were honeycombed with gun emplacements; torpedo launching tubes were installed on its coast; and an airfield was built in its center. Lack of water limited the island's garrison to 12,000 men, and mountainous terrain restricted the size of the air base. Pantelleria's antiaircraft defenses were not up to date.

On May 20, Allied air attacks began against the island. Malta's strengthened air force joined the 4,000 Allied planes assembled in North Africa. The bombardment continued until June 11; 1,500 tons of explosive hit the target that day. Allied naval forces approaching Pantelleria were not fired upon by the island's vaunted 16-inch rifles. The demoralized garrison surrendered without a fight. Southeast of fallen Pantelleria, Lampedusa capitulated on June 12 and Linosa on the following day, yielding a total of 600 prisoners.

The Sicilian Campaign.—In Sicily, with an area of 9,860 square miles and a population of over four million, the Germans maintained three infantry and one panzer divisions and 24,000 Luftwaffe men on 18 airfields. The Italian Sixth Army, also in Sicily, included five first-line divisions and a large number of second-rate and auxiliary formations of poor quality. The total strength of the defending forces was estimated at 345,000, but it was actually about 200,000. Nearly 1,200 Axis aircraft were based in Sicily.

The Allied assault was a three-dimensional operation: air bombardment softened up defenses and disrupted supply and communication lines; naval action covered the landings; and Allied naval and air forces assisted the ground forces after the invasion.

After June 13, the Northwest African Coastal, Tactical, and Strategic Air Forces, the Gibraltar, Malta, and Middle East Commands, and the Naval Cooperation Groups joined in smashing airbases and defense installations, disrupting railroad traffic, and wrecking harbors and ferries in Sicily and Southern Italy.

Saboteurs were dropped by parachute to add to the destruction in Sicily.

Invasion convoys assembled on July 6. The initial forces included 160,000 men, 600 tanks, 1,800 guns, and 14,000 vehicles of various types. Troops landed subsequently brought the total number to 250,000. The invasion army embarked from Gibraltar, Oran, Algiers, Bizerte, Tunis, Tripoli, the United Kingdom, and the United States. Naval craft numbering 3,200 were involved in the operation, the code name for which was "Husky."

On July 9, German broadcasts reported the

presence of thousands of Allied ships in the Mediterranean. The German presumed that Sicily was to be attacked, but simultaneous landings in Sardinia, Corsica, and the Italian mainland were not discounted. Neither the Italian surface fleet nor twelve Axis submarines in North African coastal waters interfered with Allied shipping. Improved Allied landing craft—the LCI (landing craft infantry) and the LST (landing ship tank)—came as a surprise to the Axis. Men were transferred from transports to landing craft at a safe distance from the shore.

The combined Allied air forces under the command of British Air Marshal Sir Arthur Tedder (The United States portion was the Northwest African Air Force under Lt. Gen. Carl Spaatz) provided an air umbrella. The naval commander in chief was again Admiral Cunningham. The British task force included the ships *Nelson, Rodney, Formidable, Warspite, Valiant, Indomitable, Howe,* and *King George V.* Its assignment was to guard the invasion armada against possible attack by the Italian Navy and to confuse the enemy by widespread operations in the Tyrrhenian and Ionian Sea, thus implying preparations for an imminent invasion of the Balkans, Sardinia, and central Italy as well as Sicily. At the same time, two United States battleships, the *South Dakota* and the *Alabama,* reinforced the British Home Fleet at Scapa Flow. The British Navy escorted General Montgomery's Eighth Army to its landing places.

The United States portion of the Allied fleets, the Western Task Force, was under the command of Vice Admiral Henry K. Hewitt. The escorting cruiser division including the *Philadelphia, Boise, Savannah,* and seven destroyers, was assisted by British MTB (motor torpedo boat) and MGB (motor gunboat) flotillas. The United States task force split into three main attack forces for landings, code-named "Joss," "Dime," and "Cent."

General Eisenhower's deputy commander, Sir Harold Alexander, was in command of the attacking land force (the Fifteenth Army Group). The army group consisted of the United States Seventh Army (Lt. Gen. George S. Patton, Jr.), and the British Eighth Army (Lt. Gen. Sir Bernard Montgomery). The United States Seventh Army included the 22d Corps (Lt. Gen. Omar N. Bradley, 1st and 45th Divisions and paratroopers) and a separate task force (3d Division and parts of the 2d Armored Division) under Maj. Gen. Lucian K. Truscott. The British Eighth Army included the 5th, 50th, and 51st British and the 1st Canadian Divisions, with the 78th Division held temporarily in reserve.

According to the Allied plan of campaign, the landings were to take place on the southern coast of Sicily. The objective of attack force Joss (main force 3d Division) was the port and airfield of Licata. Attack force Dime (1st Division) was to capture Gela and the nearby air base of Ponte Olivo. Attack force Cent (45th Division) was to invade Scoglitti, take the airfields of Comiso and Biscari, and establish con-

tact with the British Eighth Army, which was to land in full force on Pachino Peninsula (southeastern Sicily) for an opening drive on Augusta and Syracuse. After reaching these objectives the British Eighth Army was to advance along Sicily's east coast toward Catania and Messina. Inland, it was to by-pass Mount Etna from the west. The United States Seventh Army was to seize Porto Empedocle in the south and drive across the island to Palermo. From there, the push was to continue east to join the British at Messina.

The Germans hurriedly fortified the approaches to Catania. The lava-encrusted western slope of the 10,875-foot volcano Mt. Etna made natural fortresses of the towns of Adrano, Bronte, and Randazzo. The rugged terrain of Sicily offered a formidable obstacle even to superior attacking forces.

D-day was July 10. A sharp breeze sprang up in the early morning hours, interfering with the transfer of troops to the landing craft, but the landings were carried out on schedule. Low flying Axis aircraft in small groups bombed the fleet off shore and accounted for the loss of one destroyer. The United States 82d Airborne Division descended in the rear of the beaches three hours ahead of the seaborne forces. Heavy winds scattered the paratroopers over wider areas than expected, and the divisions suffered substantial losses from enemy action.

The Allied air forces flew an average of 1,200 sorties during the first days of the operation. The landings of the British Eighth Army and of operations Joss and Cent proceeded smoothly. Operation Dime met with a temporary crisis. The German Hermann Göring Division attacked before American tanks, antitank guns, and heavy artillery were ashore to reinforce the Gela beachhead. Thirty German tanks drove to the beach, but Allied naval artillery turned the tide. Gela was secure by the early afternoon of D-day.

In the plans, the Allied High Command had allowed for 20,000 casualties during the initial attacks, but less than 1,000 men were killed or wounded on July 10, 1943. The Italians frequently surrendered en masse. Two hours after the first Allied troops went ashore, Italian prisoners of war were helping to unload men and supplies. During the first 48 hours, more than 80,000 men, 7,000 vehicles, and 300 tanks were ready for action, with additional forces pouring in.

The United States Seventh Army split into three columns, one pushing along the south coast toward Porto Empedocle, the others racing inland toward Palermo. The 3d Infantry Division met unexpectedly heavy Italian resistance at Empedocle and Agrigento. On July 17, British and United States cruisers shelled those cities until they surrendered. The British drive on Augusta and Syracuse reached its objectives two days after the landings. On July 15, all the ground captured by the Eighth Army was securely held with the assistance of British commando and naval units. On July 16, one quarter of Sicily was in Allied hands.

The British 5th and 50th Divisions from Augusta moved north along the coastal highway toward Catania to take the town, its harbor, and its airfields. The Canadian Division swung inland for a thrust around Mt. Etna. The 5th and 50th Divisions ran into strong German positions barring the way to Catania. Following the first unsuccessful attempt to breach the German line, there was a stalemate until August 5, when the defenders were forced out. The Canadians attacked Adrano, on the western slopes of Mt. Etna, a mountain village built of stone, where every house was a pillbox. They were finally able to overcome German resistance with the help of the British 78th Division and strong artillery support. Adrano was taken on August 7.

From Palermo, taken July 22, the American Seventh Army continued toward Messina, splitting into two columns, one of which progressed along the coast, and the other parallel to the first drive, pushed eastward inland. The inland drive aimed at Randazzo to join the Canadians, the French, and other Seventh Army forces.

Although the fall of Adrano and Catania made the further defense of Sicily meaningless, the Wehrmacht continued to fight with strong rearguards, while the main forces withdrew toward Messina and the ferry to the Italian mainland.

During the last part of the campaign, the United States Seventh Army fought very hard. Neither Allied superiority on the ground nor the violent air bombardment of the Messina ferry broke up the orderly German withdrawal across the straits, only 2 miles wide at their narrowest point. According to Gen. George C. Marshall's report, the Germans, by using heavy concentrations of antiaircraft guns, managed to evacuate thousands of their first-line panzer and airborne troops, as well as a considerable amount of light equipment.

Patrols of the United States 3d Division entered Messina from the west at the same time that British units entered from the southeast. On August 17, organized resistance came to an end. Axis casualties totalled 167,000, of which 37,000 were German. Allied losses amounted to 31,158 killed, wounded, and missing, of which 19,235 were British and Canadian. On August 17, the Italian islands of Lipari and Stromboli, north of Sicily, surrendered to a U.S. task force.

The Air Attack of Rome.—After the landings in Sicily, most of the Allied Mediterranean air power turned against the Italian mainland. The Ports of Genoa, Trieste, Leghorn, Naples, Taranto, Bari, and Brindisi suffered heavily, as did the industrial centers of Milan and Turin.

On July 19, 500 United States planes raided Rome, concentrating on its railroad yards. The possibility of damaging Vatican City and the desire to protect venerable monuments accounted for previous Allied reluctance to bomb the capital. But Rome was an important transportation hub, and the Wehrmacht made use of its presumed inviolability to direct much transportation through the city. Moreover, the political crisis in Italy, rapidly moving to its climax, called for drastic warfare to hasten the Italian surrender.

Mussolini's Downfall.—The emotional, popular enthusiasm which followed Italy's entry into the war subsided when the Italians realized that the war would not end quickly, and it was replaced by inertia when setbacks accumulated. The loss of the African Empire wiped out the belligerent spirit in Italy. Italian antipathy to the Germans had not been entirely eliminated even in the heydey of the Axis pact. It rose to deep hatred when the Germans tightened their grip on Italy. Discontented officers blamed the Fascist Party for inadequate preparations, favoritism in assignments, and the subordination of

Italian needs to German demands. Pro-Allied elements in the armed forces were increasingly active. Some Fascists, worried about the future, blamed Mussolini.

On Feb. 5, 1943, Mussolini dismissed 12 members of his government, including his son-in-law, Count Galeazzo Ciano, and assumed complete command of political and military operations. Mussolini urgently requested German antiaircraft weapons, planes, and raw materials. In payment, he offered to dispatch even more Italian labor to the Reich. The chief of the Italian government expected the Allied invasion in February 1943.

On April 15, Mussolini met Hitler. Il Duce, in the humilating role of a petitioner, explained that 30 additional German divisions and strong Luftwaffe forces were needed to hold the country against Allied attack. Hitler replied that the defense of the whole of Italy would put a heavy strain on German strength and that if the Italians were unable to defend themselves, parts of the Apennine Peninsula would have to be abandoned. Il Duce, returning from this conference on April 17, wrongly told his inner circle that the German führer was preparing to give all necessary assistance and made an attempt to tighten his control of the Army. Party purges and changes in civil service appointments followed, but signs of revolt increased. Italian casualties, totalling 633,251 after the fall of Tunisia, alarmed the public.

On July 19, Mussolini met Hitler again in Verona, Italy. The German leader refused the plea of his Axis partner for more help and flatly declared that Italy should be evacuated south of a line running along the southern border of Tuscany.

Mussolini was forced to inform the Fascist Great Council of the true German attitude. On July 24, led by Count Dino Grandi, former Italian ambassador to London, the council expressed lack of confidence in Mussolini by a vote of 19 to 5. The next morning, Mussolini yielded to a demand of his ministers and submitted the German plan to the king of Italy who flatly rejected it. At 11:00 P.M., July 25, 1943, the Rome radio announced that King Victor Emanuel had accepted the resignation of Mussolini and appointed Marshal Pietro Badoglio as his successor. As he was leaving the royal palace, Mussolini was taken into custody and, after various transfers, was interned. His guard had orders to shoot the former dictator rather than let him escape. Neglect of duty accounted for Mussolini's rescue by a special detachment of German parachutists. He was first taken to Germany and subsequently to northern Italy. Hitler decided that the maintenance of German control over most of Italy was vital to the German war effort. Additional German divisions poured into Italy, and Mussolini was used as a puppet to force Italians to aid the Wehrmacht.

On September 23, German broadcasts announced the formation of a new Fascist cabinet of 12 members in German-controlled Italy. Five days later Mussolini proclaimed himself chief of a new Republican Fascist State. On October 31, Mussolini's government demanded the death penalty for the king of Italy, Marshall Badoglio, and the members of the Fascist Great Council who had voted against Mussolini. Il Duce's mobilization orders failed to raise substantial Italian forces, but Republican Fascists, assisting the gestapo, established a reign of terror in central and northern Italy.

The Surrender of Italy.—On July 26, King Victor Emanuel proclaimed: "I assume, as of today, the command of all armed forces. Italians! I am today more than ever indissolubly united with you by unshakable faith in the immortality of the fatherland." Another proclamation by Badoglio was disappointing. After announcing that he had taken over the military government of Italy with full powers, by order of the king, he merely stated: "The war goes on."

Speaking in the House of Commons on July 27, Prime Minister Churchill hailed the downfall of Mussolini but warned that the Allies would have to resort to extreme measures to force the Italians to help the Allies against Germany. On July 28, President Roosevelt reiterated in a broadcast that the terms to Italy were the same as to Germany and Japan: unconditional surrender. General Eisenhower also broadcast to Italy: "We commend the Italian people and the House of Savoy for ridding themselves of Mussolini." He added that the only remaining obstacle to an honorable peace was the fact that the German aggressor was still on Italian soil. The Allies were coming as liberators, and the Italian people should immediately cease any aid to German military forces.

An immediate Italian surrender was vital to the Allies before German countermoves became effective. On August 2, the Allies warned the Italian people that their breathing spell was over and that an Allied invasion of their mainland was imminent. On August 14, Marshal Badoglio declared Rome an open city. On August 15, an Italian envoy, General Castellano, armed with credentials issued by Badoglio, visited the British ambassador to Spain, Sir Samuel Hoare. He proposed that Italy should join the Allies as soon as they landed. The British ambassador, after obtaining instructions, suggested that the envoy proceed to Lisbon to meet American and British staff officers. The envoy learned in Lisbon that unconditional surrender would be asked and directions for actions following surrender were already prepared. Before leaving, he was further informed that civil and administrative terms would be presented later. The envoy left for consultation with Badoglio and returned to Lisbon on August 31, accompanied by the highest ranking Allied prisoner of war, British Gen. Adrian Carton de Wiart, as a token of Italian goodwill. The Badoglio government was prepared to accept Allied terms and instructions but failed to see how they could be carried out with German forces gathering around Rome and other key places in Italy. It was agreed that the armistice should be announced at the moment when conditions were most favorable for the Italians to extricate themselves from the German grip.

On Sept. 3, 1943, armistice terms were signed in Syracuse, Sicily. The Soviet government, fully informed about the negotiations, authorized Gen. Eisenhower to sign on its behalf. Part of the terms were made public on September 12. Publicized terms stipulated: immediate cessation of hostilities; Italian denial to the Germans of facilities that might be used against the United Nations; immediate delivery of all Allied prisoners of war (about 70,000 British and 25,000 Greeks and Yugoslavs) and internees to the Allies; transfer of the Italian Fleet and aircraft to points designated by the Allied commander; requisition-

ing of all Italian merchant shipping; surrender of Corsica and all Italian territory; Allied use of all airfields and ports, with Italian armed forces guaranteeing their protection until the Allies took over; withdrawal of Italian armed forces from participation in the war; employment by the Italian government of its available armed forces to insure compliance with the armistice provisions; Italian acquiescence in an Allied Military Government to control such parts of Italian territory as the Allied commander might consider necessary; Italian acceptance of all measures of disarmament, demobilization, and demilitarization imposed by the Allied commander; compliance with other conditions of a political, economic, and financial nature to be transmitted later; and nonpublication of the armistice conditions without prior approval by the Allied commander. Among the unpublicized conditions was Italy's renunciation of its colonies. The question of its metropolitan borders was left open.

On September 8, the king of Italy, Crown Prince Umberto, Marshal Badoglio, and the members of his government fled from Rome to southern Italy. Two days later, the Germans formally took possession of the capital.

In a message to Hitler, on September 9, Marshal Badoglio stated: "Our defence has crumbled . . Italy has no power of resistance left . . The Italian government can no longer assume responsibility for continuing the war."

In a radio address, the German führer replied by denouncing Italian "treachery." The day the armistice was signed, according to Hitler, Badoglio assured the German chargé d' affaires in Rome that he would never betray Germany and that Italy had no thought of surrender. The king, Hitler asserted, had made similar commitments. Hitler added that measures for the protection of German interests, in view of events in Italy, were already taking their course according to plan, and that the decision of the Italian government to break the alliance would make Italy a real theater of war.

On September 10, Roosevelt and Churchill told Badoglio and the Italian people: "It has fallen to you to win back for Italy an honorable place in the civilization of Europe. Now is the time for every Italian to strike his blow. . . Strike hard and strike home." The following day, from behind Allied lines, the king and Badoglio appealed to the Italian people to defend themselves against German aggression.

On Oct. 13, 1943, Marshal Badoglio, in the name of King Victor Emanuel, declared war on the Reich. A joint statement issued by President Roosevelt, Prime Minister Churchill, and Marshal Stalin accepted the active cooperation of the Italian nation and armed forces as cobelligerents against the Reich. Cobelligerency did not substantially change the status of Italy or affect the military situation. The war-weary, poorly equipped Italians could not rise to a major military effort. Small Italian forces, however, joined the Allies and fought better against the Germans than they had previously fought at their side.

Soon after the armistice was proclaimed, the Germans built up their strength in Italy to 24 divisions (more than the Allies could muster in that theater) although only 10 of them were in southern Italy. Most of the Italian Air Force failed to land at fields designated by the Allies. The Italian fleet sailed to harbors named by Admiral Sir Andrew Cunningham and surrendered. Five battleships, 8 cruisers, 27 destroyers, and 19 submarines arrived safely. A German bomb attack sank the 35,000 ton battleship *Roma*. (The bomb used was a test missile, carried to the vicinity of the target by a dive bomber and then released to continue under radio control. One type of the later Japanese Kamikaze closely resembled the test bomb.) Most of the Italian merchant fleet in home waters was seized by the Germans. Only 80,000 tons of a total of 300,000 were added to Allied shipping.

On the mainland, Italian garrisons surrendered to small German forces, and vital ports and air fields fell into German hands. Italian air bases were of particular importance to the Allies. South German and German-controlled war plants in Czechoslovakia and Austria which previously had been safe from large scale bombing were within easy range from Italy. German installations in the Balkans, including the oil fields of Ploesti, could be raided from Italy without excessive losses, and air assistance could be given to the Russians. The Allies had to fight hard for Foggia, the only major base they gained in 1943.

Sardinia, not garrisoned by the Germans, came under complete Allied control on Sept. 20, 1943. French and American forces landed in Corsica on September 9. The island was garrisoned by 70,000 Italians and 10,000 Germans. After three weeks of fighting in which the Italians did not participate, but aided by a popular uprising, Corsica was in Allied hands.

On September 8, Field Marshal Sir Henry Maitland Wilson appealed to the Italian forces in the Balkans and the Aegean islands to resist German attempts at disarmament and to seize German positions. Twenty-five Italian divisions faced 22 German divisions, many of which were *Landwehr* (militia). Cooperation between Italians and guerillas appeared to guarantee control of strategically vital areas by anti-German forces until the Allies could take over.

There were substantial Allied forces available in the Middle East which were not involved in the opening stages of the Italian campaign. These included most of the British Ninth and Tenth armies, a strong Polish corps (which went to Italy later), and Greek and French troops. All Field Marshal Wilson needed to carry on amphibious operations was adequate shipping space which was not allotted. The Germans were thus enabled to seize control of the Aegean and the Balkans.

The Germans, outnumbering the Italians in Crete, disarmed their Axis partners after a flurry of shooting on July 31. The Aegean islands, on the way to Greece, were manned by Italians, except for Rhodes, an important strategic base and site of good airfields. Thirty thousand Italians faced 7,000 Germans there. On September 9, a "good-will mission" of three British officers wanted to land at Rhodes "to rally the Italians to our cause," but were turned away. The Italian garrison surrendered to the Germans.

A small British seaborne force occupied the island of Samos on September 9, Six days later, British parachutists seized Cos, and Leros was occupied on September 16. With Crete and Rhodes in German hands, and substantial Luftwaffe based on their air fields, Samos, Cos, and Leros had little, if any, stategic value. It was hard to supply them, and a defense against counterattacks was almost impossible. The Allies made no attempt to carry on against Rhodes and Crete.

Cos fell to a German airborne attack October 6. Six hundred British and 2,500 Italian soldiers were captured. Leros was lost November 12, with 3,000 prisoners, and Samos was evacuated without a fight on Nov. 23, 1943. The Germans shot captured Italian officers. In the Balkans, the Wehrmacht disarmed the bewildered Italians except for a few units who joined Mussolini's army.

German prestige in southeastern Europe, at a low ebb in the summer of 1943, rose again. Potential elements of resistance in Bulgaria were discouraged, and an increasing number of people in the Balkans, regardless of their political view, began to look upon Russia instead of the Western Allies as their future liberator.

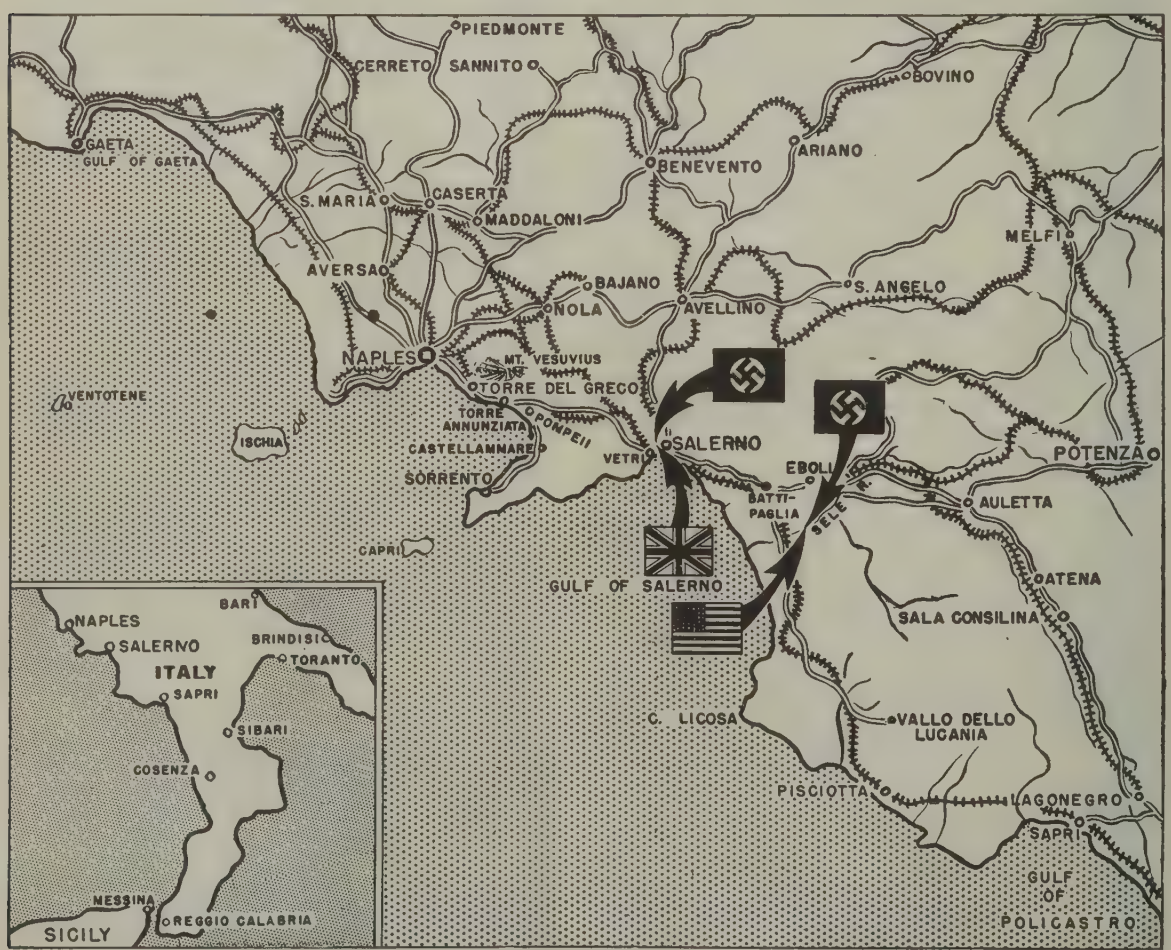
The Invasion of the Italian Mainland.—The Allied landings in Italy were designated as "Operation Avalanche." The British Eighth Army (Lt. Gen. Sir Bernard Montgomery) and the American Fifth Army (Lt. Gen. Mark Clark) formed the 15th Army Group, commanded by Field Marshall Sir Harold Alexander. The Fifth Army embarked from Bizerte on September 6. It included the United States 6th Corps (36th and 45th United States Divisions, American Rangers, and British Commando units) and the British 10th Corps (only one division strong). The 82d Airborne Division was held in reserve.

Four landings were scheduled for the week beginning Sept. 3, 1943. Strong forces from the British Eighth Army were to cross the Straits of Messina near Reggio di Calabria, while other parts of that army landed near Pizzo on the Gulf of San Eufemia, 50 miles from Reggio. The rest, supported by the 1st British Airborne Division, invaded the naval base of Taranto. The United States Fifth Army was to land at Salerno, south of Naples.

The United States Seventh Army's troops from Sicily were transferred to Britain to prepare for participation in the invasion of France. Its headquarters remained in the Mediterranean to mislead the Germans.

Sir Andrew Cunningham again commanded the naval phase of the three-dimensional operation. A task force including four battleships, under Vice Admiral Sir Algernon U. Willis, guarded the Tyrrhenian Sea. An amphibious air support group, including five aircraft carriers (Rear Admiral Sir Philip Vian), provided fighter cover for the United States Fifth Army. Land-based bombers also supported the drive.

The naval force covering the landing of the Fifth Army included more than 500 vessels of various types. This force, under the command of Vice Admiral Henry K. Hewitt, was split into a northern and southern attack force, under Rear Admiral Richard L. Connolly, and Rear Admiral John L. Hall, Jr., respectively. The northern attack force was to land the British 10th Corps on a ten-mile beach extending from the Sele River to within three miles southeast of Salerno, while the southern attack forces landed the United States 6th Corps on an eight-mile beach from the Sele southward to Agropoli. Fifth Army landings were scheduled for September 9.



Courtesy the New York *Times*

It was assumed that the Tenth Army under Field Marshal Gen. Kesselring had the Hermann Göring Division and 15th Motorized Division in the Naples area and the 16th and 26th Panzers, 29th Motorized, and 1st Paratroop Divisions south of that port. Actually, Kesselring not only had these troops but also the 65th and 305th Infantry Divisions and the 3d Panzer Grenadiers available for immediate action. Two German Alpine Chasseurs Divisions were also on the way to southern Italy. Italian opposition, even before the publication of the armistice, was rightly discounted.

On September 3, before dawn, the British crossed the Straits of Messina without encountering noteworthy opposition. By nightfall, strong forces were established at Reggio. The major part of these forces moved northward in the direction of Salerno; the rest proceeded along the coast of the Ionian Sea toward Taranto. Supported by sea and air operations, the landings at Pizzo and Taranto proceeded smoothly. Only German demolitions hampered the initial moves of the Eighth Army.

By September 9, the toe, foot, and heel of the Italian boot, including Taranto, had been secured and the advance was continuing. The right wing of the Eighth Army drove through Brindisi and Bari to capture Foggia on September 27. It ran into a heavy German counterattack designed to recover the Foggia air fields. The British had to use all their available strength to deal with the German drive until October 3, when a successful landing operation at Termoli in the German rear broke up the Wehrmacht's attack. The Germans, however, reinforced by one panzer division, prevented the British drive from gaining momentum.

On the morning of September 9, General Clark's Fifth Army landed on the assigned beaches, with the advantage of naval support and air superiority. The Luftwaffe flew an average of 100 sorties a day, against 750 for the Allies during the critical period of the fight. The Wehrmacht was superior in armor. The United States 2d Armored Division from Sicily had embarked for Britain, and curtailed shipping allotments deprived General Clark of heavy armor on the spot immediately after the infantry went ashore. Only on September 14, did the British 7th Armored Division unload on the beaches to assist the assault infantry.

German artillery on high ground beyond the beaches held the invaders under fire and could not be silenced by Allied naval shelling. Within four hours, the Americans reached Paestum and progressed toward Mt. Soprano. Wehrmacht batteries inflicted heavy casualties upon the attackers, and German panzers, split into small groups in order not to offer big targets to navy rifles, succeeded in crashing through American lines, breaking into the beachhead area, and raising havoc among the unloading parties. The British took Battipaglia but were unable to hold it. Rangers and commandos reached the passes leading into the Naples plain but could not keep contact with the main forces.

On September 10, the Allies entered Salerno. On September 12, the beachhead, 2 to 7 miles in depth, extended 25 miles from Salerno to Agropoli. After the loss of Salerno, the Germans used glider bombs against Allied positions and shipping, inflicting serious damage and casualties. The Germans gathered strength more rapidly than the Allies. Kesselring's forces rose to five divisions, including powerful armor.

On September 13, the Germans launched a heavy counter blow between the Sele and Calore rivers. The Allies were pressed back. By nightfall, it was doubtful if the beaches could be held. But the Wehrmacht discontinued its drive during the night, giving the hardpressed Fifth Army a breathing spell and an opportunity to gather additional reinforcements, including the United States 82d Airborne Division. Every available Allied airplane was thrown into action. In 4 days, 2,150 tons of bombs were dropped in support of the ground forces, while the navy shelled the Germans without respite.

The crisis was surmounted on September 15, when the Eighth Army's left wing reached the southern end of the beachhead. Kesselring's forces began to fall back, and the Allied advance was resumed on September 16. Patrols of the Fifth and Eighth Armies met 40 miles southeast of Salerno. An advance of 9 miles carried the Fifth Army inland from Agropoli, and an airfield, 12 miles from Salerno, was captured. Glider bombs ceased to fall and unloadings were speeded up. Eboli, in the center of the front, fell to the Allies on September 20. German rearguards held out against the Allied advance for five more days. During the first 18 days of the Salerno operation, navy crews and army services landed a total of 108,000 tons of supplies, 30,000 motor vehicles, and 189,000 troops.

Twenty-one days after landing at Salerno, the Allies entered Naples. The Germans had wrecked the port and its installations. Residential sectors, cultural monuments, and public utilities were ruined in an orgy of destruction by the Germans. Thousands of murders were added to acts of vandalism and arson. Allied salvage teams restored Naples harbor to normal capacity within four months.

Allied shipping space amounting to 300,000 tons was used exclusively to build up air power in southern Italy. The movement of bombers and fighters into Foggia was an enormous undertaking. Two heavy bombardment groups, two medium groups, and two fighter groups were established on 10 fields. The strengthening of the Fifteenth Strategic Air Force in Italy under General Doolittle considerably delayed the building up of the ground forces. By the end of 1943, 35,000 combat airmen were established with their supporting troops. Pipelines and pump stations were transferred from Africa to Italy. For a substantial period, on the ground the Wehrmacht remained stronger than the Allies. Only Kesselring's insistence on guarding the coast against the imaginary threat of Patton's army accounted for the fact that the Germans did not gain superiority in the front line.

The Fifth Army, after a 20-mile advance beyond Naples, reached the southern bank of the Volturno River in contact with the left wing of the Eighth Army. The center and right wing of the Eighth, operating on flatter ground than other Allied forces, had formidable barriers ahead in the Trigno, Sangro, and Moro rivers, swollen by constant heavy rains. On October 13, the battle for the crossings of the Volturno began. After 9 days of stubborn fighting, the Allies succeeded in securing high ground beyond Capua, north of the river.

The Germans prepared a "winter" line across the peninsula, following generally the courses of

the Liri and Sangro rivers. It was 75 miles from Rome at one point. Neither the "winter line" nor the Barbara, Bernhardt, Hitler, Gustaf, or Gothic lines was composed of continuous artificial fortifications. German propogandists used the term "line" freely to imply the existence of several "impregnable walls" across the Apennine Peninsula. Actually the German Tenth Army availed itself of numerous natural obstacles and skillfully improvised strongholds, protected by mine fields, wire entanglements, and log and earth emplacements, on key terrain features. Mortar and machine gun emplacements were frequently dug four or five feet deep into solid rock. Howitzers (240 mm) and 8-inch guns had to be rushed to Italy from the United States to deal with the German strongpoints. Up to November 23 and 25, respectively, British casualties on the Italian mainland totaled 16,074 and American 10,649.

On November 28, General Montgomery attempted a breakthrough along the Adriatic coast. The attackers could only inch forward despite heavy artillery and air support. The initial objective, Lanciano Ridge, was seized on December 1. It took 13 more days to cross the Moro River. Ortona, defended by German tanks, flame throwers, and infantry, was captured on December 29, in 7 days of costly house-to-house fighting. The attack bogged down five miles beyond Ortona.

Also in December, the Fifth Army arrived at the entrance of the "Cassino Corridor" south of Rome, where it was stopped by extremely strong German positions. The 2d Moroccan Infantry Division came to Italy in December, as the forerunner of the French Expeditionary Corps under Gen. Alphonse Juin, after the United States agreed to equip eight French infantry and armored divisions. Moroccan *Goumiers,* Indian Ghurka's, and New Zealand Maoris distinguished themselves in mountainous terrain.

On December 5, the Combined Chiefs of Staff delegated responsibility for all operations in the Mediterranean except for strategic bombing to Gen. Dwight D. Eisenhower. On December 24, Eisenhower was appointed supreme allied commander of the invasion forces from the west (meaning from the British Isles) and was ordered to England to take charge of final preparations for the invasion of France. General Montgomery, Air Chief Marshal Tedder, and General Bradley joined him there. Sir Henry Maitland Wilson was named supreme commander of Allied forces in the Mediterranean, with Lt. Gen. Jacob L. Devers as his deputy. Lt. Gen. Sir Oliver W. H. Leese assumed command of the Eighth Army. Lt. Gen. Carl Spaatz took charge of the United States Strategic Air Forces in Europe, General Doolittle of the 8th Air Force, and Lt. Gen. Ira C. Eaker of the Mediterranean Allied Air Force. Maj. Gen. Nathan T. Twining was given command of the Fifteenth Strategic Air Force.

Early in January 1944, preparations were under way to break the stalemate in Italy by another amphibious operation.

AIR AND SEA BATTLE FOR EUROPE

In 1943, Allied air power became as important a factor in the war as ground and naval forces. In contrast with German manpower allotments which gave the ground forces priority over the Luftwaffe, a substantial proportion of draftees in the United States and Great Britain were assigned directly to the air forces. Increasing production and improvements in aircraft design, in which the United States took the lead, permitted the Allies to develop an independent air strategy while simultaneously strengthening team work among all the services.

The Air War Over Europe.—The Germans were the first advocate of total war. Allied air strategy brought it closer to realization than ever before. What happened between 1943 and 1945 gave a relatively minor foretaste of what might happen in the event of future armed conflict between highly industrialized and scientifically progressive nations.

Allied air power aimed to disrupt Axis industries and communications and to undermine enemy manpower at its source, not only by inflicting civilian casualties but also by striking at morale through the destruction of housing and the nerve-wrecking strain of incessant night raids.

In reality, industrial bombing did not seriously affect the Reich's output of war materials. It did, however, force German planners to keep millions of men in war jobs who otherwise might have joined the depleted ranks of the Wehrmacht, and it impeded a further increase in German war production by diverting manpower to essential reconstruction. The disorganization of transportation offset the Reich's initial advantage of short lines of communication. Civilian casualties rose, and the German working potential was gradually reduced.

Both the Allied air forces and the Luftwaffe suffered substantial losses. Replacement capacity of airplanes and crews was far higher on the Allied side, because of United States production which rose to 9,000 planes in December 1943, and to manpower allotments. The Luftwaffe could no longer afford to husband its forces and rely upon ground defenses. German planes gave battle when Allied raiders approached in force. In 1943, long distance bombers had no fighter cover for the latter part of their trip, and the Germans were willing to sacrifice several fighter planes to shoot down a heavy bomber. Most Luftwaffe losses in 1943 were fighters. As the range of Allied fighters increased, the Germans were deprived of this advantage.

In 1943, the Allies dropped 152,448 tons of bombs on the Reich (72,467 during the last three months of the year) against 41,440 in 1942. The United States share in the bombings increased during the year, but even during the last three months it did not match that of the RAF (28,227 tons of bombs compared with 44,240 tons, and 36 day raids compared with 41 day and 56 night raids). Cooperation between the Allied air forces assigned the RAF chiefly to night saturation bombing and the United States Air Force to daylight precision bombing. By mid-1943, Gen. Ira Eaker's 8th Air Force numbered 2,000 planes, half of which were heavy bombers. In 1943, British plane losses over Germany were 672, United States losses 489.

Berlin, seat of the highly centralized German government, site of great war plants, and a vital communication hub, was hit by 3,000 tons of bombs on Aug. 23 and 31 at a loss of 105 planes. Between November 22 and 27, the city felt the impact of 5,000 tons of bombs, a number of which were blockbusters. In December 1943 and January 1944, raiders came over the capital almost nightly. On Feb. 9, 1944, 1,000 planes drop-

ped 2,300 tons of explosives and incendiaries on the capital.

The Ruhr suffered considerably. Essen, Düsseldorf, Mühlheim, Bochum, Wuppertal, Krefeld, and Duisburg—the latter a great inland port—were heavily hit. A specially trained RAF force smashed dams on rivers, releasing waters which inundated Dortmund and Wuppertal, and ranged as far as Kassel.

German research laboratories on the Baltic at Peenemünde were destroyed in an RAF attack in August 1943, which killed many scientists and impeded the development of new weapons.

On August 17, the United States Air Force raided German ball-bearing plants at Schweinfurt with 424 tons of explosives, and airplane industries at Regensburg, Bavaria, with 298 tons. The Luftwaffe put up a strong defense, destroying 60 out of 350 United States Flying Fortresses.

During six days, beginning June 24, Hamburg was hit by 8,000 tons of explosives and incendiaries which devastated about three fourths of the built-up area. Cologne, industrial city and Rhine port, suffered additional damage on June 29, July 4, and July 9.

On Aug. 1, 1943, a United States force of 178 B-24 heavy bombers from North Africa raided Ploesti in Rumania, site of fields from which the Axis obtained three million tons of oil a year, with a loss of 54 bombers. Great fires were started, and the Wehrmacht lost urgently needed fuel for its mechanized forces and the Luftwaffe.

A shuttle service was introduced in 1943, and planes from Britain, after bombing targets in southern Germany and northern Italy, continued to North Africa or to Foggia, to refuel, take on new bomb loads, and carry out another mission on the return trip to Britain. Another shuttle service between Britain and the USSR did not reach noteworthy dimensions. By July 1, 1943, two thirds of the Luftwaffe was engaged against the Western Allies.

The U.S. Air Force.—In May, 1943, United States Air Force mobilization was fixed at 273 combat groups as follows: 5 very heavy bombardment (B-29 Superfortresses), 96 heavy bombardment (Flying Fortresses and Liberators), 26 medium bombardment, 8 light bombardment, 87 fighter, 27 troop carrier, and 24 reconnaissance groups.

According to General Marshall's report, experience taught that casualties suffered in air missions had to be replaced the same day, as vacant chairs at the mess hall had a depressing effect on the survivors of heavy fighting. It was also found necessary to provide three combat crews per operating plane and to return the men to the United States after 25 missions in areas of strong opposition and after 50 missions in less strenuous theaters. Most of the best qualified inductees were allotted to the air force, and a top strength of 2,380,000 was authorized.

The U.S. Ground Forces.—Early in 1942, the United States Army established a troop basis of 3,600,000 men to permit the organization of 59 infantry (including 18 National Guard), 10 armored, and 2 cavalry divisions. No larger force could be envisaged at that time. Yet, by the end of that year, the total strength of the United States Army had increased to 5,397,674 men, thanks to greater numbers of trained officers and noncommissioned officers and more equipment available. Even this figure was considered insufficient when plans for future invasions of Europe were drafted. For 1943, a peak army mobilization of 8,248,000 officers and men was planned. The turning of the tide in the eastern theater of war in early 1943 led to a slight reduction of the estimate to 7,700,000 in an army of 90 divisions, including 3 "light" divisions for jungle and mountain warfare. This figure included the air force. The number of combat troops was further reduced by necessary allotments to service forces. Tremendous distances between the American homeland and the theaters of war required 2,174,000 men to secure communication lines and to build and man service installations.

The ceiling on American men physically fit for active service was between 15 and 16 million, of which 14 million were actually mobilized; in this respect the United States ranked third behind the USSR and Germany. The United States ranked only fifth among the belligerents in the number of combat divisions organized, after the USSR, Germany, Japan, and China (Chinese divisions were under normal strength by international standards). The United States Women's Army Corps (WAC), numbering approximately 100,000 at the end of the war, including 6,000 officers, helped to release men for combat duty and contributed substantially to relieve the shortage of hospital personnel. Approximately 17,000 WAC's were on duty in active theaters when the war ended.

Original calculations based upon North African experiences overestimated future losses in the armored services and underestimated infantry losses. This led temporarily to a rather critical shortage of adequately trained infantrymen in 1944, which was overcome in time to secure victory in both main theaters of war.

Conditions in Britain were analogous to those in the United States. Great Britain and the Dominions had to allot a considerable proportion of available manpower to the navy and the air force. Despite the mobilization of 12,000,000 men (fourth, after the United States), Britain ranked seventh in the number of divisions (after Italy as well as the other nations mentioned).

War in the Atlantic—1943.—Early in 1943, the German High Command began to consider the possibility of an Allied invasion of Europe. To prevent such an invasion, it was estimated that the German Navy, assisted by the Luftwaffe, must sink at least an average of one million tons of Allied shipping a month. This estimate discounted American ability to build 16 million tons of shipping space a year as planned and placed the figure at 11 million tons instead. (In reality, United States ship construction reached 19 million tons a year.) Grand Admiral Erich Raeder, commander of the German Navy since 1928, declined to guarantee such a volume of sinkings. However, Admiral Karl Doenitz—in charge of submarine operations—insisted that it could be done. On Feb. 1, 1943, Raeder was discharged and Doenitz, promoted to the rank of Grand Admiral, was put in command of the German Navy (*Wehrmacht Marine*).

In March, Doenitz called the U-boats out in strength. The wolf pack system was continued. The Germans claimed Allied shipping losses of 851,000 tons during the first month of the offensive. The Allies made no counter claims, but the Germans had to admit the sinkings had declined to 107,000 tons by June. Allied sources stated that the tonnage of new ships built in the first

half of 1943 (before United States ship construction had reached its peak) exceeded losses by three million tons, and that the Germans, in a three-month offensive, had lost an average of one U-boat a day.

A new type of escort carrier had been added to the protection of convoys, providing constant air cover. Air attacks on submarines increased. Sloops and destroyers, freed from escort duty by the new small carriers, were organized in "killer groups" and hunted down the wolf packs with the aid of aircraft. German U-boat pens in the Bay of Biscay were watched, and submarines leaving or returning to port were intercepted. Radar facilitated the detection of lurking raiders.

After the failure of his first campaign, Doenitz withdrew most of his submarines to be equipped with new devices. Improved torpedoes of a magnetic type were introduced. So was an ingenious invention designed to fool the Allies. The appearance of air bubbles, oil slicks, and debris on the surface was considered evidence of the sinking of a submarine. The Germans equipped their U-boats with an apparatus to discharge such "evidence" through torpedo tubes. When Allied ships —believing the raider sunk—continued their course, they were attacked by magnetic torpedoes. German submarines were also equipped with heavier caliber guns and AA cannon and their armor was reinforced. Wolf pack tactics were not abandoned, but were supplemented by attacks by single raiders.

The submarine offensive was resumed late in September 1943. For three weeks ending September 19, not a single Allied ship had been lost in the Atlantic. Then sinkings began to rise. A convoy from the United Kingdom to the United States lost 5 merchantmen and 3 escort vessels to 15 attacking U-boats. Another new German weapon turned up, resembling a type used on the beaches of Salerno. Long-range German planes carried glider bombs. These winged missiles, speeded up by rockets, were guided to Allied ships by radio waves. Tight air umbrellas dealt with that weapon.

On October 12, it was simultaneously announced in London and Lisbon that Portugal had granted Great Britain the use of facilities in the Azores in exchange for material and supplies for Portugal's armed forces and for the maintenance of Portugal's national economy. Use of these facilities did not prejudice Portuguese sovereignty, and all British forces were to withdraw at the end of hostilities. The Azores were ideally located for the protection of shipping lanes from the United States to the Mediterranean and West Africa. They were 1,285 miles from Gibraltar, 1,470 from St. John's, Newfoundland, and 1,785 from Dakar.

Two weeks after the announcement, British anti-submarine patrol planes went into action from the newly acquired bases. The German reaction was confined to angry protests against Portugal's breach of neutrality. The Reich continued to maintain a spy organization in Portugal and to import tungsten from there.

In November 1943, Allied shipping losses in the Atlantic had dropped again. Hitler, in his New Year message of 1944, admitted a "slackening in the U-boat war," which he attributed to an Allied device that German technique would soon neutralize. This device, which German technique never neutralized, was a magnetic airborne detector, mounted on planes and dirigibles, which located submarines beyond the range of radar.

Other elements of success in the anti-submarine war were the strengthening of Russian air defenses at Murmansk and increasing protection given to Allied convoys by Murmask-based Russian fighters. Grand Admiral Doenitz called upon German capital ships in Norway to raid the Murmansk route—protected by the British and Canadian navies—in the early fall of 1943.

The battleship *Tirpitz* prepared to sail from its berth in the Altenfjord, 200 miles inside the Arctic Circle. The narrow and heavily defended channels which led to the vessel's mooring seemed to make any approach by hostile craft impossible. But on Sept. 22, before the *Tirpitz* could get out, British midget submarines, traveling 1,000 miles, penetrated the channels and scored torpedo hits. None of the submarines returned to its base, but air reconnaissance showed the *Tirpitz* surrounded by a thick oil slick extending two miles from its berth. No docks capable of accommodating a vessel of its size were available close to the Altenfjord, and the damage prevented long distance towing. The last big German battleship was out of action.

Another powerful surface raider, the 26,000 ton battle cruiser *Scharnhorst,* mounting nine 11-inch (280 mm.) rifles, attacked a Murmansk-bound convoy protected by 3 British light cruisers on December 26. A British battleship, the *Duke of York,* escorted by four destroyers, was nearby, but the *Scharnhorst* turned away to the southwest before it came within range. After a sharp chase, the *Duke of York* caught and sank the battle cruiser 60 miles from the North Cape. The German ship's gunners fired 1,000 rounds of heavy shells, but scored only two hits.

Blockade runners augmented the Reich's short supplies of vital raw materials. A number of them were intercepted between Iceland and the Bay of Biscay. Four large cargo vessels and one tanker were caught in the second half of 1943. Their cargoes included 30,000 tons of rubber, 5,000 tons of tin, 25,000 tons of edible oils, and smaller quantities of tungsten and quinine from Japanese-controlled territory.

CHINA'S WAR

Allied reverses in Burma, resulting in the severance of the Burma Road, placed China in a desperate situation. No early counter-offensive was feasible. Chiang Kai-shek's appeals to the British government to grant genuine self-government to India and his conferences with Pundit Nehru and Mohandas Gandhi failed to increase India's war effort appreciably. Although the European war had top priority in Allied land operations, the United States and British High Commands realized the vital importance of keeping the Chinese in the war. The possibility could not be discounted that if the Japanese should gain control of the vast spaces and natural resources of China, they might continue the war on the Asiatic mainland long after their home islands were invaded.

On July 15, 1942, the Chungking government reported that 6,000,000 more men had been drafted, bringing the total to 26,000,000. On October 23, Gen. Ho Ying Ching announced that, since the opening of hostilities in 1937, 11,129,572 men had been conscripted for military service. Even the latter claim possibly was far in excess of the actual figure.

China desperately needed supplies. The only

remaining supply line in 1942 was the air route over the 500 miles of the Himalayan Hump between Assam Province in India and Yunnan Province in China. Hump flyers could not carry such heavy equipment as trucks, rolling stock, tanks, and artillery of which the Chinese were particularly short. They did deliver gasoline, bombs, and ammunition to General Chennault's Fourteenth Air Force, assisting Chinese ground forces. The load carried over the Hump rose from small beginnings to 46,000 tons a month in 1945.

In 1942, American engineers, using Chinese labor, undertook to build a new road from India to China, leading from Ledo in India to the old Burma Road at Mongyu. It was finished in the spring of 1944. A pipeline from the Indian port of Calcutta to Ledo and parallel to the road from Ledo was also under construction. The goal of the combined air and land routes and the pipeline, as established at the first Quebec Conference, was 85,000 tons of general stores and 54,000 tons of petroleum products.

On May 5, 1942, the Japanese, advancing along the captured western section of the Burma Road, penetrated into Yunnan Province, but soon came to a halt 20 miles east of Wanting. The Japanese High Command believed that Doolittle's raiders had taken off in China and decided to eliminate General Chennault's air bases. On May 19, four Japanese columns from Hangchow advanced on Chuhsien air field, which was captured on June 7. Three days later, the city of Chuhsien and its railroad station fell to the Japanese. This continued advance ran into stiffening Chinese resistance and was halted on July 10. Supported by United States air power from remaining bases, the Chinese regained Chuhsien on August 29. This setback was especially annoying to the Japanese because, with Chuhsien in their hands, they could hope to gain control of the Chekiang-Kiangsi railroad, the missing link in land communications between Korea and Singapore. The growth of United States sea power and heavy shipping losses forced the Japanese to rely more and more on land transportation. The bombardment of Hangkow, Canton, and Hongkong by the United States Fourteenth Air Force added to their transportation troubles. In March 1943, the Japanese lost their hold in Yunnan Province.

The Japanese next attempted to conquer China by starvation. A considerable proportion of Chinese rice supplies came from Hunan and Hupeh provinces, where the "rice bowl" around Lake Tungting produced an average annual surplus of 650,000 tons of this basic food. In February 1943, a Japanese force of 100,000 moved south of the Yangtze River in the direction of Lake Tungting. Infiltrating the fertile region, they burned granaries and destroyed crops. Not before May 23, when the damage was already serious, were the Chinese, aided by United States air support, able to prevent further Japanese advances. The invaders were defeated in a battle lasting one week, in which the Japanese lost 31 planes to American action. Before the autumn crop was secure, another Japanese raid, carried out by 80,000 men, hit the "rice bowl." Chinese counter-action culminated in the battle for Changteh, Dec. 3-9, 1943. The city was finally won by the Chinese. Only 30 of its 10,000 buildings remained standing. Additional quantities of rice were destroyed. Although the Chinese did not literally starve, few people in the world could have endured the privations they suffered.

In May 1943, the "Trident Conference" in Washington, D. C., decided that a campaign should be launched to recover Burma in the fall of that year, after the end of the monsoon season. In August, the Allied "Quadrant Conference" created the Southeast Asia Command under Admiral Lord Louis Mountbatten. Lt. Gen. Joseph Stilwell became Mountbatten's deputy. The RAF and the United States Tenth Air Force on the Burma front were formed into the Eastern Air Command under Maj. Gen. George E. Stratemeyer. Allied operations faced considerable difficulties. The railroad from Calcutta to Assam, main supply route of the attacking forces, changed from broad to narrow gauge en route and crossed the Brahmaputra River by ferry. The jungles along the Burma-India frontier were hotbeds of disease. An amphibious attack on southern Burma might have facilitated the Allied offensive, but no shipping space was available for that purpose.

During the Cairo conferences of 1943, it was emphasized that there should be an Allied attack across the India-Burma frontier to reopen the Burma Road. To assist the impending drive from the east, the Chinese 22d and 38th Divisions moved into the Hukawng Valley. In February 1944, they were joined by a specially trained United States infantry combat team, the *Galahad* force under Brig. Gen. Frank D. Merrill.

The Japanese, aware of Allied preparations, opened an offensive during the fall and winter of 1943–1944 to capture Assam Province and to sever the Ledo Road, the Hump air line, and the Assam-Bengal railroad. Japanese forces in Burma, attacking across the Salween River in the Lung Ling area, were repulsed by the Chinese before they could reach the Ledo Road. Another Japanese drive, however, aimed at the supply base at Imphal, India, and the Assam-Bengal railroad, caught the British Fourteenth Army in the process of final organization for its drive, lagging behind the "Trident" schedule and with its advanced lines incompletely manned. In April 1944, Imphal was isolated (the Japanese wrongly claimed the capture of the city) and the railroad was threatened at Dimapur. Airborne British and Indian reinforcements repulsed the Japanese at Dimapur and reestablished contact with Indian troops at Imphal, while another British drive along the Bay of Bengal pressed the Japanese back in Arakan. Another sharp reverse at Kohima added to Japanese losses in the short-lived invasion of India.

Chinese and American forces, advancing through the Hukawng Valley in May 1944, invested Myitkyina in northern Burma. The Japanese tried in vain to reinforce their troops in this sector after the 18th Division of Singapore fame was annihilated. British and Indian long range penetration groups, commanded by Maj. Gen. Orde C. Wingate, blocked the Irrawaddy River Valley, through which Japanese reserves had to pass. Part of these jungle troops marched from India; others were carried to the theater of operations in gliders.

STRATEGY IN THE PACIFIC

Japanese offensive strategy in the Pacific was designed to gain permanent control of that ocean by establishing bases on its key islands. The Japanese even seized many secondary islands but

were never able to achieve their major objective of closing most of the Pacific to the United States Fleet. The Japanese conquests could only be held and extended by maintaining naval and air superiority. In 1943, this superiority passed completely to the Allies because of United States ship and aircraft construction which was little short of miraculous by prewar standards. Thus the foundations of Japanese offensive strategy collapsed.

A Japanese switch to an effective defensive strategy required large scale redeployments, absorbing a huge amount of shipping space. As Japanese shipping was cut down and vital lanes came under Allied attack, garrisons in outlying bases were isolated, and their planes were grounded by lack of fuel. Meanwhile, new positions closer to the home islands needed men and equipment.

According to Undersecretary of the Navy James Forrestal, 1,600,000 tons of naval vessels were built in the United States in 1943. This doubled the size of the fleet, which by the end of 1942 already far exceeded its own pre-Pearl Harbor strength plus that of the other great powers. New ships included six 27,000 ton *Essex* class and six converted 10,000 ton cruiser aircraft carriers, in addition to 50 smaller carriers. The United States Navy also received 13,617 new combat planes in 1943. By the end of the year, naval personnel numbered 2,294,000, in addition to 399,700 marines, and 171,500 in the coast guard. United States overseas transportation increased rapidly. From June 1942 to June 1943, 16,000,000 tons of cargo and 780,000 men were sent to the Pacific theater of war, plus 24,000,000 tons of cargo and 1,820,000 men to the European theater.

The Japanese Navy in 1943 was reduced to 79 per cent of its 1941 tonnage, and shipbuilding could not keep pace with losses. The Japanese merchant marine (6,369,000 tons in 1941) had already lost 2,500,000 tons, mostly to United States submarines.

Eighty per cent of American naval strength was deployed in the Pacific, but Admiral King's hopes that the United States fleet would meet and decisively defeat the Japanese Navy did not materialize in 1943. The Imperial Navy shunned major engagements. The Japanese still expected the Allies to attack every Japanese-held island and to fight until the defenders were annihilated, suffering tremendous casualties in slow "island hopping." This would have been a characteristic textbook strategy before the weapons of World War II were developed. But Allied planners realized that island garrisons without naval and air support were no threat to amphibious advances beyond their striking distance. They decided, therefore, to concentrate on carefully selected breakthrough areas, aimed toward the Japanese home islands, the Philippines, and China, and to by-pass islands that could not interfere with their progress.

At the Quadrant Conference, General Arnold called for the establishment of bases in China, in the Marianas, and in other Pacific islands, to enable B-29 Superfortresses to carry total war to Japan. His plan which was disappointingly hard to execute in China succeeded brilliantly in the Pacific. It reduced Japan's war potential and tied a large proportion of available Japanese fighter planes to their home bases.

Three lines of advance were decided upon by the Joint Chiefs of Staff at the turn of the year 1943. Two of them were aimed at the Philippines and the Asiatic mainland beyond; the third pointed across the Central Pacific toward Japan proper. The Philippine drives, under the strategic command of MacArthur, led along the coast of New Guinea and through the Solomons. They were scheduled to reach their goal in the fall of 1944. Lt. Gen. Walter Krueger was the field commander in New Guinea, while Admiral William F. Halsey took charge of the Solomons operations. The Seventh Fleet was under General MacArthur's command. On July 1, 1943, MacArthur had at his disposal four American and six Australian and New Zealand divisions, plus small forces of United States Marines. Admiral Chester Nimitz, in charge of the Central Pacific offensive, commanded nine United States Army and Marine divisions. Reinforcements kept arriving. The air force included 150 heavy bombers and numerous naval aircraft.

The success of the revolutionary strategy was described in a report made by General MacArthur late in 1944: "The enemy garrisons which have been by-passed in the Solomons and in New Guinea represent no menace to current and future operations. . . . Their capacity for organized offensive effort has disappeared. The various processes of attrition will eventually account for their final disposition . . ."

The Continued Fight for the Solomons.—Between March and May 1943, heavy air raids against Rabaul, Wewak, and Munda gave evidence of growing Allied might. Japanese reserves massed at Truk in the Carolines (about 200,000 men and a large number of aircraft) were unable to help their compatriots in the southern islands. Their mobility was sharply restricted by Japanese naval deficiencies.

The Japanese-held island of New Georgia in the Solomons, 40 miles long and up to 20 miles wide, could not be by-passed. Its Munda airfield became a main target for Allied air attacks prior to invasion. Admiral Halsey's naval forces were engaged in protecting Maj. Gen. Oscar W. Griswold's 14th Corps, New Zealanders, and United States Marines assigned to land in New Georgia.

A group of United States Marines landed near Viru Harbor, 35 miles from Munda, on June 23, 1943. By July 5, the marines had seized the anchorage. On June 30, United States Army forces effected a surprise landing on Rendova Island, less than six miles from Munda. The small Japanese garrison offered only minor resistance for 48 hours. United States 155-mm. guns shelled Munda airfield from Rendova. On July 5, elements of the United States 37th and 43d divisions landed 12 miles north and 6 miles south of Munda, opening a twin drive toward the base. There were 10,000 Japanese on New Georgia, mostly concentrated near Munda. Almost 200 Japanese planes battled the invaders. On the first day, the Japanese lost 123 aircraft to the Americans 14.

The Japanese Navy, a mere shadow of what it had been in the battle for Guadalcanal, made attempts to duplicate its previous Solomons strategy by landing reinforcements and supplies on the invaded island. Strong United States naval forces, with effective air support, intercepted enemy cruisers and destroyers in Kula Gulf between New Georgia and the adjoining island of Kolombangara. Five Japanese vessels were blown

up by the first blast of American heavy guns. During the subsequent pursuit, the Japanese lost four more ships in as many hours. The United States task force lost the light cruiser *Helena* in the engagement of July 6, 1943. Light Japanese forces returned one week later, and four more Japanese ships were sunk. No reinforcements or supplies reached the defenders. The last naval action near Munda took place on August 3 and resulted in the loss of three more Japanese craft.

On land, the defenders offered stubborn resistance. The approaches to the airfield were honeycombed with small pillboxes, offering indistinct targets to aerial bombs and artillery shells. On July 12, the invaders were halted two miles from the airfield. Tanks failed to clear the way. Flame throwers were more effective, but it was extremely difficult to bring them into range against Japanese fire. During the following week, air attacks destroyed the remaining Japanese planes and saturated the defenders' positions with bombs. The land attack was resumed on July 25, after 200 bombers raided Munda with 186 tons of bombs and troops of the United States 25th Division joined the invaders. On August 5, Japanese resistance ceased. The defenders of Munda were wiped out.

Bairoko Harbor was occupied on August 25. Part of the Japanese garrison escaped to Kolombangara. Vila airfield on Kolombangara came within United States artillery range on August 27, when American forces invaded Arundel Island, and was abandoned by the Japanese six weeks later. By-passing Kolombangara, General Griswold's forces occupied Vella Lavella Island, northwest of Kolombangara, on October 9. Five weeks earlier (September 5), the Japanese had given up their seaplane base at Rekata Bay on Santa Isabel Island. A Japanese attempt to mass relief air forces on Wewak was wrecked by American raids on August 17 and 18, which destroyed all but 10 of the 225 planes assembled there.

Rabaul, on New Britain, was still a major Japanese air and naval base. A raid on October 12 knocked out 177 Japanese planes, most of them on the ground. Three destroyers, three large merchant ships, and 43 smaller merchant ships were destroyed in the harbor. Between Rabaul and Bougainville, two Japanese destroyers and eight cargo ships were sunk by American aircraft on November 2. On the same day one heavy cruiser and nine smaller naval vessels were added to Japanese losses near Rabaul. On November 12, one Japanese cruiser and two destroyers went down, and twelve vessels of various types suffered damage. Four Japanese destroyers, heading for Rabaul, were sunk on Nov. 25, 1943.

New Zealanders landed in the Treasury Islands on Oct. 26, 1943. Two days later, New Zealand parachutists invaded Choiseul.

A major operation began on Nov. 1, 1943, directed against Bougainville, an outer island of 3,880 square miles in the Solomons. The Japanese garrison numbered 25,000. Initial landings at Empress Augusta Bay, on the island's west coast, were carried out by the 3d Marine Division of Lt. Gen. Vandegrift's First Marine Amphibious Corps. It was decided not to wage a battle of annihilation against the garrison, but to drive it back into the interior and leave it to perish by starvation and disease.

After heavy air and naval preparation, the marines met little opposition on the beaches. Advancing beyond the landing grounds, however, they encountered violent counterattacks. Light Japanese naval forces attempted to intercept the mighty American task force and to land reinforcements. The few seaborne Japanese who reached shore were quickly wiped out by the marines. The Imperial Navy lost one cruiser and four destroyers. The bridgehead was extended on November 11, when United States Army forces of the 37th Division, equipped with armor, joined the marines. In almost four weeks of intensive fighting, a firm hold on an area seven miles wide and five miles deep was established. On December 15, General Griswold took charge of operations. A fighter strip was completed on that day, and a bomber field was placed in operation ten days later. The disorganized defenders confined their activity to patrol raids. A naval base and three airfields were rapidly established within fighter range of Rabaul, 235 miles away. From Bougainville, Maj. Gen. Nathan F. Twining's 13th United States Air Force neutralized what remained of Japanese installations in the Solomons.

On March 10, 1944, the Japanese launched a desperate drive to dislodge the United States forces. It continued until April 1. When the unsuccessful assault subsided, 7,000 Japanese dead were counted. Patrols kept stabbing at the American lines during April, but there was no organized resistance on Bougainville thereafter.

Naval Forces in the Pacific.—The South Pacific command had to be reorganized because of the growth of United States forces and the needs of their deployment. The Seventh Fleet remained at MacArthur's disposal. Admiral Halsey took command of the United States Third Fleet in the Central Pacific, and the Fifth Fleet was assigned to Admiral Spruance. Both Halsey and Spruance were subordinate to Admiral Nimitz. A special unit originally attached to Spruance's fleet, Task Force 58, was created at the end of 1943 under Admiral Marc Mitscher.

The Attack on New Britain.—The Japanese hold on New Britain and New Ireland impeded the successful completion of MacArthur's campaign in New Guinea. MacArthur's air forces raided secondary air bases at Arawe, Gasmata, and Cape Gloucester (New Britain) late in November and early in December 1943. On Dec. 15, 1943, after air and naval preparation, a reinforced United States cavalry regiment landed close to the village of Arawe, on the western end of New Britain, where it could partly control Vitiaz and Dampier straits. The beaches were secure after two days of fighting. On December 26, another invasion hit New Britain, west of Cape Gloucester and east of that cape at Borgen Bay. Two weeks of aerial bombing and one week of naval shelling preceded these landings by the First Marine Division. Cape Gloucester airfield was captured after four days of frustrated Japanese counter attacks. The third invasion of New Britain was carried out at Talasea, 170 miles from Rabaul. Once formidable, Rabaul had become useless to the Japanese, who vainly attempted to divert shipping and air movements to nearby New Ireland. Crushing air and sea superiority enabled the Americans to turn at will against the new target. Kavieng on New Ireland suffered relentless bombardment, and naval shelling completed its destruction on Feb. 18, 1944.

On March 20, Emirau Island, 75 miles northwest of Kavieng, was seized by United States forces, and this island held the key to control of the Bismarck Archipelago. Almost 100,000 Japanese troops on New Britain and New Ireland were finally isolated and bypassed.

The Reconquest of New Guinea.—After the success of the Allied Buna campaign, the Japanese still held the long northern coast of New Guinea, thereby blocking one avenue of Allied approach to the Philippines.

Early in 1943, the Japanese made attempts to land reinforcements, the most determined of which led to the Battle of the Bismarck Sea. On March 1, 1943, Allied planes observed a Japanese convoy north of New Ireland, proceeding in the direction of Lae in New Guinea. It was joined the next day by additional vessels, bringing the total to 12 merchant ships escorted by 10 cruisers and destroyers. From March 2 to 4, Allied air forces kept the convoy under constant attack. Japanese land-based planes, attempting to intercept Allied squadrons, lost 63 craft (to 4 of the Allies) without preventing the convoy's systematic destruction. The last Japanese vessel went down on March 4. Ninety thousand tons of Japanese shipping were lost, and approximately 15,000 soldiers on board were drowned.

The unopposed invasion of Woodlark and Kiriwina islands off the eastern tip of New Guinea, on June 22 and 23, respectively, prepared the New Guinea offensive. Regimental combat teams quickly seized both islands and established air strips.

The attack on Salamaua began on June 30. After ten days of bitter fighting, two attacking groups joined and outflanked Mubo, which fell on July 15. It took the Americans and Australians the rest of the month to reach Salamaua's air strip, five miles from the settlement. A counterattack led to some loss of ground, but an Allied invasion near Lae forced the Japanese at Salamaua to discontinue the attack and to abandon the place on September 11.

The Japanese garrison at Lae was reinforced by the defenders of Salamaua. After heavy naval and aerial preparation, an Australian force had invaded the shore a few miles above Lae on September 4. Squeezed between sea and airborne Allied forces, Lae fell on September 16, and the Allies moved on to seize Huon Peninsula and Finschafen.

On September 18, Allied forces (mostly Australian) landed 60 miles northwest of Lae. Four days later, other Australian forces went ashore six miles from Finschafen, which was occupied on October 2. The defenders fell back to high ground at Sattelberg. A Japanese thrust from Sattelberg through the Sang River Valley temporarily opened a corridor to the coast, through which reinforcements were expected, but no reinforcements arrived. Allied control of the coastal waters was too tight. By the end of October, the Australians closed the corridor and isolated Sattelberg. On November 17, after air preparations, the assault on Sattelberg began. After nine days of severe fighting, the Australians advanced beyond the take-off positions, while a drive from Finschafen took Wareo, 12 miles away. The conquest of Huon Peninsula was not completed until early February 1944. The air force had a considerable share in the final success, which gave the Allies full control of Dampier and Vitiaz straits.

On Jan. 2, 1944, a regimental combat team of the United States 32d Division by-passed Huon Peninsula and landed 10 miles beyond crumbling Japanese positions near Saidor, where an air strip was put into operation on January 7. From Saidor, the Americans drove toward a junction with the Australians fighting their way through and beyond Huon Peninsula. The Japanese defenders of Huon, still about 14,000 strong, were caught between the Americans and the Australians. On February 10, they were attacked from both sides and virtually annihilated.

The Japanese hold on the Admiralty Islands west of the Bismarck Archipelago impeded further Allied advances along the New Guinea coast. Air fields and harbors in the archipelago were needed for General MacArthur's offensive. The invasion was originally scheduled for April 1944, but as progress in New Guinea exceeded expectations and shipping space allotments were satisfactory, operations started on February 29. Advanced elements of the United States 1st Cavalry Division, supported by units of the Seventh Fleet (tactical commander Vice Admiral Thomas C. Kinkaid), landed at Los Negros Island and captured Momote airdrome. Fanatical counterattacks were broken up. The fight for the Admiralty Islands, in which the entire 1st Cavalry Division became engaged, continued for six weeks. By that time, Los Negros, Manus, and smaller adjacent islands were under American control.

Australian airborne forces from Markham Valley worked their way painfully across the Finisterre range toward Madang. They were supported by an American landing 50 miles from Saidor on March 7. The combined Allied forces took Madang on April 25. Even where Japanese resistance was relatively weak, the terrain and climate imposed great hardships upon the attackers.

On April 22, a major amphibious operation struck Hollandia and Aitape, 400 miles west of Madang. Powerful units of the United States Third Fleet (Admiral Halsey) and carrier-based naval aircraft assisted the landings. Troops from the United States 24th, 32d, and 41st divisions went ashore on three beaches, two of them near Hollandia and one near Aitape. They formed part of the 1st Corps (Lt. Gen. Robert L. Eichelberger). Fifteen thousand Japanese were thought to be in that sector, but no more than 5,000 were actually found. After offering weak resistance, they retreated along the coast toward Wewak. The Japanese lost 1,054 men compared to 125 American casualties. The Americans were operating three Japanese air fields at Hollandia and the naval base of Humboldt Bay by April 27. Landings at Aitape were even less firmly opposed, and American fighter planes were soon using its air strip.

At Wewak, half way between Hollandia and Madang, Japaneses troops were caught between Allied forces moving toward a junction and were subjected to heavy air attacks. On July 11, the trapped forces attacked American spearheads in an effort to break out. After small penetrations, the drive was repulsed and the remnants of the Japanese were isolated.

Elements of the United States 41st Division landed unopposed at Arara, 110 miles west of Hollandia, on May 17, 1944. The drive continued in two prongs. One of them—amphibious—took Wadke Island on May 18; the other, moving

along the coast, captured Maffin air strip on May 24. Sharp fighting took place on May 27, when the bulk of the 41st Division invaded Biak Island, off Geelvink Bay, 330 miles farther to the west. When the Americans moved beyond the beaches, 8,000 excellently equipped Japanese struck a furious counter-blow and overran advanced American units. Seaborne reinforcements halted the attack. Organized Japanese resistance subsided on June 22, when the island's three airfields were put into operation by the Americans. Occasional stabs by small Japanese units were discontinued late in July.

In an operation winding up the New Guinea campaign, elements of the United States 6th Division landed at Sansopor on Vogelkop Peninsula, at the western end of New Guinea. The 18,000 Japanese troops on the peninsula were caught off balance, and resistance was negligible. Further air and naval bases were secured. The few remaining Japanese footholds in New Guinea, such as Manokwari and Sarong, were isolated and doomed.

On July 6, General Krueger's Sixth Army Headquarters moved to Hollandia and General MacArthur's Headquarters—previously located at Brisbane, Australia—was established there on Sept. 8, 1944. General Eichelberger, appointed commander of the newly activated United States Eighth Army, took charge of these forces on September 8 also.

According to General Marshall's report, the Allied drive in the Southwest Pacific had pushed 1,300 miles closer to the heart of the Japanese Empire in a little over 12 months, cutting off more than 135,000 enemy troops beyond hope of rescue.

The Gilbert Islands.—The personnel used in the Central Pacific area was given special training, under the supervision of Gen. Robert C. Richardson, Jr., of the Army Command, at amphibious and jungle training centers in the Hawaiian Islands. American aerial and naval superiority was fully exploited in the vast spaces of Pacific operations. The Gilbert, Marshall, and Caroline Islands—in this sequence—were the most formidable obstacles in the Central Pacific path of advance. After United States carrier task forces had raided the archipelagoes, Baker, Nukufetau, and Nanumea islands, close to the British Gilbert group, they were occupied in minor operations on Sept. 1, 1943.

Allied air activity left the Japanese uncertain as to where the next blow would fall. Long range bombers, based in the Ellice Islands, hammered away at the Gilbert atolls, while heavy diversionary raids hit the Marshalls. On October 24, light United States naval forces attacked Tarawa atoll in the Gilberts, sinking one Japanese patrol boat and damaging one destroyer.

The invasion of the Gilbert Islands, designated "Operation Galvanic," began on November 21, 1943, after a naval and air bombardment in which Maj. Gen. Willis H. Hale's 7th Air Force had a major share. Betio Island in Tarawa, less than one square mile in size, was the key to Japanese defenses, where 4,500 picked troops manned 500 pillboxes. Twelve hundred Japanese held Makin Island. Abemama, another target of this exclusively American operation, was taken without opposition.

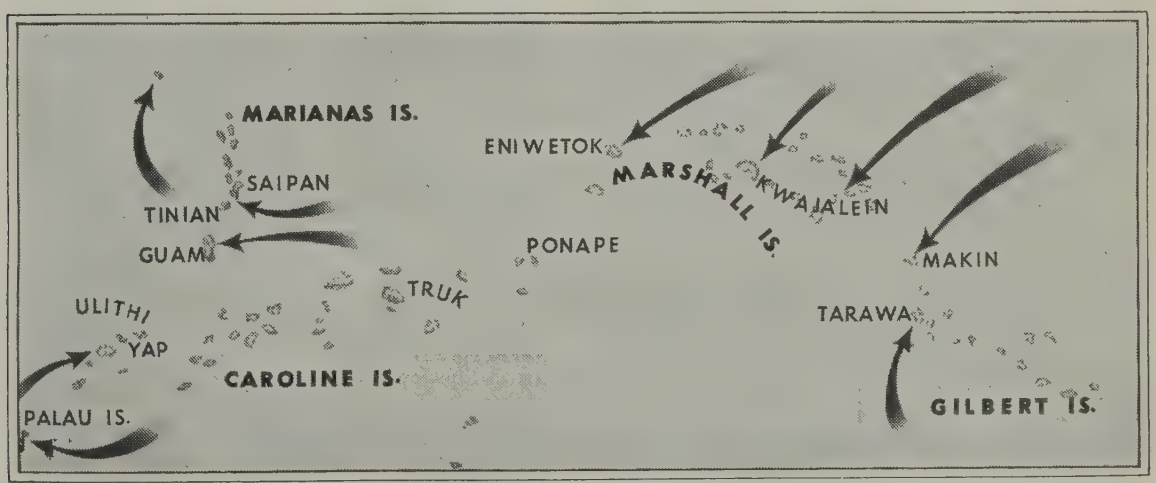
The 2d Marine Division was assigned to capture Betio Island. Despite shattering naval and air preparations, landing barges ran into severe cross-fire. Hundreds of casualties were suffered off shore. Mines and beach obstacles added to the difficulties of the invasion. Amphibious tractors, floated beyond the range of shore batteries and deployed in landing boat formation, proved very effective. Three battalions went ashore in the first assault wave. During the following night, some artillery and a few tanks were brought in.

On November 22, the strength of the invaders rose to two regiments. They battled their way from pillbox to pillbox. Further reinforcements landed the following day in the southwest corner of the island. Armored half tracks, mounting 75-mm. guns, were effective in the closing stages of the operations. The island was entirely in American hands on November 24.

A combat team of the United States 27th Division captured Makin Island. The fight for Makin, although on a smaller scale than Tarawa, was hardly less severe. The most substantial United States naval loss occurred off Makin, where the small carrier *Liscombe* went down with 700 casualties.

Total United States casualties in the campaign amounted to 3,772, of which 3,031 were suffered by the marines.

The Marshall Islands. — The Marshall Islands, made up of 33 atolls and islands, had been under German control from 1885 until 1914, when Japan seized them. In 1919, Japan was given a mandate over the Marshalls and pro-



ceeded to build strong fortifications in this strategically important area.

After the seizure of the Gilberts, Admiral Nimitz prepared to carry the drive to the Marshalls in an operation code-named "Flintlock." Heeding the lessons of Tarawa, preliminary bombing and shelling was intensified, to soften Japanese defenses. More landing craft, including amphibious tractors, were used to put stronger forces ashore in the initial steps of the invasion. Care was taken to smash opposing air forces by devastating landing strips, even though this would delay their future use by the invaders.

From mid-November 1943, constant American air raids hit Wotje, Jaluit, and Kwajalein in the Marshalls. The bombardment reached its peak in late January 1944. The Japanese believed that a simultaneous invasion would be directed against all three targets. However, in a classic example of by-passing strategy, the Americans cut behind Wotje and Jaluit to concentrate on Kwajalein, the world's greatest atoll: 30 islets 66 miles long and 18 miles wide.

Naval forces covering the invasion included modern battleships and carriers. On January 29, the armada lined up offshore to give Kwajalein an unprecedented shelling, while carrier-based aircraft showered heavy loads of bombs on the dazed defenders. On Jan. 31, 1944, the United States 7th Division landed in the southern section of the atoll. Its northern islands, Namu and Roi, were invaded by the 4th Marine Division. Both divisions formed part of Maj. Gen. Holland M. Smith's 5th Marine Corps.

In Roi and Namu, the marines broke Japanese resistance in 27 hours, losing 229 killed and 797 wounded against 3,800 Japanese dead. The naval base on southern Kwajalein resisted until February 4, but mopping up operations continued for four days more. Army casualties were 117 killed and 1,037 wounded. Japanese losses in both sectors amounted to 8,122 killed and 264 captured. General Richardson, reporting to General Marshall, stated: "As a result of the air, naval, and artillery bombardment, the scene of Kwajalein was one of great devastation. The destruction was . . . even greater than that of Betio on Tarawa. With the exception of rubble left by concrete structures, there were no buildings standing." Majuro, an anchorage close to Kwajalein, was also invaded and occupied on January 31.

The next operation was directed against Eniwetok atoll in a further by-passing move. From Feb. 10 to 12, 1944, a powerful naval task force, including aircraft carriers, pounded the atoll at the northwestern end of the Marshalls. On Feb. 19, a marine combat team (22d Regiment) and a combat team of the 27th Division (106th Infantry Regiment) landed at Eniwetok, Engebi, and Parry islands. Engebi was seized in 6 hours. The fight for the other islets lasted until February 22. The marines lost 196 killed and 550 wounded, and the Infantry had 70 killed and 228 wounded.

The Japanese Base at Truk.—One of the most important moves toward strengthening Japan's position in the Pacific had been the placing of the Caroline Islands under the Japanese mandate in 1919, after they had formed part of the German Colonial Empire since 1899. The Carolines comprised 770 islands of varying size, including Palau. Ulithi, Ponape, and Truk. The Truk lagoon, 40 miles long, could accommodate almost unlimited naval forces. The Japanese built Truk into a base matching Pearl Harbor. Its potential importance was greater in offensive than in defensive warfare. When Japanese naval power dwindled, Truk was too remote from the home islands to keep the main fleet there.

An assault on Truk would have resulted in severe casualties as long as its land, air, and naval defenses were fully manned. With the shrinkage of Japanese sea and airpower, however, constant bombing could reduce the base without invasion. Early in February 1944, air reconnaissance disclosed that two of the few remaining Japanese carriers and twenty-three other naval vessels were still anchored in the lagoon, although the bulk of the Imperial Fleet had left.

United States carrier-based planes raided Truk on Feb. 16 and 17, 1944. The Japanese carriers had left the port prior to the attack. Two Japanese cruisers, three destroyers, and eighteen merchant ships were sunk and 201 Japanese aircraft destroyed, against a loss of 17 United States planes. After the seizure of the Marshalls, Truk came under air attack from there also.

In late February, United States bomber crews reported negligible air opposition from Truk, very little shipping in its harbor, and considerable reduction in the number of land forces. By spring of 1944, Truk was no longer of value to the Japanese.

THE RUSSIAN CAMPAIGN, 1943–1944

In the great war against the Russians, the Wehrmacht was getting its replacements from men who had no prewar military training. The balance of quality changed in favor of Russia, where almost no able-bodied men of draft age had escaped such training. Axis satellite forces were reduced to 28 divisions, 14 of which were Finnish, deployed exclusively in the isolated sector from Lake Ladoga to the Arctic Ocean. The remaining 14 divisions, made up of Rumanians Hungarians, and Slovaks, were badly mauled and dispirited. The Luftwaffe no longer could outfight the Red Air Force which was well equipped with American planes. The Germans retained an advantage only in tanks and self-propelled guns, due to the superior quality of their Tigers and Panthers and the self-propelled Ferdinand guns. The USSR organized new armies with considerable striking power to continue the offensive during the summer.

The Summer Campaign of 1943.—The Pripet Marshes and thick woods of Polesie (in Poland) were 200 miles behind the German lines on the central front. If the Red forces could press the Wehrmacht back to that region, German communications between the northern and southern sectors of the front would be impaired, and the Red Army could operate against two, almost isolated sectors.

In June 1943, two adjoining bulges were crucial sectors. In a rough triangle, based north and south of Kursk, a Russian wedge pushed sharply into the German lines. Immediately to the north, Wehrmacht positions in a semicircle, with the hedgehog of Orel on its perimeter, pointed toward Tula. The bulges outflanked each other. The Russians had to eliminate Orel before breaking out of the Kursk bulge, while the Germans had to destroy the Kursk triangle before attempting an offensive on the central front.

The German High Command had conditional

offensive plans. It wanted to drive the Red armies back from Kursk, but the offensive was to continue eastward only if the defenders of Kursk were destroyed. If the Russians were forced to evacuate the wedge without suffering a major defeat, the Germans planned to adjust their lines for a successful defensive. If the attack should fail, the Wehrmacht had little if any chance to hold the initiative.

All that the Germans could muster for the offensive were 17 infantry, 17 armored, and 4 motorized divisions, supported by 1,500 planes. This army group was placed under the command of Field Marshal Gen. Gunther von Kluge. The northern perimeter of the Kursk wedge was held by Gen. Konstantin Rokossovski's army, the southern by Gen. Nikolai Vatutin's. Kluge attacked on July 5. Soviet antitank defenses took a terrific toll of the panzers. The Germans made very little progress in the south until July 8; in the north, however, they gained between 7 and 10 miles, at a cost of 40 per cent of their armor, and captured Maloarkhangelsk. Beyond that city the drive was halted by stiffening Russian resistance. On July 15, the army of Gen. Markian Popov, on General Rokossovski's northern flank, opened up against Orel. Rokossovski captured Maloarkhangelsk on July 18. On July 22, the rapid progress of the Russian attack on Orel forced Kluge to withdraw to his initial positions. Eight of his panzer divisions were crippled, and the motorized divisions were all but destroyed. His infantry had lost 100,000 men.

After July 22, 1943, the eastern European campaign became a succession of German retreats, interrupted by occasional local counterattacks and positional warfare. The Russian armies resembled a gigantic steam roller which moved at varying speeds and with many halts to the logical end of the campaign: the destruction of the Wehrmacht's remaining eastern forces in Berlin.

On July 21, Red vanguards were only 10 miles east of the town. Heavy rainfalls prevented a quick severance of communications between Orel and Bryansk, and immense mine fields at the approaches of the town held up the frontal advance. From July 28 to 31, Russian sappers removed the mines. On August 4, Rokossovski entered Orel. On the same day, Vatutin's army, joining the offensive, captured Belgorod.

The original Russian plan called for an attack on Bryansk prior to another drive on Kharkov by Gen. Ivan S. Konev's army. But when Vatutin penetrated the German lines between Belgorod and Rakitnoye in a two-day battle, clearing the way for Konev, the Soviet High Command gave priority to the Kharkov offensive.

On August 11, Konev's troops were beyond the Donets at Zmiyev, and Vatutin, having severed the Poltava-Kharkov railroad line, was threatening the rear of the Germans in Kharkov. Deploying all available armor, the Germans held Vatutin long enough to evacuate their troops from Kharkov in reasonable order. The Red Army entered the badly damaged city on August 23. The attack on Bryansk was resumed the week before Kharkov fell. In the Bryansk sector, where the Luftwaffe was strongest, it flew more than 1,000 sorties a day to make up for lack of armor.

On August 22, General Tolbukhin attacked in the southern sector with strong armored forces. Within one week the Russians flooded over the area between Stalino and Taganrog, capturing Taganrog on August 30 and achieving a strategic breakthrough. German militia troops gave a poor account of themselves. Between the Seim and the Desna rivers, farther to the north, Rokossovski captured Sevsk on August 27 in a two-pronged attack and took Glukhov on the highway into the Ukraine, 60 miles from Sevsk, on August 31. On September 2, his army approached the crossings of the Seim River between Sumy and Chernigov, while Vatutin's columns entered Sumy. Joining forces, the two armies broke through to Konotop.

In the Smolensk sector, another Russian army under Gen. Vassili Sokolovski took Dorogobuzh on September 2, piercing prepared German positions. Two more Red armies under Generals Yeremenko and Ivan Y. Petrov attacked in the sector of Velikie Luki and in the long-dormant lower Kuban district.

The Wehrmacht was compelled to carry out a general withdrawal. New German positions ran from Zaporozhe south to the Sea of Azov, covering the Perekop Isthmus, from Zaporozhe northwest to Kiev along the western bank of the Dnieper, and from Kiev along the Desna River, covering the approaches to the Pripet Marshes and the district of Polesie. Two more river lines extended the Desna defenses to the rear. The Germans fought costly rear-guard actions to cover the withdrawal of the main forces.

After entering Bakhmach on September 8, Vatutin pressed German rear guards toward Poltava. Malinovski took Stalino on September 7. On September 9, his vanguards were 50 miles from the Dnieper, and Tolbukhin captured Mariupol.

Two panzer divisions and six German and six Rumanian infantry divisions lost Novorossisk to General Petrov's army on September 15 and made a precarious withdrawal across the Kerch Straits into the Crimea 13 days later.

A Russian communiqué, datelined September 18, triumphantly announced the liberation of 1,200 towns and villages in a single day. Rokossovski's right flank went beyond the Desna, while Popov's columns fought for crossings of that river in the direction of Roslavl. Sokolovski took Yartsevo, and Yeremenko took Dukovshina, both on the approaches to Smolensk. Smolensk itself fell to the Red armies on September 25. The Germans lost Bryansk on September 20 and Chernigov on September 23. On September 28, Konev opened an attack on Kremenchug, while Malinovski's forces reached the left bank of the Dnieper opposite Dnepropetrovsk. Rokossovski was approaching Kiev.

German propagandists proclaimed that the Dnieper would be the Wehrmacht's 1943–1944 winter line. Its right bank, then under German control, was generally higher than the left. At Kiev, 600-foot cliffs on the western bank formed a forbidding obstacle. Rapids in the river, which was up to 1,000 yards wide, made crossings hazardous under fire.

From Zaporozhe to the south, the Germans held positions across the steppes to Melitopol and the Sea of Azov east of the Dneiper bend, manned by the best mobile formations the Wehrmacht could muster and commanded by von Mannstein. The Wehrmacht also stubbornly clung to its positions inside the Crimea, although their usefulness as a springboard for an attack on the Caucasus was gone.

From Zaporozhe to Kiev—200 miles—the Germans left only screening forces and observers on the river bank. The main forces were concentrated 30 to 40 miles to the rear, along the railroad. In case of a Russian attack, they were to be rushed to the crucial point. A German-built highway along the river bank was supposed to ensure swift deployment.

On October 5, Yeremenko took the railroad center of Nevel north of Vitebsk. The next day, before the German mobile defensive system could function, several Russian bridgeheads were established across the Dnieper, north and south of Kiev. Malinovski's army attacked Melitopol. Mannstein, relying on the city's strong fortifications, concentrated the bulk of his forces on the northern wing near Zaporozhe in an effort to outflank the Russians. The Germans were routed and lost Zaporozhe in a sea-saw battle that raged for four days. Konev's divisions erupted from their Kremenchug bridgehead. On October 17, the opposing German lines broke on a front 28 miles wide. Three Russian columns advanced in the directions of Krivoi Rog, Kirovograd, and Dnepropetrovsk. Before Konev's drive could be stopped, Malinovski's vanguards crossed the Dnieper, and a twin attack wrested Dnepropetrovsk from the Germans. The Melitopol line collapsed on October 27. The Russian advance bypassed the Perekop Isthmus. The Crimea was bottled up and left for later mopping-up operations.

A new German line was formed along the lower course of the Dnieper, covering Krivoi Rog, Apostolovo, Dolinskaya and Znamenka. The Russian advance halted in early November in front of this sector. The center of gravity of the Russian offensive again moved north. Although the edge of the marshy regions had been reached, the Wehrmacht was not as firmly pinned against the marshes as the Russians had planned.

A remarkable innovation in Russian tactics was the maintenance of bridgeheads in positional warfare along rivers. Their perimeter was exposed to heavy pressure, and it was hard to supply them. Experience showed that losses sustained in holding these outposts were offset by the more rapid development of later offenses and reduced casualties in such operations.

On Nov. 4, 1943, a special Russian communiqué gave German losses since July 5, 1943, as 2,700,000 and territory recovered since the counteroffensive near Stalingrad as 335,000 square miles. The casualty claim was fantastic, but more than half of their earlier conquests in the east had been wrested from the Germans. A Russian threat to German-occupied territory, satellite states, and the Reich itself began to take shape.

The Russian Offensive.—Reconquered Soviet territory revealed a picture of horror, second to none in any previous invasion of present European Russia (100 of them are recorded in history). Almost 10,000,000 people had been forced into slave labor in Germany. Systematic demolition by special German squads was added to the destruction wrought by military action and the scorched-earth policy.

Ever since the establishment of Soviet rule in Russia, official propaganda had been designed to convince the citizens that living conditions in the USSR were better than anywhere else, and that other nations and governments, envious of Russian achievements, should be viewed with suspicion. The barbarous behavior of the Germans in Russia strengthened the Russian belief in the propaganda, and their distrust of foreigners increased. There were relatively few cases of Russian collaboration with the enemy, most of them in the Crimea and the Kuban Valley. A flaming hatred and desire for revenge on the Germans became a dominant factor in Russian psychology.

In the south, General Petrov's group in the Taman Peninsula cooperated with Gen. Fedor I. Tolbukhin's southern group on what was termed the 4th Ukrainian front, running from the lower Dnieper to a point close to Zaporozhe. From there to the sector north of Krivoi Rog, the 3d Ukrainian front was held by General Malinovski's group. Konev's forces formed the 2d Ukrainian front toward Kirovograd and Znamenka. To Konev's right, on the 1st Ukrainian front, General Vatutin's army, reinforced by troops drawn from General Rokossovski's group, prepared for the assault on Kiev. The rest of Rokossovski's divisions concentrated on Gomel on the "White Russian front," north of the Pripet Marshes. On Rokossovski's northern wing, Popov's army aimed at Mogilev and Orsha; on Popov's right, General Sokolovski's objective was Vitebsk; and on Sokolovski's right flank, Yeremenko prepared to drive toward Polotsk.

The Germans called part of the sector north of the marshes the "Fatherland Line," for it covered the approaches to the Reich. The German High Command, discounting Russian ability to continue the offensive on a broad front before midwinter, expected only a local thrust in the direction of Krivoi Rog and its railway system linking the city with Nikolaev, Odessa, and Kiev. Field Marshal General von Mannstein, in charge of the Krivoi Rog sector, received most of the available reserves, and the Kiev front was bared by the withdrawal of almost two thirds of its defenders to assist Mannstein.

During the latter part of October 1943, the Russians strengthened their bridgehead across the Dnieper north of Kiev. On November 2, Vatutin's forces broke out of the bridgehead to take Dymer on November 3. Mechanized units south of Dymer captured Svyatoshin four miles from Kiev, cutting the railroad and highway leading to the west of the city. A three-quarter circle was formed around Kiev. On November 6, the Russians entered the city in pursuit of withdrawing German forces. The Soviet official communiqué reported 15,000 Germans killed and 6,000 captured in that operation.

The drive disrupted communications between the northern and southern German armies, and Mannstein made an attempt to halt Vatutin's army, fanning out in an arc almost 130 miles wide and capturing Zhitomir on November 11. Although the Russians temporarily lost Zhitomir, the loss was offset by the capture of Korosten. From Korosten the Russians, using paratroopers in great numbers, pushed on in the direction of the nearby Pripet Marshes.

On November 15, the left wing of Rokossovski's army, after two days of fighting, captured the railroad town of Rechitsa and on November 25 entered Gomel.

Mannstein, switching the center of gravity of his attack toward Korosten, recaptured the town on November 28. Reserves from as far as Norway and the Balkans were pulled in, but the German offensive was no lightning war with wedge and kettle. The Luftwaffe ceased to be a major partner in the Wehrmacht team. The panzers,

suffering appalling casualties, were unable to drive wedges into the Russian lines. Finally, unseasonable rain interfered with German maneuvers. Half of the Russian bulge—formed since the capture of Kiev—had been evacuated, but the rest of it was consolidated.

On December 15, Cherkassy, between Kiev and Dnepropetrovsk, was captured by the Russians. A powerful Soviet armored drive gained control of the railway system in the northern area inside the great Dnieper bend. In the north, Popov took Dovsk on December 3. The Red offensive expanded farther to the right and, on December 13, Gen. Ivan Bagramian's First Baltic Army, with cavalry and armor, attacked from the Nevel sector toward Vitebsk. This assault tore a gap in the Fatherland Line 50 miles wide and up to 18 miles deep, but German counterattacks met the advancing First Baltic Army. Bagramian abandoned frontal attacks on Vitebsk and opened flanking drives to sever its communications. Gorodok fell to the Russians on December 24, and one week later a vise encircled Vitebsk. But the Germans still held out, and the front became deadlocked.

Between December 10 and 20, Mannstein failed to gain ground. Russian forces—with equipment including the heaviest-caliber guns—poured across the Dnieper at Kiev to counter the attackers. On December 24, Vatutin's sudden assault broke through weary German lines on both sides of the Kiev-Zhitomir highway. On December 31, the Russians not only had recovered the ground they had lost to Mannstein but had driven beyond the limits of the former Kiev bulge.

Jan. 3, 1944 was a memorable date in the Soviet-German war. The Russians crossed their pre-1939 borders beyond Zhitomir, capturing Olevsk on former Polish soil. Vatutin's vanguards approached the Bug River on a 50-mile front.

With German north-south communications disrupted in Polesie, Soviet grand strategy aimed at establishing another communications block beyond the Pripet Marshes at the Carpathian range, deep inside German-conquered and satellite territory. The First Ukrainian Army had supply troubles, and the unusually mild winter transformed the earth into quagmires. New German positions faced Vatutin's forces between Vinnitsa and the railway junction of Kristinovka. From January 13 to 23, Red attacks failed to gain ground, and the Soviet High Command announced that poor weather had temporarily halted the offensive. The Germans threw eight infantry divisions and some armor into a counterdrive and gained ground in the region of Vinnitsa. The Wehrmacht's communiqué triumphantly announced the defeat of 10 Russian infantry divisions and one tank corps. This report was exaggerated to bolster the morale of the home front. On January 31, the German drive reached its climax, but Vatutin's lines recoiled. Five days later, the First Ukrainian Army took Równe (Rovno) and Luck, and Shepetovka fell on February 11. The German operational reserves—the Sixth and Eighth armies—always seemed to arrive too late with too little.

Early in 1944, Konev's group in the south, cooperating with Vatutin's southern wing, prepared an offensive toward Kirovograd and Krivoi Rog. On January 7, the Russian official communiqué reported that Konev had pierced the German lines on a sector 60 miles wide and had scored advances up to 25 miles. The Russian breakthrough was marked by a tactical innovation. Parallel spearheads, operating less than 10 miles apart, tore gaps in the enemy front. Squeezed between spearheads and lacking operational space, the Germans abandoned their base line, and the Russian twin breaches widened into a single solid wedge. On January 8, Kirovograd fell to Konev's troops. Five German divisions fell back, leaving 8,000 dead. To the north of Kirovograd, Vatutin pressed toward Uman. A narrow German bulge remained between Russian pincers based on Medvin and Smela.

On February 3, a successful breakthrough linked the First and Second Ukrainian armies near Shpola, cutting off 10 German divisions at Korsun. A corridor 20 miles wide was opened between these divisions and the bulk of the Wehrmacht. Mannstein deployed the remnants of 8 panzer divisions to break the Russian trap from the outside. From inside, the trapped forces hammered at the vise from the opposite direction. On February 17, the Russians announced the liquidation of the encircled troops, of which 58,000 were reported killed and 18,000 captured, while the relief forces were said to have suffered an additional 20,000 casualities. The German High Command countered by claiming that the ring of encirclement had been broken and the trapped forces rescued.

On February 5, Malinovski made a feint toward Krivoi Rog, immediately followed by a powerful drive along the railway from Dnepropetrovsk. A breakthrough on a front 94 miles wide, to a depth of 37 miles, resulted in the capture of Apostolovo and cut the supply lines of five German divisions at Nikopol on February 6. Tolbukhin's forces, on Malinovski's left, crossed the lower Dnieper and seized Nikopol two days later. Krivoi Rog fell to the Soviet forces on February 22.

Four Russian army groups were deployed north of the Dnieper: Bagramian's First Baltic Army, Popov's Second Baltic Army, Meretskov's Volkhov Army, and Govorov's Leningrad Army. On January 14, while Bagramian was stalled before Vitebsk, Popov severed the railroad running south from Leningrad, an important German supply route. Meretskov cut the railroad in another place north of Lake Ilmen, while Govorov assaulted the Wehrmacht on the hills and ridges of the southern approaches to Leningrad. German positions, built up to a depth of 20 miles, included underground chambers, concrete blockhouses, and other permanent fortifications, but these were demolished by Red firepower.

On Jan. 15, 1944, twin drives from Oranienbaum toward Ropsha, and from Pulkhovo in the direction of Krasnoye Selo, drove the Germans back to Krasnogvardeisk after five days of fighting. On the same day (Jan. 15, 1944) the Volkhov Army took Novgorod and, in cooperation with the Leningrad Army, crushed German positions across the railroad at Mga, opposite Schlusselburg. The Wehrmacht's hold on the eastern bank of the Volkhov River, near Chudovo, was eliminated on January 25. Communications between Leningrad and Moscow were permanently stabilized. The loss of Krasnogvardeisk on January 28 was even more serious for the Germans.

The next Russian goal was Luga, the pivotal communications hub west of Novgorod. The Wehrmacht made a fighting retreat, but Russian pressure did not permit the organization of effec-

tive defenses. Luga was captured on February 12, forcing the Wehrmacht back to the Estonian border along Lake Peipus and the Narva River. The retreat bared the rear of German divisions south of Lake Ilmen, forcing them to abandon Staraya Russa on February 18 and to fall back along the railway Staraya Russa-Dno-Pskov. This retreat exposed the German Lovat River positions south of Staraya Russa. A Russian attempt to cut off substantial German forces by a drive in the direction of Riga and Latvia fell short of its objective. Advancing on Pskov, the armies of Generals Govorov and Popov reached a point on the southern edge of Lake Peipus, five miles from the town, on March 3. A simultaneous Russian attempt to penetrate northern Estonia by forcing the passage of the Narva River was unsuccessful.

Early in March 1944, General Gogorov, promoted to the rank of marshal of the Soviet Union, was put in charge of the Karelian Army, deployed to launch a final drive against Finland. Malinovski held the front from the mouth of the Dnieper to the region southwest of Kirovograd. From there to Vinnetsa, Konev was in command. On his army's right flank, Marshal Zhukov replaced Vatutin who had died on April 14, 1944, of wounds received previously.

Total Russian strength approximated 300 divisions, outnumbering the Wehrmacht 2 to 1. The equipment of this huge force was made possible by vigorous efforts to increase domestic production and by lend-lease. Between October 1941 and March 1944, the United States shipped 8,800 planes, 5,200 tanks and tank destroyers, and 190,000 trucks and jeeps to the Soviet Union. During the same period, 6,700 planes and 5,000 tanks (many of them American-made) came to Russia from Great Britain.

The Russians concentrated on the Odessa-Lwów railroad line, the main link between German forces in Poland and in southern Russia. The reinforced German Sixth and Eighth armies and the First and Fourth panzer armies defended the vital railway.

On March 4, Zhukov attacked on a 112-mile front. After two days, his First Ukrainian Army severed the Odessa-Lwów railway. Widening a wedge in the German lines, the Russians invested Tarnopol in eastern Gallicia Province on March 9. Konev and Malinovski attacked two days after Zhukov's push got under way. Konev's armor defeated six panzer divisions near Uman. On March 10, the Soviet High Command announced the rout of 14 German divisions in a breakthrough on a 109-mile front in the direction of the Bug River. No substantial Wehrmacht reserves were available for the defense of the Bug line, which was reached on March 12.

On March 15, Konev was beyond the river, capturing Vapnyarka on the Odessa-Lwów railway. Malinovski shattered German positions covering Nikolaev, at the mouth of the Bug River, and Odessa harbor farther to the west. Tarnopol, Proskurov, Vinnitsa, and Zhmerinka, gateways to the Carpathian range, continued to resist. On March 20, however, Zhmerinka and Vinnitsa fell into Russian hands.

On March 19, Konev, crossing the Dniester into Bessarabia, brushed aside five second-rate Rumanian divisions to capture Mogilev. His gains threatened the flank of the Germans facing Zhukov's army. Malinovski captured Kherson on March 13. On March 24, the Russians were within sight of Nikolaev. Konev advanced through northern Bessarabia and reached the Prut River, Rumania's pre-World War I border, on March 28. On April 3, Foreign Commissar Molotov announced the crossing of the Prut but insisted that the Soviets had no designs on Rumanian territory nor any intention of interfering in Rumanian affairs. While Konev's drive continued toward Iasi, Malinovski liberated Nikolaev on March 28. On April 10, the Russians recaptured the port and city of Odessa. Four days later, German rearguards crossed the lower Dniester, beyond Ukrainian soil.

The liquidation of 110,000 Germans and Rumanians by-passed in the Crimea was begun on April 8. Tolbukhin attacked through the Perekop Isthmus and Yeremenko from the Taman Peninsula. Ten days later, the remnants of the Axis garrison, of 44,000 men (most of the rest were captured) fled to Sevastopol. Tolbukhin attacked the fortress on May 7, and captured it two days later.

Farther to the north, the Germans formed a line from Stanislaw to Brody to cover the gap between the western end of the Pripet Marshes and the Carpathian range. Zhukov countered by a vigorous attack east of Tarnopol. The First Ukrainian Army advanced 40 miles, while Konev penetrated into Bucovina Province. On March 29, the Russians took Kolomya, severing the Lwów-Iasi railroad. Cernauţi, provincial capital of Bucovina, fell on March 30, and Stanisławów on March 31.

On April 8, 1944, another historic date in the campaign, the Russians reached the Carpathian range at Tatar Pass on the Czechoslovak border. Tarnopol, encircled for 38 days, fell to the Red forces on April 15. By that time, the momentum of the Russian offensive was lost, and German counterattacks drove the tired captors of Stanisławów out of the city. Kishinev, provincial capital of Bessarabia, by-passed in Konev's earlier drive, continued to resist. The garrison of Iasi gained some ground in a local counterattack. The Russians took Tiraspol on the southern end of the front but failed to penetrate the Galati gap into the Danube Valley. The Russian lines, although thinned out by rapid advances and with supply channels in the process of organization, proved almost shock-proof. They rarely gave way and never broke.

Rumania: Among the Axis satellite governments, Rumania under Marshal Ion Antonescu was ready to go to the limit to prevent a German disaster, although he occasionally played with the idea of contacting elements in favor of a separate peace. Rumanian strength was nearly exhausted. First-line troops were decimated, and second- and third-rate troops, in the German High Command's opinion, were not worth their German-supplied equipment. But Rumania was still very important to the Germans. Despite damage from air attacks, the Ploesti oilfields supplied most of Germany's natural oil. After losing the Ukraine, the Reich also needed Rumanian wheat. Moreover, a Russian thrust beyond the Danube delta would have unhinged the southern anchor of the eastern front. Anti-German elements in Rumania, loyal to King Michael, did not put up an effective resistance, but rallied to contact Allied representatives late in 1943.

Bulgaria: Although Bulgaria had been at war with Great Britain and the United States since Dec. 13, 1941, its government resisted German

calls for participation in the war against the USSR. The Bulgarians never forgot that they owed their independence to Russian assistance, and their Slavic nationalism made no distinction between czarist and Soviet Russia. The deployment of the Bulgarian Army on the eastern front might have resulted in mass desertions and uprisings against the unpopular king and his German-dominated government.

On March 31, 1943, King Boris was summoned to Hitler's headquarters and told that the führer insisted upon having Bulgarian divisions dispatched to Russia. Commitments made by the king were not disclosed but, upon his return to Sofia, violent anti-German demonstrations forced Prime Minister Bogdan Philov to declare a state of siege. No Bulgarian troops went to the eastern front. Angry and impatient, Hitler again summoned the king. At a brief conference Boris was handed a five day ultimatum, calling for total military and economic mobilization in the interest of the German war effort, Gestapo control of the country, and the guarding of the Bulgarian-Turkish border by German forces. The day the ultimatum expired (Aug. 28, 1943), the Bulgarian prime minister announced the death of King Boris "after a brief but grave illness." The German radio spoke of angina pectoris. Neutral sources attributed the death to assassination, and Russian broadcasts said that the king had been poisoned by the Germans.

On September 7, a special session of the subservient Bulgarian parliament nominated a regency to rule until the late king's 6-year-old son, Simeon II, became of age. The council's members were approved by Berlin. The regents yielded to all German demands except one: assistance against Russia. Allied bombing of Sofia on Dec. 10, 1943, bolstered popular anti-German feelings, which were strong after the Bulgarians came to know the Germans in their ill-fated partnership in World War I. On Dec. 11 and 27, 1943, the United States and the USSR issued joint warnings to the Bulgarians to withdraw from the war. These warnings could not be acted upon by the people, who lacked organization, and they met with no response from the Gestapo-controlled government.

On May 28, 1944, Hitler presented another ultimatum to Philov. It demanded: an immediate break with the USSR, the placing of the Bulgarian Army under German command, greater contributions to the German war effort, the mobilization of 20,000 laborers for the construction of fortifications in western Europe, and the appointment of a "strong cabinet" to carry out German demands.

The regents appointed Ivan Bagrianov to head the strong cabinet. Although they formally yielded to the German ultimatum, they did not put its terms into full effect. On June 13, 1944, Hitler, infuriated by Bulgarian recalcitrance, sent Joseph Neubacher to Bulgaria to govern the country. Neubacher was unable to live up to his führer's expectations. After Turkey adjusted its political stand (Aug. 2, 1944) by breaking off diplomatic relations with Germany, Bagrianov made a pro-Allied gesture by reassuring Turkey of Bulgaria's friendliness (Aug. 26, 1944). He also assured the Russians that Bulgaria was neutral. Bagrianov remained in office until September 7, when Russian might cast its shadow over the country.

Hungary: Since Hungarian forces suffered severely in the defeat of Voronezh, only a few reinforcements were sent to the eastern front thereafter. On March 18, 1944, Hitler brought pressure to bear on Regent Admiral Nicholas Horthy to mobilize at least 300,000 more men and bring Hungary into a state of total war. The regent countered by suggesting that the Wehrmacht should release Hungarian divisions already deployed in other sectors for the defense of the threatened homeland. The next morning, the Germans formally proclaimed the occupation of Hungary, which had actually been in effect for three years. Admiral Horthy, after being detained in Hitler's headquarters for a while, named a new cabinet on March 22 under Field Marshal Doeme Szotajay, "for more effective cooperation against bolshevism." Extremists of the Nazi type held leading posts in the government. The ensuing reign of terror and pogroms failed to increase Hungary's war effort.

Finland: The strategic value of Finland as a German operational base had vanished with the Russian advance. Economically it had always been a liability and was in a state of semistarvation. The once important air base of Petsamo was neutralized by the growing strength of Murmansk. Yet Finland still tied down a number of Russian divisions, a more important contribution to the Germans than the survival of the Finnish nation. Col. Gen. Eduard Dietl's German Lapland Army in Finland did little if any fighting in 1944. Its mission was to encourage pro-Nazi elements and to frighten those who wanted to break away.

The Finnish people were still strongly anti-Russian, but they were also anti-German. Torn between rival aversions and uninformed about world affairs because of iron censorship, the average Finn could see no way to get out of the war. The Finnish president, government, and other military and civilian collaborationists feared personal consequences if the country acknowledged defeat. Field Marshal Mannerheim, opposed to both the USSR and Germany, had little political skill and was only an aging symbol of confused Finnish nationalism.

The U.S. government, not at war with Finland, exerted pressure for a separate peace between Finland, the USSR, and Great Britain Contact between Russian and Finnish representatives was established at Stockholm, Sweden. On Feb. 16, 1944, Dr. Juho K. Paasikivi, negotiator of the Finno-Russian treaty of 1940, met Soviet Ambassadress Alexandra Kollontai to discuss armistice conditions. Dr. Paasikivi was informed that the Moscow government asked for an immediate break in German-Finnish relations, internment of all German troops in Finland, restoration of the 1940 peace terms, and release of Allied prisoners and internees. Further negotiations at Moscow would determine conditions of demobilization, reparations, and the future status of Petsamo. Despite appeals by the president of the United States and the king of Sweden, the Finnish government rejected the terms on March 17.

On June 22, preceded by infiltration of the Finnish capital by troops of the German Lapland Army, German Foreign Minister von Ribbentrop and Field Marshal General von Keitel arrived in Helsinki. Four days later, President Risto Ryti of Finland unconstitutionally pledged that Finland would not make peace without Ger-

man consent. On June 30, 1944, Secretary of State Cordell Hull charged the Finnish government with having become a puppet of Nazi Germany and announced the severance of United States-Finnish diplomatic relations, although no state of war was declared.

THE ROAD TO ROME

Although Allied efforts in Europe were concentrated on the impending invasion of France, the drive in Italy had to be continued in order to tie down the greatest possible number of German divisions in this secondary theater of war and to gain air bases closer to the Reich's southern border.

Three roads led to Rome from the Allied positions in early 1944: the Appian Way along the Tyrrhenian coast, a highway across the peninsula from Pescara on the Adriatic, and the Via Casilina from embattled Cassino. The Appian Way led through narrow ground between hills and the sea north of the mouth of the Liri (Garigliano) River and then farther north through the flooded Pontine Marshes. The cross-country road from Pescara—longer than the other routes of approach—crossed snowbound mountains. Along Via Casilina, strong German positions blocked Allied advances.

Anzio and Cassino.—The French Corps under General Juin took over the right sector of the Fifth Army front, and the United States 6th Corps withdrew to participate in the new invasion. In mid-January, an Allied convoy assembled in Naples harbor, while the German radio announced that the Allied navies had withdrawn from the Mediterranean to England to prepare for the invasion of western Europe. The United States naval forces assigned to the impending attack, called "Operation Shingle," were under the command of Rear Admiral Frank J. Lowry; the British forces were commanded by Rear Admiral Thomas Troubridge. Some French, Dutch, and Greek naval units joined the action. The objectives of the invasion were the beaches on both sides of Anzio, a small town 55 miles to the rear of the main German line and 30 miles from Rome. Landing forces, 40,000 strong, included the United States 3d Division, American Ranger and Parachute units, and one British division. They were reinforced later.

The convoy left Naples on Jan. 21, 1944, sailing first in the direction of Corsica and then toward the mouth of the Tiber River—to mislead German observers—and finally toward Anzio. The first landings met no opposition. Heavy mining of the beaches, however, delayed operations and caused some casualties. Operations began at 2 A.M., Jan. 22, 1944. German observers on surrounding hills did not realize what had happened until just before daybreak. With remarkable speed, German 88-mm. cannon, tanks, and aircraft arrived to prevent further disembarkations. But the Germans failed to demolish Anzio and neighboring Nettuno as they had planned. Both towns were occupied by the Allies on D-day. The Luftwaffe used all available craft to bomb the landing grounds. Allied fighters based in Naples battled with the German Air Force. German tanks, in small groups, attempted to slice through Allied bridgeheads. A group of Allied cruisers and destroyers, successfully substituting for land artillery, which was still not unloaded, fought the panzers.

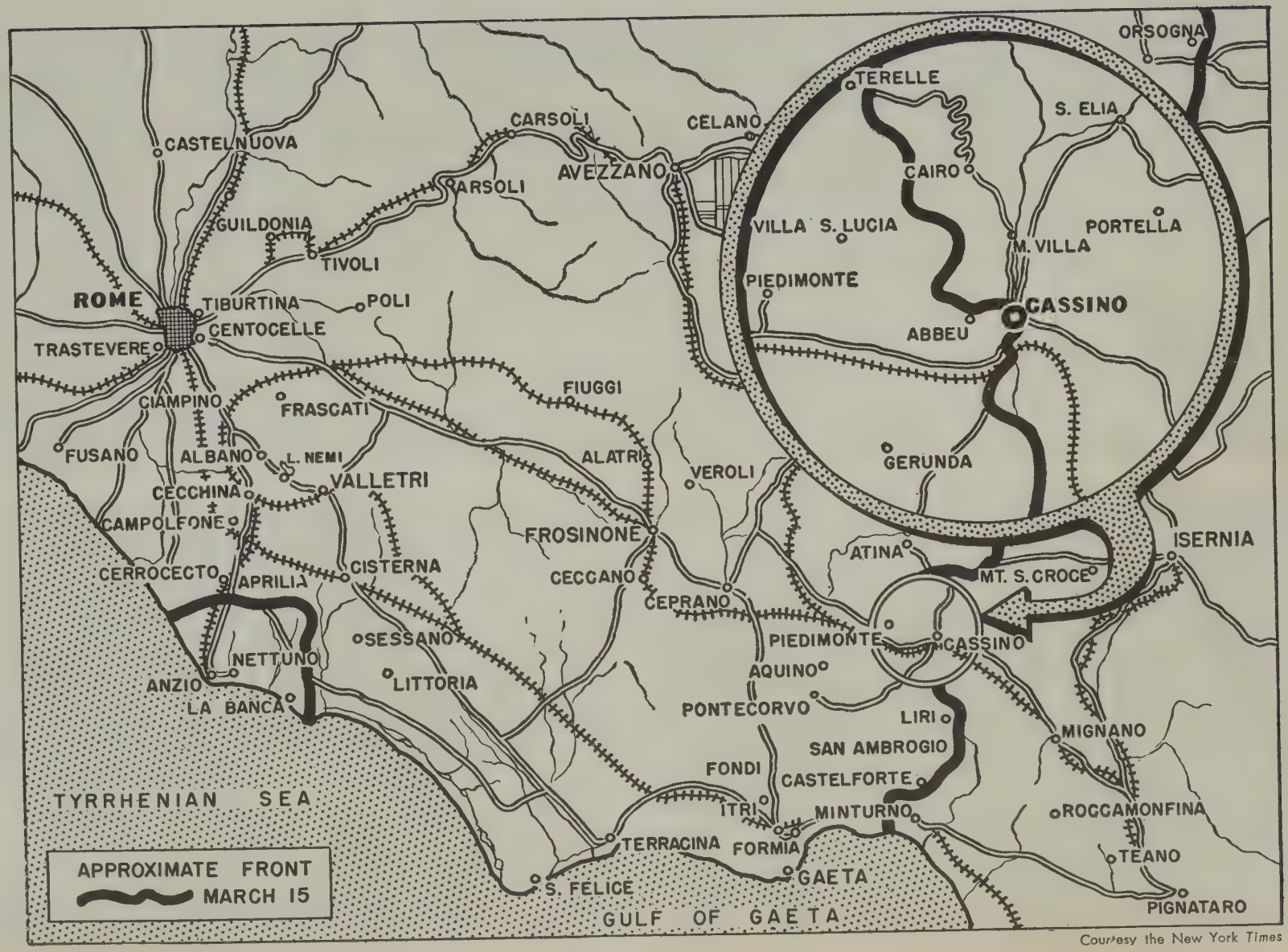
Strong German forces continued to mass around the beach. The Allied High Command had expected such reinforcements to be drawn from the German Tenth Army, but they came from northern Italy and the Balkans instead. Gales delayed landings and accounted for the loss of many small vessels. On January 24, German heavy railroad guns went into action. A perimeter was formed of German forces, which rose to seven divisions during the first month of operations. The beachhead forces attempted to break out but failed. The Americans drove toward Cisterna and the British against Campoleone, but both attacks were repulsed.

On the main Fifth Army front in the south, the Allied offensive fared no better. The entry into the Liri Valley, gateway to Rome, was blocked by the fortifications of Cassino. Thick-walled stone houses with deep cellars were made into pillboxes. The deep and swift Rapido River was another formidable obstacle. The narrowness of operational space prevented armored enveloping moves, while two German tanks in the lobby of a Cassino hotel held off attacking infantry. Monte Cassino rose to the rear of the town. The Allies insisted that the Wehrmacht was using the ancient Benedictine Monastery at the top of Monte Cassino as an observation post. The Allies spared the priceless shrine for a while, but the monastery was destroyed on February 13 to save the lives of Allied soldiers. The Liri River, emptying into the Tyrrhenian Sea, constituted another barrier.

The attack on Cassino and the Liri crossing produced heavy casualties but failed to gain. It was temporarily discontinued after February 3.

In the meantime, the situation at Anzio became critical. Bad weather eliminated the only factor of Allied superiority—air power. On January 27, local German thrusts were stepped up and developed into a full scale offensive. Kesselring aimed to split the beachhead and annihilate the Allied forces ashore. The United States 3d and 45th divisions (the latter landed after the initial invasion) stopped furious German assaults. Allied naval shelling brought temporary relief, but German artillery kept the entire beachhead area under constant fire, and the pressure was severe. On February 10, when German victory seemed almost certain, a break in the weather enabled Allied airpower to go into action. After 48 hours, the German offensive was stopped and disaster prevented, although the bridgehead remained precariously narrow.

On February 16, six German divisions—among them the Hermann Göring Division and the 29th Panzer Grenadiers—attacked Allied lines after a heavy artillery barrage. The British, bearing the brunt of the fight, were pressed back, but an Allied air assault restored the situation. The Germans resumed their drive with 10 divisions. Kesselring then had two armies under his command, the Tenth and Fourteenth. The Wehrmacht used a new weapon, a miniature crewless cable-controlled tank, loaded with up to 150 lbs. of high explosives to be blown up through the control cable. The length of the cable (1,800 feet) limited the vehicle's range and effectiveness. Neither this weapon, nor an improved and enlarged crewless tank, introduced by the Germans two months later, seriously affected the final outcome of the campaign. Two days of fierce struggle brought no important changes of position. After that, the fighting subsided. Kesselring contented himself with hemming in the Anzio beach-



Courtesy the New York *Times*

head to prevent extensive maneuvers by Allied forces, which had increased to almost 150,000.

In the south, Allied attacks were resumed on February 8. A precarious foothold across the Rapido River could not be expanded sufficiently to cut the Via Casilina behind Cassino. Small French advances in the hills west of the city failed to unhinge the German positions. The continuation of the offensive concentrated on Cassino and Monte Cassino, the latter held by troops of the German 1st Parachute Division. After the monastery was destroyed by air attack and artillery fire, artillery pounded Cassino for three more days. But the subsequent assault was again repulsed after two days of hard fighting.

On March 15, another attempt was made to break through into the Liri Valley. Five groups of medium bombers and eleven groups of heavy bombers raided the ruins of Cassino with 1,400 tons of bombs, and an artillery barrage by 900 guns poured 85,000 rounds of shells into the rubble. But cellars remained intact and sheltered by debris. When New Zealanders and Indians launched the infantry attack, they were met by withering fire. Some blocks of ruins were seized at heavy cost, but the crucial southwest corner of Cassino, covering the Via Casilina, remained in German hands. Ghurka detachments tortuously inching up Monte Cassino did not reach its top, and the operation was called off on March 23.

Rome.—Until May 11, there was little activity on either Italian front. Fair weather then permitted continued air activity and on dry ground mechanized units could penetrate into regions inaccessible in winter. Mobility of American-built vehicles permitted attacks in sectors which the Germans had considered secure from tank assault.

The Fifth and Eighth armies launched a coordinated drive from the south. On the Anzio front, Maj. Gen. L. K. Truscott prepared to join the offensive. Truscott's forces included the 3d, 34th, and 45th Infantry divisions, the 1st Armored Division, the first Special Service Force (85th and 88th Divisions), two British divisions, and the 100th Infantry Battalion, composed of Americans of Japanese descent.

Close to the ruins of Cassino, Polish units attacked high ground held by German parachutists. The Poles had been assembled in Russia, but the refusal of their commander to fight under Russian orders led to their transfer to the Middle East and later to Italy. British and Canadians, pushing past the southwestern edge of Cassino, crossed the Rapido River in assault craft. To their left, the French attacked the Aurunci hills close to the Tyrrhenian coast, while American troops pressed along the coastal highway beyond the mouth of the Liri River. The Poles were unable to score substantial gains, but the French, clearing the Germans from hill crests, threatened the upper Liri Valley from the rear, and eased the task of the British and Canadians. The Americans also overcame stiff German resistance.

On May 13, the Eighth Army held a bridgehead five miles wide and one mile deep beyond the Rapido and pressed through a region of extensive minefields where villages were transformed into labyrinths of pillboxes. Three days later, the Via Casilina was reached beyond Cassino and the town was by-passed. On May 18, 1944, the remainder of its garrison of 1,500 men surrendered. The Americans broke through Santa Maria Infanta and reached Formia on the same day. The French, on their right flank, seized Esperia. The Poles under General Anders resumed the attack and drove on Monte Cairo, anchor of two German defensive systems. One of them, the Gustav Line, was already shattered, while the other, referred to as the Hitler Line when it seemed secure and as D-Line when it crumbled, was in the path of the Allied advance west of the Polish sector. Its strongest section was near Pontecorvo. On May 22, the Canadians broke through north of that town, and the line gave way.

The break out from the Anzio beachhead also took place on May 22. Fierce fighting continued around Cisterna until May 25, when the town fell into Allied hands. Advancing beyond Cisterna, General Truscott aimed to cut the Via Casilina to the rear of the retreating Germans from the south. Other beachhead forces marched along the Appian Way to meet the Americans coming up from the opposite direction. On May 25, 1944, spearheading patrols of both groups met on the coast.

The Allies had two objectives: to advance to Rome and beyond, and to trap Kesselring's main forces. The Via Casilina was the Wehrmacht's chief artery of retreat. One lateral road, connecting with the Via Casilina at Frosinone, was used by the Germans falling back from the Pontine Marshes; another, departing from Velletri, was used by the Wehrmacht forces which had been defeated at Cisterna. Stubborn rearguard action enabled most of the German forces from the Pontine Marshes to escape. Few prisoners were taken when the Canadians captured Frosinone on May 31. A determined American attack on Velletri drove a wedge into German lines and reached the heights beyond the town. Velletri was occupied on June 2, but not many Wehrmacht forces from Cisterna were captured. Rome, a most vital road center, was passed by German divisions retreating in a northerly direction. The Alban Hills, on the approaches to the Eternal City, were defended to cover their movements. The Wehrmacht continued rear guard operations beyond the Alban Hills into Rome's southern suburbs. The most historic parts of the city were spared when the Germans pulled out, and the Allies entered Rome on June 4, 1944.

Total German losses in the beachhead area were 25,000, slightly higher than Allied casualties. On the former southern front, the Wehrmacht lost almost 60,000 men, one third of whom were prisoners. Although the Allies had won a victory, they had failed to annihilate their opponents, who retreated toward new defensive positions far south of the Po Valley. But the Fifth and Eighth Armies carried on the pursuit beyond Rome.

THE INVASION OF FRANCE

(The following account of the invasion of France and the subsequent fighting in western Europe is based primarily upon the report by the supreme commander to the Combined Chiefs of Staff on the Operations in Europe of the Allied Expeditionary Force, June 6, 1944, to May 8, 1945.)

On Feb. 12, 1944, Gen. Dwight D. Eisenhower, supreme commander of the Allied Expeditionary Force, received the following directive: "You will enter the continent of Europe and, in conjunction

with the other United Nations, undertake operations aimed at the heart of Germany and the destruction of her armed forces. The date for entering the Continent is the month of May 1944... It is understood that the Soviet Forces will launch an offensive at about the same time as OVERLORD with the object of preventing the German forces from transferring from the Eastern to the Western front. The Allied commander in chief, Mediterranean Theater, will conduct operations designed to assist your operation, including the launching of an attack against the south of France at about the same time as OVERLORD."

"Overlord" was the code name for the invasion of the European continent. No detailed cooperation with the USSR was worked out, and mutual understanding was confined to broad outlines of strategy.

The ill-fated Dieppe Raid had made it clear to the Combined Chiefs of Staff of the United States and British armed forces that an invasion could be carried out successfully only by forces large enough to penetrate the perimeter of German defenses. This type of operation required very substantial shipping space, a large number of landing craft, complete mastery of the air, and the disorganization of enemy communications.

The Germans also understood the importance of air supremacy in the invasion battle. The Wehrmacht generals could not agree among themselves, however, if the main battle should be fought on the beaches or if the invaders should be allowed to advance some distance inland where they could be hemmed in and annihilated by counterattacks. The former attitude represented by Field Marshal General Rommel, had a greater following, because the Dieppe raiders were defeated at the beaches. The second theory was not completely abandoned. Its chief advocate, Field Marshal General von Rundstedt, retained direct command of the threatened areas, while Rommel was appointed field commander. The Todt Organization who were in charge of the construction of fortifications sided with Rommel. It was impossible to establish a complete first line of defense within the anticipated time limit, and the construction of defenses in depth was out of the question. In order to achieve air supremacy, Reichsmarshal Göring planned to mass a special Luftwaffe force of 10,000 planes. German aircraft construction in 1943 was supposed to be increased to 3,000 planes a month.

Although German records later claimed achievement of the production goal, the number of planes actually available lagged far behind Göring's blueprint.

The Military Plan of Attack.—Before the nomination of General Eisenhower as supreme commander, the plan approved by the Combined Chiefs of Staff called for an assault by land, sea, and airborne forces on the coast of Normandy between the mouth of the Seine at Le Havre and the Cotentin Peninsula. After the establishment of beachheads with adequate ports and a breakthrough into the open, the drive was to continue along the Loire and Seine rivers in order to free France and destroy German strength. May 1, 1944 was the date set for this part of the operation which was referred to as "Cossack." A total of 29 divisions was to be available. Three infantry divisions were to land in the first wave, and two in the second, while two airborne divisions preceded the seaborne invaders. Two more divisions would follow quickly, the other 20 gradually as needed. Landing craft were allotted for simultaneous landings by five divisions. Port facilities would have to be made available for all 29 divisions, with three to five more a month coming in later. Landing beaches were to be established in the Caen area first and later on the Cotentin Peninsula. A drive to capture Cherbourg was planned within two weeks after D-day.

On Nov. 29, 1943, directives for Operation Cossack were issued to the Twenty-first Army Group, including the United Stat s First Army and the British Second Army. Headquarters for the operation were in Norfolk House, London. Later, General Eisenhower moved his headquarters to Bushy Park, London. Maj. Gen. Walter Bedell Smith was appointed Eisenhower's chief of staff. Other major appointments were as follows: deputy supreme commander—Air Chief Marshal Sir Arthur W. Tedder; deputy chief of staff—Lt. Gen. Sir F. E. Morgan; chief administrative officer—Lt. Gen. Sir Humfrey M. Gale; commanding general of the 21st Army Group—Field Marshal Sir Bernard L. Montgomery; commander of the Allied Naval Expeditionary Force—Admiral Sir Bertram H. Ramsay; and commander of the Allied Expeditionary Air Force—Air Chief Marshal Sir Trafford Leigh-Mallory.

Experiences in Sicily proved that first-wave-attack force of three divisions was inadequate, so that a minimum of five divisions was ordered. This required a postponement of plans in order to provide additional landing craft. According to a decision reached on Feb. 1, 1944, the invasion was to take place no later than May 31, 1944. On May 17, the date was changed to June 5. An attack on Cotentin Peninsula was included in the initial operations to speed up the establishment of adequate port facilities. The total strength available on D-day was set at 37 divisions (23 infantry, 10 armored, 4 airborne). The planned influx of reserve divisions remained at three-to-five a month. Allied strength at the end of the campaign actually amounted to 61 American, 13 British, 5 Canadian, 10 French, and 1 Polish divisions, plus 3 incompletely equipped French divisions, small Czech, Belgian, and Dutch units, and the French Forces of the Interior whose fighting value was estimated to be the equivalent of 15 divisions. Allied divisions, including tank, antitank, and anti-aircraft units, averaged 17,000 men. On June 1, 1944, United States Army troops in Britain numbered 1,562,000.

The final estimate for D-day of the Twenty-first Army Group under Field Marshal Montgomery was as follows: Canadian First Army (2 Corps), under Lt. Gen. H. D. G. Crerar; British Second Army (1st, 8th, 12th, and 30th corps), under Maj. Gen. Sir Miles C. Dempsey; British 1st and 6th Airborne divisions under Lt. Gen. F. A. M. Browning; and the United States First Army (5th, 7th, 8th, and 19th corps, with parts of the 82d and 101st Airborne divisions) under Lt. Gen. Omar N. Bradley.

Two airborne divisions were to land ahead of the seaborne forces in the rear of the beachhead areas to capture vital bridges and disrupt enemy communications. Air Chief Marshal Leigh-Mallory feared that such operations might result in the loss of 75 to 80 per cent of the men and

aircraft involved, but losses were actually less than 10 per cent.

The assault on D-day was aimed at the beaches between Ouistreham and Varreville. Initial objectives were the capture of Caen, Bayeux, Isigny, Carentan with its adjoining airfields, and the seizure of the city, port, and airbase of Cherbourg. A subsequent advance on Brittany was to capture the ports south to Nantes. The next objective was a drive to the east along the Loire on the right wing and across the Seine on the left wing, in the general direction of Paris, destroying as many German forces as possible in this area. As the ultimate intention was to supply American troops from the United States through the ports of Cherbourg and of Brittany Peninsula, the United States First Army was to take over the right flank, while the British and Canadians (to be supplied from Britain) took the left. The British-Canadian drive was to seize continental Channel ports as far northeast as Antwerp.

The United States First Army was assigned to the beaches of Varreville (code name "Utah") and of St. Laurent (code name "Omaha"). Maj. Gen. J. Lawton Collins' 7th Corps, spearheaded by the 4th Infantry Division, was assigned to make the Utah attack. The 82d and 101st Airborne divisions, dropping near Ste. Mère-Église, were to capture the crossings of the Merderet River, to hold the Douve River barrier, and to assist the advance of the 4th Division. The 7th Corps was to cut through Cotentin Peninsula and seize Cherbourg on D-day plus 8. Omaha's 7,000-yard beach was assigned to the 5th Corps (Maj. Gen. Leonard T. Gerow), with combat teams of the 1st and 29th Infantry divisions (16th and 116th regiments). During the initial advance, forces of the United States Third Army under Lt. Gen. George S. Patton were to land and remain under the operational control of the First Army until D-day plus 30.

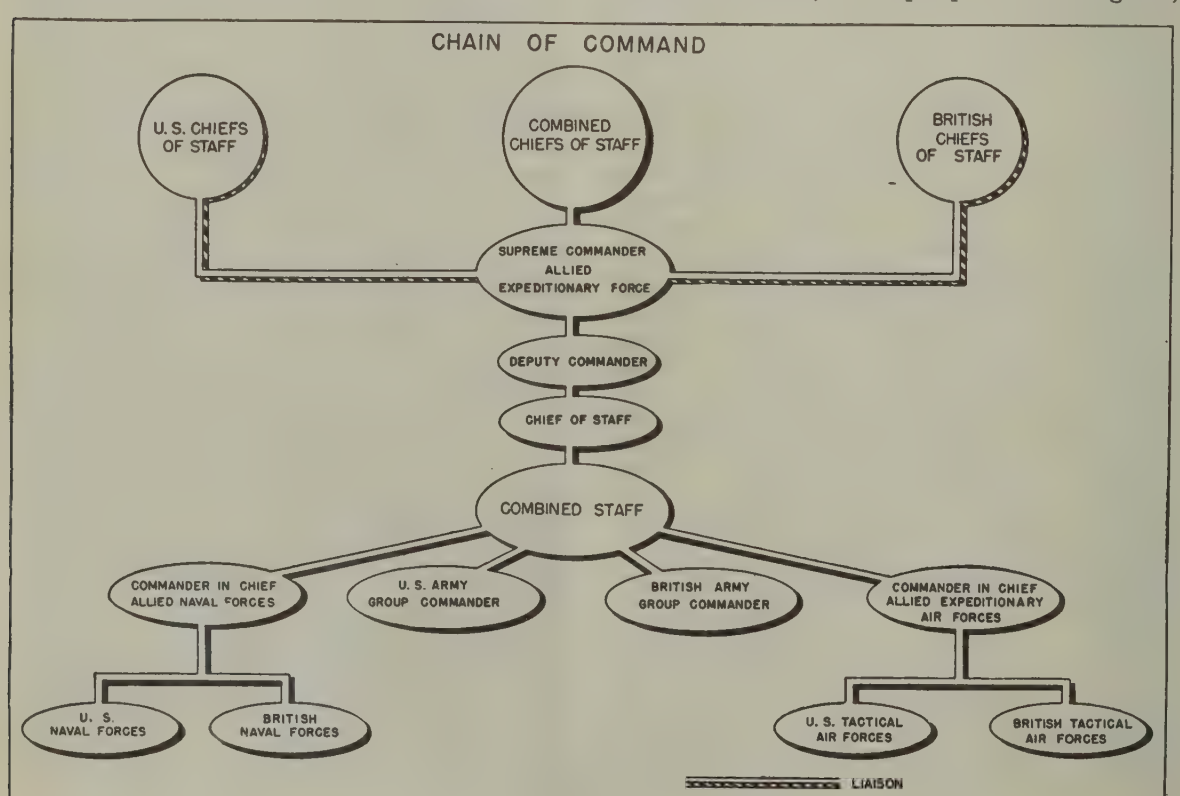
On D-day plus 30, the First Army was to turn into Brittany in the direction of St. Malo, leaving the reduction of the peninsula to the Third Army, and to swing east along the Loire to a line beyond Angers and Le Mans, which was to be reached on D-day plus 40.

The British and Canadian forces, established on the beaches of Ouistreham (Sword), Courseulles (Juno), and Asnelles (Gold), were to protect the Allied flanks against counterattacks from the east and to advance south and southwest of Caen where the terrain was well suited for the deployment of armor and the establishment of airfields.

The first seaborne wave in the eastern sector was formed by the 3d and 50th British divisions and the 3d Canadian Division, while the British 6th Airborne Division was to secure bridges over the Caen Canal and the Orne River. By D-day plus 20, these forces, with follow-up troops, were scheduled to reach the Vire-Falaise line and to continue along the general line of the Seine.

On D-day plus 90, the Allied front was to stand along the Seine River from its mouth at Le Havre to Paris, and along the Loire from Nantes to Orléans. Brittany Peninsula was to be fully occupied. The Allies were to take Paris, or encircle and isolate the big city if the Germans refused to evacuate it, cross the Seine and advance along the Marne to the Somme toward the borders of Belgium, Luxembourg, and Germany.

Further operations envisaged an advance on a broad front, with the main impact on the northern flank, a thrust toward Metz, and a junction with Gen. Jacob L. Devers' forces coming from the Mediterranean coast of France. The invasion of southern France (operation "Anvil" under the supreme command of Field Marshal Sir Henry Maitland Wilson) was postponed to Aug. 15,



1944. The subsequent penetration of the Siegfried Line (Westwall) aimed at inflicting decisive defeat upon the Wehrmacht west of the Rhine. If resistance should continue, Rhine crossings were to be effected in great strength in the direction of the Ruhr, and in lesser strength via the Frankfort Corridor developing into pincers to close east of the Ruhr.

In the early stages of the campaign, Field Marshal Montgomery had operational control of all land forces, including the United States First Army. After sufficient forces were on land, a United States Army group was to come into being under American command, on an equal footing with Montgomery's Twenty-first Army Group. Relations between the British and Americans, according to General Eisenhower's report, remained smooth and effective.

The Role of the Navy.—Naval forces engaged in Overlord amounted to more than 5,000 craft, about half of which were American. On April 15, 1944, an allotment by the Combined Chiefs of Staff assigned 6 battleships (U.S.S. *Texas, Nevada,* and *Arkansas,* and H.M.S. *Warspite, Nelson,* and *Ramillies*), 2 monitors, 22 cruisers, and 93 destroyers to the invasion forces. The naval assault area was divided into the western part (American), and the eastern part (British and Canadian), under the respective commands of Rear Admiral A. G. Kirk and Rear Admiral Sir P. L. Vian. The dividing line ran north from Port-en-Bessin to the parallel of 49° 40′.

Five naval assault forces were assembled as follows:

THE AMERICAN

U (Utah), under Rear Admiral D. P. Moon at Plymouth.
O (Omaha) under Rear Admiral J. L. Hall, Jr. at Portland.

THE BRITISH AND CANADIAN

S (Sword) under Rear Admiral A. G. Talbot at Portsmouth.
J (Juno) under Commodore G. N. Oliver at the Isle of Wight.
G (Gold) under Rear Admiral C. Douglas-Pennant at Southampton.

Two follow-up forces, B and L, were concentrated at Falmouth, Plymouth, and Nore. Vessels of similar speed and design were herded together, landing craft ahead of all other ships. Landing craft included the following types:

LCP—landing craft personnel
LCM—landing craft mechanized
LCS—landing craft support (rocket firing)
LCT—landing craft tank, some of them capable of carrying the heaviest type of armor
LCC—landing craft control
LCI—landing craft infantry, carrying 6 officers and 182 men or 75 tons of cargo
LCVP—landing craft vehicles or personnel
LST—landing ship tanks, 345 feet 10 inches long, with crews of 7 to 9 officers and 204 to 220 men, carrying 27 twenty-five-ton or 15 forty-ton tanks in addition to 168 troops.

The port problem remained troublesome. A delay in the capture of Caen, Cherbourg, and Brittany Peninsula was to be avoided if possible. Engineers and technical experts simplified the problem by designing huge artificial harbors, code named "Mulberries," and smaller installations, called "Gooseberries." Prime Minister Churchill took a personal interest in the construction of two Mulberries, one of which was to operate in the American sector and the other in the British-Canadian sector. Portable breakwaters were made of hollow, concrete caissons up to 60 feet high. The caissons were floated to the beaches and then sunk at predetermined places. The British War Office developed portable Loebnitz piers resembling pontoon bridges, which were built out 3,000 feet to reach water deep enough to accommodate LST's at low tide. A line of ships sunk inshore formed the end of the harbor. A device invented by a Scotsman, Robert A. Lockner, reduced wave levels.

The caissons required 30,000 tons of steel and 500,000 tons of concrete. It took 20,000 men to build them. The Mulberries could handle 10,000 to 12,000 tons of traffic a day, in addition to hundreds of vehicles. The total cost of the artificial harbors amounted to £100,000,000. By Sept. 5, 1944, a total of 2,086,000 men, and 3,446,000 tons of supplies had been landed.

The installation of Mulberries and Gooseberries of similar construction was begun on June 7. Ten days later, the first LST could be brought in. On June 19, the worst gales recorded in 80 years hit the invasion coast. After three days of storms, the American Mulberry was ruined beyond repair, although the British one was kept in operation. The Gooseberries, one per beach, also resisted the elements.

The Allies had 11,000 planes of various kinds available for the invasion. Other surprises for the Germans were rocket-firing Typhoons and several glider types, including the British Hamilcar (net weight 18,500 lbs., carrying capacity 7.8 tons), the British Horsa medium glider, the United States GG-4A Hadrian, and the heavier CG-13A. The Hamilcar could carry 60 airborne troops, or two jeeps or armored cars, or similar heavy matériel such as one self-propelled Bofors gun or one bulldozer. The United States CG-13A accommodated 30 men or an equivalent cargo. Air preparation preceding the invasion was code-named "Point-blank."

General Eisenhower assumed operational control of the Allied air forces in the European theater of war on April 14, 1944. Prior to this date, large scale preparatory operations had begun, including the bombing of critical industrial and military targets. Six industrial systems were considered indispensable to the German war effort: submarines, aircraft, ball bearings, oil, rubber, and communications. During Operation Pointblank, 700 light and medium bombers and 2,434 fighters attacked rail and road targets, bridges, airfields, coastal batteries, and radar stations. The attack on railroads opened on D-day minus 60, on bridges on D-day minus 46, and on airfields within 130 miles of the invasion area on D-day minus 21. During the invasion, 171 fighter squadrons protected naval forces, destroyed remaining enemy radar installations and still intact beach defenses, and covered established beachheads.

On Feb. 9, 1944, civilian travel between Great Britain and Eire was suspended in order to prevent the numerous German agents in Eire from gathering information. On April 1, at General Eisenhower's request, the British government imposed a ban on visitors to coastal areas where the invasion was in preparation. On April 17, the movement of diplomats and their couriers into and out of the United Kingdom was banned, and censorship was extended to hitherto immune correspondence. On May 25, an artificial delay of ten days was imposed on the forwarding of mail to the United States. As a result of these measures, German intelligence failed to learn the initial objectives of the Allied invasion.

In February 1944, von Rundstedt and Rommel had 53 divisions in France, Belgium, Holland, and Luxembourg. By June 3, the number had increased to 60, ten of which were armored, but many divisions were under normal strength. The influx of reserves was slow because of lack of manpower and equipment and the disruption of communications. Sixty per cent of the forces were concentrated in the north, from Holland to the French port of Lorient. The strongest group, the Fifteenth Army, was on duty in Pas-de-Calais; the next strongest, the Seventh, assembled west of that French department. The German High Command was convinced that the Allied invasion would concentrate on Pas-de-Calais. Even after the landings in Normandy, the Germans continued for several weeks to consider them a diversion and refused to send the Fifteenth Army to the crucial sector. The Allied command, aware of the German mistakes, concentrated available surplus shipping in the Thames estuary, close to Pas-de-Calais, and moved embarkation places farther east than was necessary in order to mislead the Germans still further.

The Wehrmacht High Command understood the importance of adequate harbor facilities to the invasion forces. All the main harbors from Den Helder to Brest were heavily fortified, and Cherbourg and Le Havre became primary strong points. The harbor garrisons were ordered to continue resistance even after being by-passed by Allied drives. Lack of supplies would reduce the power of the attackers and prevent deep penetrations. Concrete positions, coastal and flak (AA) batteries, mine fields, and wire entanglements were built between the ports, and obstacles, occasionally connected with mines, were planted in the shallow waters of the beaches. Fixed heavy and medium guns threatened approaching ships. Medium and light artillery, two to three miles inland, was to lay down a tight barrage on invasion beaches. German underground fortifications were reminiscent of the Maginot Line. The morale of their garrisons was influenced by the "Maginot spirit" of total defense. The German defenses did not reach any notable depth except in the harbor zones, and even in Pas-de-Calais they were not really continuous.

German available naval forces (as estimated by the Allies) consisted of 5 destroyers, 9 to 11 torpedo boats, 50 to 60 E-boats, 50 to 60 R-boats, 25 to 30 minesweepers, 60 miscellaneous surface craft, and 130 submarines. An additional 70 submarines, on duty in the Atlantic, were supposed to reach the critical zone within a maximum of 14 days.

Although the Luftwaffe's first-line strength in France was estimated at no more than 3,000 planes, and actually numbered even less—there were fears in the Allied camp concerning jet-propelled aircraft. German construction of this new, fast aircraft began as early as 1937 and had progressed to a point well beyond that reached by the Allies. Large-scale use of it by the enemy could have upset Allied air supremacy, but the actual output of such planes in the Reich was extremely low.

Like the British in 1940, the German General Staff had to wait for the enemy's opening move. But the British still had some doubts about the impending German attack, whereas the Wehrmacht generals were sure that the invasion was coming.

The first United States Navy amphibious training base in Britain for the preparation of the European invasion was commissioned on July 29, 1943, at Appledore. Fourteen more were added by May 11, 1944, including training, operational, and supply bases, the largest of which were at Plymouth and Exeter. LST's and LCT's could be loaded directly from the shore on concrete-surfaced beaches. Installations, naval stores, machinery, and other commodities were obtained by reverse lend-lease. Admiral Stark was in charge of overall administration and in logistic command of bases and ships.

Ships and men poured into the United Kingdom for the naval part of the invasion, referred to as operation "Neptune." A strong enemy bomber force, or an earlier completion of the German V bombs (V standing for *Vergeltung,* which means *reprisal*), might have raised havoc among the anchored vessels. Amphibious rehearsals were held from January through April 1944. In one of the rehearsals, called exercise "Tiger," German E-boats intercepted a group of LST's near Plymouth, sinking two of them and damaging a third.

Attack from the Sky.—The Combined Chiefs of Staff listed the following among the prerequisites of invasion: the inflicting of heavy losses on the German fighter air force; a prolonged bombing offensive against sources of production and supply, and against first-line units of the German Air Force; the disorganization of Luftwaffe units and disruption of field installations within fighter range of the invasion area; the disorganization of the main elements of the German fighter command and control organization in the same area. The disruption of German communications, starting inside the Reich and ending up in the battle zone, was another objective which was more successfully attained than the reduction of the German war potential.

The results of total air war against Germany were overestimated before the occupation of the Reich showed the actual results. Although the widespread ruin was impressive, most of the industrial targets of Allied attack were by no means eliminated beyond hope of reconstruction.

German economic planners, mapping a defensive strategy against growing Allied air attacks, displayed remarkable efficiency in transferring plants into safer areas and in breaking up large production units into smaller ones. Until 1943, Silesia, southwestern Poland, the Czech "Protectorate," Slovakia, Austria, and Hungary were comparatively safe from raids, and the first four of these regions remained so until the last year of the war. Many German plants moved into these "safety zones." The Erla factory of Leipzig spread from 5 units to 25, and the main Messerschmitt factory moved to Wiener Neustadt, Austria, from Augsburg, Germany, and was broken up into 40 units. Moreover, underground factories continued their operations undisturbed by air raids. Labor priority for the construction of such plants was granted only late in the war, explaining why there were so few of them. In general, the German industrial output continued high through 1944 and declined sharply during the last four months of the war.

The number of foreign slave workers drafted into the service of the German war machine reached a total of 12,000,000. German statistics listed "foreign workers" at only 60 per cent of this figure. The rest were considered draftees,

i.e., workers pressed into compulsory labor by the puppet governments of Germany's "allies." Despite the vast number of foreign laborers, many German workers remained deferred from military service because of the tremendous task of repairing bomb damage.

Special German squads repaired damage to railroads and highways. Even so, they could not prevent the disruption of timetables and increased destruction of rolling stock and marshalling yards. During the crucial weeks after the Allied landings in Normandy, German divisions with heavy equipment could travel only a little more than 20 miles a day.

On March 26, 1944, Winston Churchill announced that the American Air Force in the British Isles outnumbered the RAF. The total weight of bombs dropped on Germany and German-controlled areas in the western theater rose constantly from March to May. It reached 37,000 tons during the first five days of June 1944. On D-day, the strength of the United States air forces in the United Kingdom exceeded 9,500 planes, of which more than 3,000 were heavy bombers.

The attack on German aircraft production actually began on April 17, 1943, with the raid on the Focke Wulff plant in Bremen and continued through the year on a limited scale. Allied estimates that the 1943 raids prevented the production of 2,500 Luftwaffe fighters were not confirmed by the facts.

In 1944, Allied raids against German aircraft production centers were greatly intensified. Fighter plants at Aschersleben, Brunswick, and Hanover were among the targets in January and early February. Leipzig was hit with 2,300 tons during the night of February 19. This was followed by a day attack by 1,000 Flying Fortresses, which hit six additional aircraft production centers and added to the destruction of the blazing city. During the following week, Stuttgart, Brunswick, Bernburg, Aschersleben, Halberstadt, Regensburg, Gotha, Hanover, Schweinfurt, Augsburg, and Steyr (Austria) became targets of heavy bombers, while lighter craft struck at Luftwaffe bases in Germany, France, and the Low Countries. Approximately 18,000 tons of bombs were dropped, and the Luftwaffe lost at least 641 fighters against 148 British and 232 United States bombers.

Raids on aircraft plants were stepped up in March and April. In May, attacks on aircraft factories were reduced, and oil and synthetic oil production facilities became the priority targets. Five raids hit Ploesti. Eastern Galician oil wells suffered damage, and refineries in Leipzig were attacked. The raiders of Galicia continued on to Russian bases and returned to Britain and Italy respectively six days later, bombing the targets again on their return trips. Up to early July, 55 refineries and synthetic plants had suffered damage. Allied sources estimated fuel production had been reduced by 70 per cent. The Germans suffered a great loss later in the year when the Red Army occupied Ploesti.

After being hit by five major RAF raids in January and February 1944, in addition to numerous night attacks by Mosquito bombers, Berlin experienced its first all-American raid on March 4. On March 6 and 8, 1,660 bombers and 1,920 bombers respectively, dropped 350,000 incendiaries and 10,000 explosive bombs, at a loss of 134 planes. Production in the Ruhr region was reported in full swing in the early spring of 1944. Essen, Cologne, Friedrichshafen, Mannheim, Ludwigshafen, Frankfurt, and Kassel, among other industrial cities, felt the impact of Allied air power again.

After Germany's unconditional surrender, Field Marshal Gen. von Rundstedt explained the German defeat in the Battle of France by saying: "We had no mobility and could not bring up reserves. Between Paris and Rouen, there was not a single bridge across the Seine." Initial communications-bombing hit two main transportation systems from Germany to the west: one through Hanover and Brunswick to Antwerp, the other through the Ruhr and Cologne to Paris—in addition to alternative lines from Coblenz, Frankfurt, and Stuttgart to France and French railway networks centered in Paris. As damage to rails had no lasting effect, Allied bombing concentrated on bridges, marshalling yards, and junctions. In April, heavy night bombers hit many communications targets. In May, marshalling yards in northern France, Belgium, and Luxembourg were attacked. The center of gravity of air operation switched later toward the middle Rhine, while Italian-based planes hit communications targets in southeastern France. The weight of single bombs used in such raids was greatly increased. A last furious crescendo hammered away at communications serving the invasion area immediately before D-day. The Reich's dwindling rolling stock suffered the loss of more than 900 locomotives and 16,000 freight cars during May 1944. When the invasion of northern France was launched, 50 out of 82 main railway junctions were heavily damaged and 26 out of 29 main bridges between Paris and Normandy were closed to traffic. Loire bridges from Orléans to the mouth of the river suffered almost equal damage.

Radar-bombing technique, first employed by the Allies in the fall of 1943, was improved. German radar stations were severely damaged. Allied scientific countermeasures neutralized most of what remained of German radar.

During the winter of 1943–1944, Rommel ordered coastal guns to be casemated and thicker concrete walls used for pillboxes in the "Atlantic Wall." Heavy coastal guns were frequently silenced but rarely destroyed by air attack. The bombardment did account for substantial delays in the strengthening of German fortifications and the failure to install the large number of underwater obstacles which the German field commander requested.

Germany's Secret Weapons.—The heaviest bombings failed to smash German morale. Later research even led to the conclusion that willingness to fight to the end was highest after raids.

As plans for a 10,000-plane, anti-invasion Luftwaffe could not be realized, the Germans reorganized their air force. The construction of bombers was greatly reduced, and fighter production was stepped up. New weapons were also developed as rapidly as possible, although the destruction of laboratories slowed up their output. The new devices, although they did not interfere with the invasion or delay the Allied victory, gave the British Isles a severe pounding.

The first V–1 missile hit southern England during the night of June 12, 1944. The V-1 resembled a small aircraft, with an overall length of 25 feet and a wing span of 17½ feet. It was launched from platforms along the Channel

coast and propelled by a primitive combustion engine, giving the robot a range of 150 miles at a speed of 200 m.p.h. Flight stability and direction were established by a system of compressed air in spherical bottles. The nose of the missile carried a war head charged with one ton of high explosive, designed to detonate when the bomb dived to its target. The V-1 was not accurate. Its relative slowness made it vulnerable to AA fire and interception by fast fighter craft. Of 8,070 V-1s launched against England up to August 31, 1944, 29 per cent penetrated British defenses, and 92 per cent of those hit the London area. A total of 5,497 persons was killed and 15,934 injured by the V-1 during that period.

The V-2, invulnerable to AA defenses and aircraft, was first mentioned publicly by Prime Minister Churchill on Nov. 10, 1944, after having been in operation since October. It was a wingless rocket, 46 feet long and 5½ feet in diameter, carrying the same weight and kind of explosive as the V-1. Its fuel, 7,500 lbs. of alcohol and 11,000 lbs. of liquid oxygen, was electrically ignited. Travelling at a maximum speed of 3,000 miles an hour, the V-2 had a range of 200 miles and greater accuracy than the V-1. Despite all the damage they caused, the new weapons were useless in the struggle for air superiority.

D-DAY AT NORMANDY

Weather forecasts, unfavorable for the period between June 3 and 5, were rather hopeful for June 6 and 7. June 6, 1944 was set as the final date for Operation Overlord. Between midnight and the dawn of that day, 5,853 tons of bombs were dropped on 10 coastal batteries between Cherbourg and Le Havre. At daybreak, the United States 8th Air Force, preceding the invaders, dropped another 1,763 tons within 30 minutes. Other raids were carried out by medium, light, and fighter bombers of the Allied Expeditionary Air Force. During June 6, the Strategic Air Forces flew 5,309 sorties, hitting various targets with 10,395 tons of bombs, and the Tactical Air Forces made 5,276 sorties.

There were only 50 Luftwaffe sorties on June 6. This was due to the destruction wrought by preparatory Allied assaults on German airfields, to the breakdown of German radar, and to the German insistence on concentrating their depleted air force in the Calais sector. When the Luftwaffe appeared in greater strength, the Allies were already well established on the beaches.

Ahead of the seaborne invaders by an average of 30 minutes, airborne assault forces dropped on both flanks of the Seine Bay. There were in action 1,662 United States planes, 512 United States gliders, 733 British planes, and 355 British gliders. The British 6th Airborne Division descended precisely in the assigned area east of the Orne River, seizing bridges across the Orne and the Caen Canal. Counterattacking elements of the German 21st Panzer Division arrived too late to dislodge the paratroopers. United States airborne landings were hampered by low clouds and high winds. Troops and supplies of the 101st Airborne Division were scattered over an area 25 by 15 miles, and 60 per cent of its supplies were lost. The division nevertheless held the approaches to Utah beach. The United States 82d Airborne Division met heavy resistance at Ste. Mère-Église, but its operations confused the defenders and aided the assault forces at Omaha beach.

Initial seaborne landings, with landing craft spaced 75 yards apart, took place in heavy surf, limiting the use of amphibious DD tanks. Supporting fire from naval vessels was very effective.

German garrisons of permanent fortifications included some very young men and others beyond normal military age. They were mixed with troops recruited forcibly from occupied countries and a number of Russian deserters. Their fighting quality was mediocre but that of field troops was considerably better.

In the British-Canadian sector, seaborne landings starting around 6:00 A.M. were carried out according to plan. The British 3d Division west of Ouistreham (Sword beach) was favored by surf conditions and could use its DD tanks to overcome moderate opposition. The Canadian 3d Division, followed up by the British 51st (Juno beach), pushed through rather heavy gun and mortar fire in the direction of Caen. The British 50th, on Gold beach near Asnelles-sur-Mer, met unexpectedly weak resistance and occupied Arromanches, Meuvaines, and Ryes on D-day. The British 49th and 7th Armored Divisions joined the operations on Gold beach.

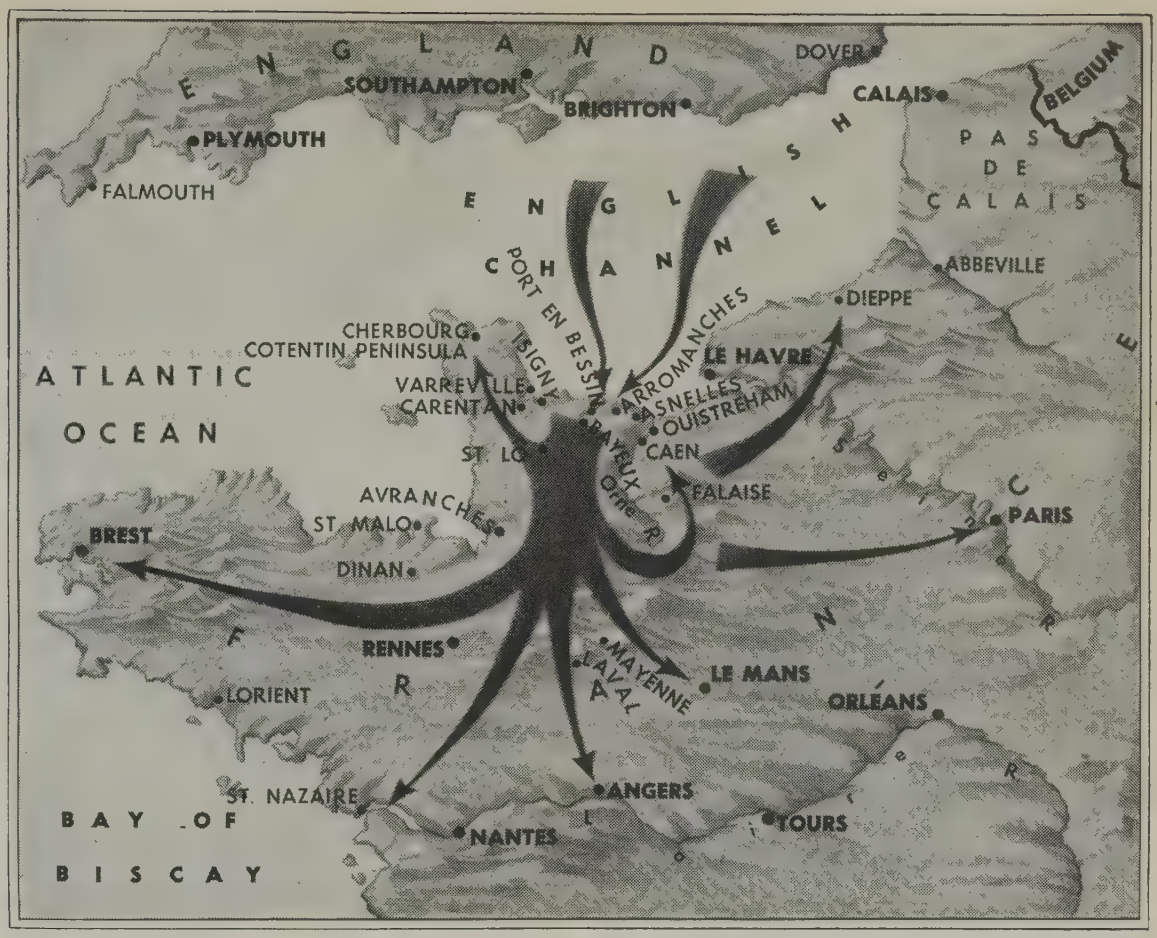
The Americans at St. Laurent (Omaha beach) had more trouble than other invasion forces. The leading elements of the 16th and 116th Infantry regiments not only encountered the Atlantic Wall garrisons, but also the full German 352d Infantry Division. Surf and underwater obstacles destroyed many amphibious tanks and landing craft. Preparatory bombing and shelling had less effect at Omaha beach than in any other sector. The invaders were pinned down and suffered heavy casualties (the 16th Regiment lost one third of its effectives). General Eisenhower's report to the Combined Chiefs of Staff stated: "by their unflinching courage, they turned what might have been a catastrophe into a glorious victory." Omaha beach was secured and the United States 1st, 2d, and 29th divisions went ashore.

The United States 4th Division, west of the Vire Estuary (Utah beach), fared better. The Germans in that sector relied upon flooded rear areas to hold the attack, but airborne troops seized the causeway through the inundated region and the 4th Division, joined by the 9th and 90th Divisions, cut through thinly manned German lines to strike northwest on the road to Cherbourg.

The problem of unloading vast numbers of men and vehicles and many thousands of tons of supplies on bare beaches strewn with mines and obstacles was complicated by heavy seas which did not permit full use of special landing devices. Beach organizations were set up under heavy German artillery fire. Continued rough weather added to the troubles caused by enemy action. By June 11, the unloading of stores and vehicles was 50 per cent behind schedule. Even so, 326,547 men, 54,186 vehicles, and 104,428 tons of supplies were brought ashore over the beaches during the first six days of the invasion.

The German Seventh Army opposing the Allied landing forces was commanded by Field Marshal General von Kluge. Kluge scrupulously obeyed Rommel's order to seek a decision on the beaches and not to allow the Allies to penetrate inland. He even committed his armor close to the landing places.

The British and Canadians, exploiting their initial success, reached a line 2 to 3 miles from Caen. But before their armor arrived in strength, the German 21st Panzer Division, supported by



the 12th SS Panzers, drove a wedge between two Allied divisions and pushed almost to the beaches. The first attack on Caen had failed. The breakout across the Orne and the advance toward the Seine were delayed.

In the center, Bayeux was taken on June 8. The United States 5th Corps advanced toward the Bayeux-Carentan road and established contact with the British 50th Division. On June 11, the 5th Corps reached a line from Caumont to Isigny, where the advance slowed down on the slopes of the hills covering St. Lô.

On the western wing, German resistance was strongest at Montebourg. Kluge wanted to protect the Cherbourg road and to prevent a junction between the Utah and Omaha forces. On June 10, however, the junction was made, and the Allies held an unbroken coastal stretch from Quinéville to the east bank of the Orne. Carentan was captured on June 12.

The Luftwaffe rallied, increasing its daily sorties to an average of 300-350, with a maximum around 450, against 4,000 by the Allies. The German Fifteenth Army in the Pas de Calais remained immobile. Reinforcements from other sources reached Kluge, via long detours, at a rate of about half a division a day. Allied bombing and sabotage by French Forces of the Interior reduced German transportation facilities still further.

The Capture of Cherbourg.—After the fall of Carentan, Kluge dispatched his 77th Division to stop the drive by the United States 9th and 82d Divisions toward St. Sauveur-le-Vicomte, which threatened to isolate Cherbourg. The Americans continued their advance in the woody countryside, where narrow fields were divided by tree-topped embankments, each of them a formidable tank obstacle and hiding place for snipers. Camouflaged machine-gun posts plagued the attackers. The drive on St. Sauveur-le-Vicomte reached its goal on June 16. Three days later, Montebourg was captured by the United States 4th and 90th Divisions. The Germans split into two groups. One of them (two complete divisions and parts of two other divisions) reinforced the naval garrison of Cherbourg; the other, including the 2d Panzer Division, fell back to escape entrapment in Cotentin Peninsula. The United States 4th, 9th, and 79th Divisions pressed on toward the prize port on the heels of the Wehrmacht.

The assault on Cherbourg opened on June 22. The German military and naval commanders, General von Schlieben and Rear Admiral Hennecke, exacted no surrender pledges from their men. This did not prevent them from giving up personally on June 26, when street battles were raging for the second day. Their example was soon followed by the rest of the garrison. By July 1, all resistance in Cherbourg and northern Cotentin Peninsula had ceased. The Allies had gained their first major victory in western Europe. Port installations in Cherbourg were thoroughly wrecked and their use was delayed. A naval fire support group, including the United States battleships *Nevada, Texas,* and *Arkansas,* the United States cruisers *Quincy* and *Tusca-*

loosa, the British cruisers *Glasgow* and *Enterprise,* and 11 destroyers, assisted the army's operations against Cherbourg and silenced opposing batteries on June 25.

While the United States 5th Corps pushed inland in the direction of Caumont, the British Second Army on its left succeeded in holding the German drive, which had been joined by elements of two more panzer divisions. Kluge had thrown six panzer divisions piecemeal against the British to prevent them from giving flanking support to an Allied army which the Germans still expected to land at Calais. Discomfited by the loss of Cherbourg, the German commander had to reinforce the western sector. One more panzer division, the Lehr (instruction) Division, and the 2d Parachute Corps joined the battle against the Americans.

After rapidly expanding United States forces were regrouped, Gen. Omar N. Bradley opened a drive southward on July 3. On July 9, the United States 8th Corps broke through German positions at La Haye-du-Puits. The 7th Corps scored small and costly gains along the Carentan-Périers highway, and the 9th Corps crossed the Vire River. A counterattack by German armor on July 11 was defeated by the United States 9th and 30th Divisions. American forces pressed toward St. Lô, strongly defended by the 2d Parachute Corps.

Not until July 8 could Field Marshal Montgomery resume his attack on Caen. From a total of 900 German tanks in operation, 700 were deployed in this sector. An air attack by 500 heavy bombers, naval shelling by H.M.S. *Rodney, Roberts,* and *Belfast,* and a land artillery barrage preceded the drive. The attackers penetrated into Caen but failed to take the section across the Orne River. The attacks soon slowed down, and another stalemate developed on the Allied left wing. To the right, the United States 29th Division took St. Lô on July 18. West of the city, the 9th and 30th Divisions reached high ground beyond the Vire.

By July 18, 15 United States divisions (three of them armored), and 15 British and Canadian divisions (4 of them armored), faced 27 German divisions, 8 of which were armored. The German Seventh Army had already lost 160,000 out of 540,000 men and 30 per cent of its original 1,200 tanks. Kluge was named field commander in France under Rundstedt, in place of Rommel, who had lost the führer's favor. In his headquarters at Rastenburg, East Prussia, Hitler issued orders to hold and crush the western Allies before the Russians invaded the Reich.

The Battle of the Falaise Gap.—On July 16 and 17, vigorous feints by the British Second Army misled von Kluge, causing him to believe that the main Allied efforts for the breakthrough would be concentrated in the Caen sector. The German field commander directed more armor to the Seventh Army's right wing. The Allied plan, however, contemplated action on both wings. The Second Army's offensive, starting July 18, was to drive across the Orne from Caen toward the Seine basin. On July 19, General Bradley's Americans were to attack across the Périers-St. Lô road, aiming at a complete breakthrough. Spearheads were to swing to Coutances, isolating the Germans between St. Lô and the coast, and then strike down through Avranches in an encircling move, designed to annihilate the bulk of the Seventh Army in cooperation with the British and Canadians closing in from the opposite direction.

The drive across the Orne began on schedule. Air bombardment accounted for considerable confusion. Enemy casualties, however, were smaller than expected. For a few hours, German resistance was scattered. The British 7th, 11th, and Guards Armored divisions, followed by infantry of the 1st and 2d Corps, reached a general line running from Émieville through Cagny to Soliers, where resistance stiffened. Bad weather interfered with air support, and muddy ground with tank operations. No breakthrough toward the Seine was achieved.

Bradley's drive was postponed until July 25 on account of weather conditions. When the assault began, 1,883 heavy bombers showered 4,700 tons of heavy explosives on the Germans. Medium bombers and rocket-carrying fighter bombers brought the total of sorties to 4,979, of which 39 planes were lost. Some bombs fell short, causing losses to American troops, including Lt. Gen. Lesley J. McNair, commander of the ground forces, who was one of the victims.

The United States 7th Corps (1st, 4th, 9th, 30th Infantry divisions, 2d and 3d Armored divisions) crossed the Périers-St. Lô road on July 25 and the St. Lô-Coutances road on the following day. The United States 8th Corps (8th, 79th, 83d, 90th Infantry divisions, 4th Armored Division) also pushed across the Périers-St. Lô road. In the swing toward Coutances, Périers and Lessay fell to the Americans on July 27. The Wehrmacht belatedly attempted an orderly retreat. Kluge's insistence on holding ground as long as possible caused the Germans to be squeezed into narrowing sectors. Columns jammed the roads and offered excellent targets to Allied aircraft. The Wehrmacht suffered higher casualties in retreat than in battle. On July 28, the United States 4th Armored Division penetrated Coutances, the United States 19th Corps reached Tessy-sur-Vire south of St. Lô, and the 5th Corps attacked south of the Cérisy woods. On the eastern wing, British and Canadians probed a German belt of antitank guns, embedded tanks, and mortar emplacements covering Falaise. The Wehrmacht still held firm in the east. In an attempt to bring the retreat from Coutances under control, Kluge dispatched one panzer division and elements of two infantry and one parachute division to his right wing. Of the German Seventh Army, only elements of two divisions in Brittany plus a division immobilized in the by-passed Channel Islands were unshaken.

The Wehrmacht's High Command finally realized that there would be no Allied landings in the Pas-de-Calais area and that the Fifteenth Army had been immobilized in vain. Reserves were drawn from its divisions, but transportation was slow and disorderly.

American progress allowed the establishment of the United States Third Army (Lt. Gen. George S. Patton, Jr.) which came into official existence on Aug. 1, 1944, including the 8th, 12th, 15th, and 22d corps. The 5th, 7th, and 19th corps remained as the United States First Army under Lt. Gen. Courtney H. Hodges. The First and Third armies as a group were under General Bradley's command. The British and Canadians already formed two armies; the Canadian First Army (Canadian 2d and British 1st corps) under General Crerar and the British Second Army under General Dempsey. Together they formed the

Twenty-first Army Group under Montgomery.

General Patton's assignment was to break through Avrancnes into Brittany, to seize Rennes, then to secure St. Malo, the Quiberon Bay area, and Brest, clearing the Brittany Peninsula. Simultaneously, the United States First Army was to seize the Mortain-Vire area, and the British Second was to concentrate near Caumont.

The United States 4th Armored Division took Avranches on Aug. 1. Knocked-out German vehicles, jamming the roads, impeded the American advance more than resistance by scattered remnants of German panzers.

The British Second Army resumed its attack from the area south of Caumont. Twelve hundred bombers supported its drive. Through a mistake, the ground attack failed to open up immediately after the air preparation ceased. Two panzer divisions opposed the British. Vire and Villers-Bocage were taken on August 5 after hard fighting.

In an amazing but characteristic burst of speed, General Patton's army invested Rennes on August 2, took Dinan, and by-passed St. Malo. Four days later, the Brittany Peninsula was cut, and the line of the Vilaine River was held from Rennes to the sea. The United States 5th Infantry Division reached the Loire River between Nantes and Angers. Nantes fell on August 10. On the same day, the United States 6th Armored Division stood before Brest. French Forces of the Interior, some 30,000 strong, effectively aided the Americans in Brittany. The Germans abandoned the interior of the peninsula and used what forces they had left to reinforce the garrisons of the ports of Brest, St. Nazaire, St. Malo, and Lorient, bringing their total strength up to 75,000 men.

The United States 8th Corps and the French Forces of the Interior were left to lay siege to the ports, and the main forces of the Third Army turned their backs to Brittany. The 15th Corps, after seizing Mayenne and Laval on August 6, switched to the east in the direction of Le Mans, supported by the 12th and 20th corps, and from there turned north toward Argentan to join with the Canadian First Army driving on Falaise. The junction was to throw a trap around the German Seventh Army. Kluge's stubbornness in Normandy recalled his costly tactics in Russia, which culminated in the establishment of the hedgehog system.

Field Marshal General von Rundstedt, who had foreseen the failure of a static defense, decided to throw a surprise blow at a weak spot in the Allied lines. The speed of Patton's drive had spread American divisions west of Avranches over a rather wide area, and their supplies were running short. The German capture of Avranches would have enabled the Wehrmacht to cut through to the sea and to isolate parts of the United States Third Army. Five panzer divisions and some infantry, supported by Luftwaffe bombers, formed an assault group. On August 7, the German attack was launched near Mortain against the United States 4th, 9th, and 30th Infantry divisions and the 3d and parts of the 2d Armored divisions. The initial advance reached hills overlooking Avranches. Ideal weather conditions enabled rocket-firing Typhoons of the Second Tactical Air Force to intercept the panzers with striking success. Rundstedt had no reserves available to feed the advance. The German attack subsided five days after it began. Runstedt's maneuver did not delay the Allied move of encirclement. Taking Le Mans on August 9 and Angers on August 10, the United States 5th Corps reached the outskirts of Argentan on August 12.

The United States First and British Second armies, from Vire and Mont Pinçon, and the Canadian First Army, violently opposed by the newly organized German Fifth Panzer Army, reached Falaise on August 17. The Allies pressed to close the narrow corridor of escape. Two panzer divisions attempted to keep the pocket's eastern exit open long enough to permit extrication of the armor.

In general, British and Canadian progress had been less impressive than American, but General Eisenhower, in his report, had this to say: "Without the great sacrifices made here by the Anglo-Canadian armies in the series of brutal, slugging battles, first for Caen and then for Falaise, the spectacular advances made elsewhere by the Allied forces could never have come about."

The trap was closed on August 20. Parts of eight panzer divisions succeeded in escaping, but lost most of their equipment. Two panzer and eight infantry divisions were caught inside the vise around Falaise. For five days, Allied air and ground forces battered the trapped Germans, who suffered terrific casualties. Then the pocket was liquidated. German losses in the west amounted to 400,000 (half of them prisoners) from D-day to August 25, in addition to 1,300 tanks, 20,000 vehicles, 500 assault guns, and 1,500 guns of various other types, not including fixed coastal batteries. The Luftwaffe lost 2,378 planes in the air and 1,167 on the ground.

The remnants of the German Seventh Army and Fifth Panzer Army were in headlong flight toward the Seine. Von Kluge, relieved of his command, committed suicide. Field Marshal Walther von Model became field commander in the west. What was left of the German Seventh Army was under the command of Gen. Hans Eberbach until August 31, when the general and his staff were captured at breakfast in Amiens.

The Liberation of Paris.—As the Allied advance progressed, the resistance movement in Paris came into the open. On August 19, the Germans laid siege to the Police Prefecture of Paris, and the police went on strike. Barricades were built in the streets. The German commander, Gen. Dietrich von Choltitz, made an unsuccessful attempt to negotiate a truce with the French resistance forces to allow his 10,000 men to withdraw across the Seine. Unable to hold the Paris streets, the Germans finally withdrew into buildings converted into strong points.

While the United States 15th and 5th corps were engaged in the Battle of the Falaise Pocket and the 8th continued operations in Brittany, Patton's 12th and 20th corps dashed eastward along the northern bank of the Loire. After the encirclement at Falaise was completed, the 15th Corps joined the other two under Patton's command in the race toward the Seine. Each corps was spearheaded by an armored division. The speed of the drive made it unnecessary to seize the strategic Paris-Orléans gap by airborne operations, as originally planned. On August 19, the 15th Corps reached the Seine at Mantes-Gassicourt, severing roads between Paris and Normandy. The 12th Corps took Orléans on

August 17. Its vanguards, cooperating with patrols of the 20th Corps, reached Fontainebleau three days later. While Allied armor drew a sickle-shaped line around the southeastern approaches to the French capital, German rearguards outside Paris fell back to the right bank of the Seine. On August 25, in another lightning sweep, vanguards of the 12th Corps reached a point 40 miles east of Troyes and continued toward the German border, only 60 miles away.

A fighter-bomber group of the 14th Tactical Air Force was attached to each armored division, providing the "eyes" for the columns and smashing the enemy's troop concentrations, armor, and supply system in advance of the ground forces.

The Wehrmacht's situation resembled that of the French armies in 1940 after the collapse of the Somme position, but the Allied supply situation was not as good as that of the Germans four years earlier. A dense net of intact communications had fed the Wehrmacht, advancing in a country of plenty which their occupation later transformed into a region of want. In 1944, by contrast, the Brittany ports were still in German hands; the wreckage of the port of Cherbourg had not been cleared; beaches and artificial harbors were overworked; railroads were out of operation; and truck transportation was not adequate for the needs of the advancing Allied armies. By air cargo, 2,000 tons of supplies per day did reach the onrushing Third Army. The planes needed for this purpose had to be taken from those allotted to the newly created First Airborne Army, under Lt. Gen. Lewis Brereton.

To satisfy French patriotic feelings and in recognition of the merits of the French Forces of Resistance, the honor of entering the capital ahead of other Allied units was bestowed upon the French 2d Armored Division, which, equipped with American matériel, had formed part of the Third Army spearhead at Argentan. This division had fought its way from Lake Chad to Tunisia in 1942–1943 and had a proud share in the liberation of Africa. On August 24, its tanks were in the outskirts of Paris. On August 25, the commander, Gen. Jacques Leclerc, received the surrender of the German garrison.

Remnants of the panzers from the Falaise gap crossed the Seine River on ferries and pontoons. The latter, well camouflaged, had largely escaped the attention of Allied airmen and facilitated German movements across the river. A single crossing ferried an average of 9,000 troops per night. Dense concentrations on their way to the ferries, however, offered ideal targets for air attacks, stepped up to 2,000 sorties a day. The British and Canadians closed in from the west against stubborn German rearguard action. This advance along the sea was supported by naval artillery. A delaying stand on the Touques River was broken on August 24, and another German resistance center at Elbeuf was captured on August 25. By August 30, the only German soldiers west of the Seine were beleaguered, port garrisons. The German Fifteenth Army, after diverting most of its divisions to the battered Seventh and Fifth Panzer armies, was badly mauled.

The Battle for the Brittany Ports.—German garrisons in the ports of Brittany rejected appeals to surrender. By August 8, all resistance ceased inside the peninsula. The attack on St. Malo opened immediately thereafter. The city was occupied on August 14, but the Germans held the citadel in a desperate stand for three more days. When the citadel was overwhelmed, resistance continued on the Isle of Cézembre, where heavy batteries commanded the approaches to the harbor. The British battleship *Malaya* assisted the attackers, and Cézembre gave up on September 2.

Brest, formerly the chief Atlantic U-boat base, had a garrison of 30,000 men under the command of Lt. Gen. Hermann Ramcke. Land attacks against Brest were supported by air bombardment and naval shelling. Progress was slow, and the Germans fought block by block within the city. Ramcke did not surrender until September 18. German demolition squads completely wrecked the once magnificent harbor installations, making it impossible to use the port as a major supply base.

It seemed more important to reinforce Allied armies advancing toward Germany than to continue the struggle for the remaining Brittany ports: Lorient, St. Nazaire, and Quiberon Bay. On September 5, the Third Army was freed from commitments in the west to take part in operations near the German border, and its 8th Corps was transferred to the newly created Ninth Army under Lt. Gen. W. H. Simpson. After the fall of Brest, the Ninth Army moved to the German border. French Forces of the Interior, equipped with United States matériel, besieged the ports in a sort of mutual blockade. The Germans were unable to break out, and the French were too weak to capture the ports.

The Invasion of Southern France.—Allied operations in southern France formed an integral part of overall strategy in western Europe. Their success was essential to a rapid continuation of the Allied sweep toward and beyond the German border.

By the beginning of 1944, Vice Admiral Henry K. Hewitt, commander of the Eighth Fleet, had been appointed naval commander for the operation (code-named "Anvil") with the designation of Commander Western Task Force. Beaches selected for landings were east of Toulon, in the Cavalaire-Fréjus area, from where the invaders could thrust rapidly up the Rhône Valley. German coastal defenses were stronger than those along the channel coast. German land forces available for possible counterattacks were inadequate, and the Luftwaffe in the Mediterranean was no longer a major factor.

Eleven divisions were allotted to Operation Anvil. The United States 3d, 36th, and 45th Infantry divisions and the French 1st Armored Division plus small British units, formed the assault forces. The remaining divisions were French and constituted the French First Army, under Gen. Jean de Lattre de Tassigny. The American Seventh Army, under Maj. Gen. Alexander M. Patch, consisted of elements of General Truscott's 6th Corps and the 1st Special Service Force. British and American airborne task forces were assigned to an assault west of St. Raphaël. These reinforced armies were combined into the 6th Army Group under Lt. Gen. Jacob L. Devers on Sept. 15, 1944. The air commander was Brig. Gen. Gordon P. Saville. The Supreme Allied Commander in the Mediterranean was Gen. Sir Henry Maitland Wilson. The German Nineteenth Army, opposing the invaders, was badly deployed and poorly led. It was un-

able to offer resistance comparable to that which the Allies encountered in Normandy.

Air attacks against invasion targets in southern France began on April 29, when the airfields of Toulon were heavily raided. They continued according to a plan coordinated with the bombing of German-occupied Europe and the pattern used in the northern areas. Far-reaching isolation of the assault region was achieved by damage to bridges, tunnels, viaducts, and marshalling yards. On the eve of the invasion, the Mediterranean Allied Strategic Air Force flew 5,400 sorties, dropping 6,700 tons of bombs.

As a preparatory operation, the island of Elba, five miles off the coast of Italy, was invaded on June 17, 1944. The Germans on Elba numbered little more than 2,000 men, but they were alert and strongly entrenched at the invasion beaches. A naval task force under the command of Rear Admiral T. H. Troubridge transported the invaders: the French 9th Colonial Division and support elements, under the command of French General Henri Martin. The struggle on the landing grounds lasted for several hours. On June 19, organized resistance ended. Heavy batteries, subsequently set up opposite the mainland, curtailed the movements of German convoys sneaking along the coast.

Early in August, Allied naval forces assembled for Operation Anvil. They included 515 United States, 283 British, 12 French, and 7 Greek vessels, and 63 merchant ships of various nationalities. On August 9, the first assault convoy sailed from Naples. On August 14, all the ships and 1,370 shipborne landing craft assembled in the assault area.

Shortly after midnight on Aug. 15, 1944, French commandos and units of the United States First Special Service Forces landed near Cap Nègre and on the Hyères Islands. These vanguards, under the command of Rear Admiral L. S. Davidson, were assisted by naval gunfire from support ships under Rear Admiral R. S. Chandler. No opposition was met on the islands, and only inaccurate small arms fire was encountered at Cap Nègre. Diversionary groups operated in the Nice-Cannes area and between Toulon and Marseille. A mock landing and repulse was staged at La Ciotat. At dawn, more than 1,300 heavy and medium bombers attacked the assigned beaches for one hour and 20 minutes. Their assault was joined by shells from 53 gunfire support ships and a shower of 14,000 rockets.

The main amphibious landings were made at 8:00 A.M. in the Fréjus-St. Raphäel sector under the command of Rear Admiral S. S. Lewis, in the St. Marine-St. Tropez area under Rear Admiral B. J. Rodgers, and on the beaches of Pampelonne and Cavalaire Bay under Rear Admiral F. J. Lowry.

In an appeal to the French people, General Wilson declared that the new invasion's objective was to join up with the Allied forces advancing from Normandy. To reach this objective, the Allies had to cut through the southern part of France in an advance northward and later eastward toward the German border. The southern coast of France and its harbors were also to be seized to serve as channels of supply.

The Luftwaffe was absent from the invasion beaches for many hours. German shore batteries and pill boxes remained almost inactive, and isolated resistance was rapidly overcome. Allied casualties during the opening operations did not exceed 300.

Beachheads 50 miles long were established and linked on August 15, including St. Tropez, Dramont, and Hyères, and high ground between Cannes and Toulon. The next day, spearheads penetrated up to 35 miles inland. Some forces were 10 miles from Toulon and in the outskirts of Cannes. Two German corvettes were engaged and destroyed in the Ciotat area by the United States destroyer *Endicott* and two British gunboats on August 17.

Toulon came under artillery fire on August 17 also. Some German opposition was encountered outside the naval base and near Cannes. Most of General de Lattre de Tassigny's French forces operated along the coast. The United States Seventh Army and the remaining French troops turned north. The 36th Division under Brig. Gen. Frederic B. Butler raced straight from the beaches through Gap and seized Grenoble on August 23. There it split into two groups. One continued to the north; the other turned toward the Rhône Valley to cut off parts of the German Nineteenth Army. The main forces of the 6th Corps, advancing through the Rhône Valley from the river's estuary, pressed on in pursuit of the Wehrmacht, but the speed of the German retreat prevented a complete German débacle. The Allies had taken 10,000 prisoners three days after the invasion began.

Meanwhile French forces by-passed Toulon and pushed on toward Marseille, the biggest French commercial port in the Mediterranean. Cut off fom the main German forces, the defenders of Toulon and Marseille did not fight to the end. Both ports, only slightly damaged, were in Allied hands on August 29.

The American column advancing northward beyond Grenoble reached the Swiss border north of Annecy on August 25. French Forces of the Interior, operating in the Savoy Alps under the command of Gen. Jean Gabriel Cochet, assisted the drive by harassing German garrisons. Six German militia battalions surrendered to the F.F.I. American forces in the Rhône Valley, joining hands with the other column from Grenoble near Avignon, reached the great industrial city of Lyon on September 3.

On September 5, southern French territory held by the Allies extended from Narbonne and Monaco on the Mediterranean to Mâcon in the north. German rearguard action in the Saône Valley stiffened to gain time for the Nineteenth Army to reach the Belfort Gap and to organize a determined stand along what was to become the southern wing of the unified battlefront covering the border of the Reich.

On September 6, troops of Patch's army, advancing through Chalons-sur-Saône, were reported to be only 60 miles from the United States Third Army at Bar sur Seine. On September 11, patrols from both armies established contact west of Dijon. Contact in force was made ten days later west of Épinal.

THE ROAD TO GERMANY

On September 1, General Eisenhower's headquarters moved to the European continent. Montgomery continued in command of the Twenty-First Army Group, designated as the Northern Group of Armies. General Bradley's command, known as the Twelfth or Central Group of Armies, consisted of the United States First Army,

Third Army, and Ninth Army. On September 15, the French First Army and the United States Seventh Army, organized as the Sixth or Southern Group of Armies under Lieutenant General Devers, also came under General Eisenhower's supreme command.

The Northern Group of Armies was accompanied by the Second Tactical Air Force under Air Marshal Sir Arthur Coningham; the Central Group by the Ninth Air Force under Maj. Gen. Hoyt Vandenberg; the Southern Group, originally supported by units of the Twelfth Tactical Air Force, was accompanied by what constituted the First Tactical Air Force.

All British and American Airborne Forces, under the command of General Brereton, formed the First Allied Airborne Army. They included the United States 18th Corps (82d, 101st, and 17th Airborne divisions), the British Airborne Troops Command (1st and 6th Airborne divisions), the United States 9th Troop Carrier Command, and the RAF 38th and 46th groups.

In his report to the Combined Chiefs of Staff, Eisenhower tells that it was decided to attack northeastward in the greatest possible strength, as the bulk of the Wehrmacht was reported to be there. Flying bombs, hitting England in increasing numbers, were launched from sites along the coast. Antwerp's port facilities were strongly needed, and possession of Belgian air bases would facilitate future advances. There were also other important reasons for this direction of attack. In late summer and early autumn, the lower Rhine offered the best avenue of advance into Germany and, if pushed through speedily, both the Siegfried Line and the Rhine River might be crossed, and strong bridgeheads established before the enemy could recover sufficiently to make a definite stand in the Arnhem area in Holland. Strong United States forces were assigned to support the Northern Army Group, while the First Airborne Army was made available to Sir Bernard Montgomery.

On August 30, the Canadian First Army broke out of bridgeheads across the Seine on both sides of Rouen. Rouen and Dieppe were occupied September 1. The garrison at Le Havre refused to surrender on September 4, but eight days later, following an aerial bombing with 11,000 tons of explosives and a naval shelling by forces that included the British battleship *Warspite* and the monitor *Erebus,* an attack by the 49th British Infantry Division led to the capitulation of the city with 7,000 troops. The Somme River, undefended by the Germans, was crossed September 4. Boulogne and Calais were surrounded on September 6, but were not captured until September 23 and 30 respectively. Smaller harbors at Fécamp, St. Valery-en-Caux, Le Tréport, and Abbeville were occupied without opposition.

Penetrating into Belgium, the Canadians seized Ostend on September 8. Turning east, patrols entered Bruges on September 9. The Canadian 2d Corps invested Dunkerque on September 11, while the Canadian 4th Armored Division took Blankenberghe on the Belgian Channel coast. As Dunkerque resisted, it was decided to encircle its garrison of 12,000 without staging an assault.

The British 11th Armored Division, advancing 30 miles from its bridgehead across the Seine at Vernon, took Amiens and crossed the Somme River on August 31. Other British units, including the Guards Armored Division, turned northwest toward the Channel and captured Albert, Bapaume, and Doullens on September 1. The British 11th Armored Division, after crossing the Belgian border at Tournai and advancing 60 miles in 36 hours, raced toward Brussels, which was reached in the late afternoon of September 3. The Germans made no attempt to defend the Belgian capital. Before leaving, however, they told the people by radio that they would return. Part of the British 11th Armored Division turned east and reached Louvain. The remainder continued toward the port of Antwerp, which was seized almost intact on September 4. The harbor, however, was useless until the Scheldt estuary was cleared of mines, and German positions commanding the sea lanes, on South Beveland and Walcheren Island, were reduced.

The British took Ghent on September 6. Northeast of Louvain, the forces of the British 30th Corps established a deep bridgehead across the Albert Canal, seized Bourg Leopold on September 7, and crossed the Dutch border to a point seven miles from Eindhoven on September 12. Other units of the corps advanced almost to the Meuse River. These advances were no longer made in sweeping drives against negligible resistance. The Allied lines were stretched, and the Germans, assembling substantial forces, strongly contested their further progress.

The American First Army's 7th Corps crossed the Aisne on August 29. Its 3d Armored Division cleared Soissons and Laon after a sharp fight and, supported by infantry, crossed the Belgian border to Charleroi and Mons on September 3. The United States 19th Corps, spearheaded by the 2d Armored Division, raced from Montes to Montdidier, and from there to the Belgian border south of Tournai, which was reached on September 2. German forces, in a pocket extending from Mons to Compiègne which was by-passed by the advance of the 7th and 19th Corps, briefly opposed the progress of the United States 5th Corps. On September 5, mopping up operations liquidated the pocket and took 25,000 prisoners. Then the 5th Corps moved to the right of the First Army, crossing the Meuse north of Sedan. The latter town fell to the 5th Armored Division on September 5. Five days later, the same division liberated the city of Luxembourg. On September 11, it reached the German frontier and the Siegfried Line.

The 7th Corps captured Namur and the Meuse crossings near Dinant on September 4 and 5, took Liège on September 8, and reached Limbourg on September 9. The closer it moved to the German border, the stiffer German resistance became. The Wehrmacht fought hard at the Meuse. But the Americans continued to advance and, at 5:23 P.M. on Sept. 10, 1944, the artillery of the 7th Corps shelled German territory. Land war returned to the western border of the Reich four years and four months after France and the Low Countries were invaded by what seemed then to be the invincible Wehrmacht. On September 11, the 19th Corps, paralleling the 7th Corps drive, reached the edge of Maastricht and crossed the Meuse, and the 7th captured Eupen and Malmédy.

General Patton's 4th Armored Division took St. Dizier and the 80th Infantry Division captured Châlons-sur-Marne on August 30. On September 1, the 20th Corps of the Third Army occupied Verdun and crossed the Meuse in the direction of Metz. On September 2, the 12th Corps

approached Nancy, which was taken thirteen days later. Additional crossings of the Meuse resulted in the seizure of St. Mihiel on September 2. Pont-à-Mousson, 13 miles south of Metz, was occupied by the Americans but remained under German artillery fire.

Between September 7 and 11, units of Patton's army, despite furious German opposition, established positions on the eastern bank of the Moselle between Metz and Nancy. On September 13, Thionville, 12 miles north of Metz, was reached. Further advances were blocked by substantial German forces. Other Third Army troops wheeled southward from Toul to compress the Belfort gap through which the German Nineteenth Army was withdrawing. After firm contact was established with General Patch's columns, the Allied line in the south extended from due south of Épinal to the Swiss border.

The United States 83d Division, far to the rear of the main front and southwest of Orléans, encountered German troops of the First Army formerly stationed in the Biscay Bay area. The German commander suggested a *pro forma* battle, in which one battalion of each force should take part, after which he would surrender. On September 16, the Americans asked for and obtained unconditional capitulation of the enemy troops, numbering approximately 20,000.

A few more Allied divisions, plus more ammunition and fuel, might have shortened the duration of the war by many months, but they were not available, and nothing short of complete success in the impending airborne operations on the Allied left wing could bring about quick victory.

The Battle of Supplies.—Allied merchantships numbering 2,000, with an aggregate displacement of four million tons, were prepared and took their place in the plan of massing supplies for the Allied Expeditionary Forces. Their crews of 70,000 men were not under direct naval discipline, but, to quote General Eisenhower, "they served the cause with consistent courage and devotion to duty."

Although the amount of supplies and matériel unloaded in northern France fell short of expectations, 1,000,000 men were ashore on D-day plus 28 and, ten days later, 300,000 vehicles and one million tons of supplies had been made available to the invading armies. Rhine ferries and many minor landing craft proved too lightly built for rough seas, and their serviceability rarely rose above 50 per cent.

A large proportion of the men and supplies still had to be landed on the beaches. Between D-day and September 30, Omaha beach handled a daily average of 10,000 tons of supplies, and Utah 5,000 tons. Cherbourg did not begin to function until August and did not reach its full capacity until October. Brest was thoroughly wrecked, and Antwerp was useless as long as the Germans could block the Scheldt estuary. Small anchorages, such as Ouistreham, Courseulles, Port-en-Bessin, Granville, St. Malo, and Morlaix, could not contribute much to the solution of the tremendous supply problem.

After D-day, the Germans attempted to disorganize Allied beaches and anchorages, but Allied navies and air forces were on guard constantly against German aircraft, E-boats, explosive motor boats, and human torpedoes. Losses due to such enemy action remained small in proportion to the tonnage involved. Land artillery fire hit the beaches as long as they were within German range. The reduction of Cotentin Peninsula removed this menace fairly soon in the west, but the eastern sector, particularly Sword beach, remained under prolonged shelling.

The cross-channel supply of fuel constituted a special problem. Submarine pipelines were laid across the Channel according to a plan known by the code name of "Pluto." Each line, three inches in diameter, was expected to discharge 250 tons of gasoline a day. Construction of the pipe lines was a hazardous operation and was greatly hampered by bad weather. The first line was not completed until August 12, and the second nine days later, the date by which 10 lines were to have been in operation. Leaks and stoppages further delayed their full use, while fuel consumption rose enormously, and the transportation of gasoline in cans put a heavy strain on the already overloaded supply system. When Operation Pluto was finally completed, 16 pipe lines were available.

During the most vital period of the campaign, the Allies had to rely on crippled Cherbourg, the remaining Mulberry, five smaller Gooseberries, and the beaches. On the continent, bridges and railroads had to be constructed, and major junctions and assembly points had to be repaired. Only 1,800 of 2,700 locomotives urgently needed were available in France. The rest had to be shipped over from England. Paths had to be cleared through the rubble of ruined towns and villages to enable Allied vehicles to pass.

Transport planes were not available in sufficient numbers to get enough food, ammunition, and fuel to the armored spearheads, and a network of trucks was introduced known as the "Red Ball Express." A circular, one-way traffic route led across France from the beachheads to the fighting zone and back again. Along the Red Ball Highway, from which all civilian and local military traffic was barred, an unending stream of truck convoys rolled at high speed day and night. On single track railroad lines, never intended for heavy traffic, trains loaded to capacity pushed eastward in a close and continuous chain.

Consumption of artillery and mortar ammunition in northern Europe averaged 8,000,000 rounds a month (80 per cent of the grand total used by the AEF in World War I). Approximately 36,000 small arms, 700 mortars, 500 tanks, 2,400 vehicles, and 100 field pieces had to be replaced each month. Gasoline requirements were one million gallons a day.

Although Allied transportation experts and technicians performed what can properly be termed miracles, logistic difficulties slowed up the Allied advance. When Antwerp became usable, it handled an average of 25,000 tons of supplies a day despite heavy fire by V-weapons (which at one time fell at the rate of one every 12½ minutes, causing thousands of military and civilian casualties). Antwerp was not available, however, until late in November 1944. The German tactics of restricting Allied port facilities in every possible way was the most successful scheme devised by the supreme command of the Wehrmacht to counter the invasion.

A daily average of 18,000 tons of supplies moved through Toulon and Marseille after they became operational in late September, although these ports were relatively far away from England, the main Allied storehouse. Railroads and trucks carried matériel and 14 reserve divisions to meet the requirements of the Southern Army

Group and part of the Central Army Group. This supply channel was helpful, but neither adequate nor in time to bring Germany to its knees in 1944, since the great airborne operation failed to reach its decisive objectives.

The Bridge at Nijmegen.—General Eisenhower decided to make a daring move to gain flanking bridgeheads across the lower Rhine beyond the main fortifications of the Siegfried Line. In his own words: "the main highway to Berlin—the plains and level fields of northern Germany—lay beyond the Rhine in the north, and . . . the southern country was unsuitable for the desired rapid advance and continued exploitation by reason of its mountainous and forested terrain."

The Allied commander in chief planned to turn the German right flank by a combined airborne and land operation. The airborne part, called Operation "Market," was designed to capture the vital bridges over the Maas, the Waal, and the Lower Rhine at Grave, Nijmegen, and Arnhem. The forces employed included the United States 82d and 101st Airborne divisions, the British 1st Airborne Division, and the Polish 1st Paratroop Brigade. The British 1st was to drop farthest north in the Arnhem area, the United States 82d around Nijmegen, and the 101st north of Eindhoven near St. Oedenrode. In the supporting land operation, "Garden," the British Second Army was to advance northward from the line of the Albert and Escaut canals. While the airborne forces held the bridges, the armor, pushing on to the Zuider Zee, was to cut off enemy troops in western Holland. The axis of advance, in a narrow sector with but one road as a supply line for most of the distance, lay through Eindhoven, St. Oedenrode, Veghel, Uden, Grave, Nijmegen, Arnhem, and Apeldoorn. During the first two days of this greatest airborne operation ever attempted, 2,800 planes and 1,600 gliders were employed. Between September 17 and 30, 20,190 troops were dropped by parachute, 13,781 landed in gliders, and 905 landed on a strip made ready by preceding airborne troops. Equipment and supplies amounting to 5,230 tons, 1,927 vehicles, and 568 artillery pieces were transported by air. In support of the airborne troops, the air forces flew 7,800 sorties, in which heavy bombers battered enemy AA positions and neutralized Luftwaffe bases in the vicinity of the planned operation. Initial losses en route and in the dropping zone were slight.

On September 17, the United States 101st Airborne Division seized Eindhoven, and the 82d took Grave. The British Guards Armored Division, overcoming heavy German resistance, established contact with both divisions on September 18. Nijmegen and the vital 6,000-foot long road bridge over the Waal were strongly held by the enemy. A regiment of the 82d Division crossed the river north of the span in boats, while the British seized the southern end. Confused and heavy fighting raged between Nijmegen and Arnhem, where the 1st British Airborne Division, after a successful landing, was opposed by superior German forces. The British infantry of the 30th Corps did not reach the lower Rhine in force until September 24. The corps found it impossible to cross the Lower Rhine and join the paratroopers on its northern bank, where they were being forced into a contracting perimeter, 1,000 by 1,500 yards. On September 25, the position of the heavily strafed and shelled division became untenable, and the order was given to withdraw during the night. From a total of almost 10,000, only 2,163 men made their way back to the southern bank.

After the arrival of infantry reinforcements near Nijmegen, British and Canadian troops pushed on to establish a line running along the Waal and the Maas. Bridgeheads were secured across the rivers, and the Northern Group of Armies was brought into line with the Central Group to strike at Kleve. These bridgeheads proved valuable in the later advance to the Rhine, but they could not be enlarged for the time being. Operations Market and Garden did not turn the German flank, and the space gained was inadequate for large-scale enveloping movements.

The Importance of Antwerp.—On Sept. 21, 1944, General Eisenhower wrote General Marshall as follows: "Right now our prospects are tied up closely with our success in capturing the approaches to Antwerp. All along the line maintenance is in a bad state—reminiscent of the early days in Tunisia—but if we can only get to using Antwerp it will have the effect of a blood transfusion."

Elimination of the Germans from South Beveland and Walcheren Island, both of which were blocking Antwerp, was planned at the headquarters of the Canadian First Army. It involved the employment of amphibious forces with air and naval support.

On October 15, the Canadians attacked north of Antwerp toward the South Beveland Isthmus. After nine days, resistance at Woensdrecht was broken and the Canadian 2d Division, fighting waist-deep in water, advanced through the narrow neck connecting South Beveland with the mainland. Units of the British 52d Division landed on the south shore of South Beveland during the night of October 25, and achieved a junction with the Canadians on October 29. The next day, the whole of South Beveland was cleared, and the British and Canadians assaulted the causeway connecting the isthmus with Walcheren. Remnants of a German division from Beveland joined with units of the Fifteenth Army in the defense of Walcheren. On Nov. 1, Allied naval assault craft, supported by British naval forces, landed Royal Marine Commandos and two British infantry battalions at Westkapelle and Vlissingen. Air support, although hampered by bad weather, was effective. The amphibious and land forces attacked in three directions. By November 9, German resistance on Walcheren ceased and 10,000 prisoners were taken. The first supply ships were unloaded at Antwerp 15 days later under the fire of German flying bombs.

The Allies Enter Germany.—By the end of September, German casualties in France and the Low Countries since D-day totalled approximately 1,000,000 men. But, after the shock of the previous defeats was overcome, the Germans, according to General Eisenhower, battled "with a stubbornness and Teutonic fury born of the desperate knowledge that they were fighting on their own 'holy soil'. Our logistic situation, coupled with the fact that the terrain was suitable to the defense, aided the enemy . . . we experienced weather conditions which admirably suited him. The rains which fell in November were the worst known on the Continent in many years and created flood conditions along our whole front, reducing the lesser roads to quagmires and

impeding tank operations and vehicular movements. All these factors made it more easily possible for the enemy, exploiting a comparatively static situation, to mine and booby-trap the areas ahead of us, contributing further to our problems."

On September 11, United States First Army forces entered Germany near Trier. The next day, other units crossed the border toward Aachen. On September 20, Aachen came under artillery fire. On October 21, after prolonged and furious resistance, the garrison surrendered to the 1st Infantry Division of the 7th Corps. North of Aachen, other First Army units breached the outer fortifications of the Siegfried Line on October 2, investing heavily defended Stolberg.

On October 3, the United States Ninth Army (13th, 16th, and 19th corps), commanded by Lt. Gen. Simpson, moved into the line between the First and Third armies. On October 23, it was transferred to the left wing of the First Army above Aachen, with the British Second adjoining it on the north. On the Third Army front, Metz resisted until November 22. South of the great fortress, progress was made only along the Moselle. The United States Seventh Army and the French First Army, pushing into the high Vosges Mountains and against the Belfort gap, brought their lines up to conform with those of the Third Army.

Except for the small breach north of Aachen, the Siegfried Line (Westwall) was intact. Hurriedly formed German *Volksgrenadier* divisions manned the forts. The Allied commanders felt that stabilization of the lines should not continue beyond mid-November, unless the Wehrmacht was greatly strengthened.

The Continued Offensive.—With the promise of a large increase of supplies through Antwerp, and with more than 3,000,000 men on the continent (although many of them were service troops) the Allies planned that the Northern and Central Army groups should advance to the Rhine from its mouth to Frankfurt if possible, but at least as far as Düsseldorf. While the river served as a defensive barrier for holding forces, enormous power could then be concentrated for a breakthrough into the heart of the Reich. The Northern and Central Army Group advance was to be supported by less ambitious offensive operations in the south.

On Nov. 15, the Twenty-first Army Group began another eastward drive under adverse weather conditions. The United States First and Ninth armies in the Aachen sector began their advance on November 16, while Allied air forces, including 1,200 United States heavy bombers, attacked German positions around Eschweiler and Düren, obliterating both towns. East of Aachen, Stolberg was taken after more than six weeks' resistance, and Eschweiler fell on November 22. Southeast of Aachen, United States troops, tortuously fighting their way step by step through the dense Hürtgen Forest, approached Düren. To the north, the Ninth Army captured Geilenkirchen on November 19 and reached the Roer River on December 3.

It was already doubtful that a decisive success could be scored quickly. "Unless some trouble develops from within Germany," General Eisenhower reported, "a possibility of which there is now no real evidence, he [the enemy] should be able to maintain a strong defensive front for some time, assisted by weather, floods, and muddy ground."

When the Ninth Army reached the Roer, the Schmidt Dams, controlling the flooding of the Roer Valley, remained in German hands. By flooding the valley, the German Sixth Panzer Army might have been able to trap American forces beyond the river. The First Army was ordered to capture the dams. This operation was not completed when the German counteroffensive was launched.

On November 8, the Third Army in the Ardennes resumed its drive in the direction of the Saar. After linking several Moselle bridgeheads, the German border was reached and crossed in various places on November 18. Four days later, the city of Metz fell to Patton's men, although diehard defenders of seven forts resisted until December 13. On December 5, the Third Army stood along the Saar on a line 16 miles wide. Three bridgeheads were secured in the area of Saarlautern, and contact was made with the main fortifications of the Siegfried Line. Regroupments were necessary prior to opening the assault on the line, scheduled for December 19.

Gen. de Lattre de Tassigny's French First Army, after one week of fighting, breached the Belfort Gap and reached the Rhine. This breakthrough assisted the American Seventh Army's advance through the passes of the Vosges. The United States 44th Infantry Division took Saarebourg on November 21. The French 2d Armored Division to its right penetrated the Saverne Gap and, on November 23, reached Strasbourg, capital of Alsace and the last big French city under German occupation. Four days later, the outer forts of Strasbourg were cleared, and the city was liberated. The Germans were firmly established across the Rhine. A German pocket remained west of the upper Rhine in the Colmar area, and attacks by units of the French First and the United States Seventh Armies were unable to eliminate it for the time being.

In the south, the Wehrmacht showed signs of aggressiveness. On November 24, the United States 44th Division lost some ground to a determined German counterattack in the sector of Saarebourg. The territory was recovered, however, with the support of the United States 79th Division, and the advance was resumed in the direction of Haguenau, which was taken on December 12. Other German counterattacks forced a temporary French withdrawal from positions along the Rhine east of Mulhouse. By November 27, however, the situation was restored.

On November 27, the Seventh Army was ordered to regroup for an attack northward to breach the Siegfried Line west of the Rhine, and to drive on west of the hills of the Pfälzerwald toward Wissembourg in conjunction with the Third Army's operations against the Saar. Fourteen German divisions were contained in the Saar and Wissembourg area. The Seventh Army's offensive was expected to lead to the diversion of additional German divisions to the south, aiding the Allied main effort in the north.

Concentration of Allied strength in sectors considered most important for offensive operations led to weakness in other regions. Between Trier and Monschau, west of the Ardennes, where difficult terrain seemed to give added security to defensive positions, four divisions of the First Army held lines 75 miles long. This was called by General Eisenhower a calculated risk, based

on the absence of strategic objectives or large depots in the area. It was realized, however, that the Germans were gradually assembing six divisions in this quiet part of the front. Wherever Allied thrusts slowed down, German armor was withdrawn and replaced by Volksgrenadiers. Allied intelligence failed to locate the whereabouts of the panzer divisions thus replaced.

THE DECLINE OF NAZI POWER

Although recurrent disasters had some effect upon the average German's faith in ultimate victory, official propaganda, well fitted to the German mentality, prevented the spread of defeatism. Reverses were attributed to "disgraceful desertion by unfaithful allies" rather than to German military inferiority. Glowing accounts were given of the effect of new weapons already in use, and more new weapons were reported to be ready to turn the tide in Germany's favor.

A number of German generals, former conservative politicians, and disappointed Nazi fellow travellers did not believe the propaganda. They felt that the war was irrevocably lost. Watching public announcements in Allied countries, they were gratified to realize that the guilt of aggression was attributed to the Nazi Party rather than to the general German attitude. They believed that the elimination of Hitler might offer them an opportunity to obtain lenient peace conditions and to assume control of a Reich that was basically intact. This group also aimed to split the Western Allies from the USSR and to negotiate with the Western Powers and Russia separately to their own advantage. Overtures to obtain Anglo-American approval of a separate peace after the removal of Hitler and his inner circle met with no response.

On July 20, 1944, according to reports from Germany, a bomb was detonated in Hitler's headquarters by Colonel Count Klaus von Stauffenberg. Hitler was said to have been slightly burned and bruised. This was the signal for a purge in which some 3,500 persons were executed, among them Dr. Karl Goerdeler, mayor of Leipzig and former government price administrator, Field Marshal Gen. Erwin von Witzleben, and Count Wolff von Helldorff, one-time Nazi terrorist and Potsdam police chief.

It was alleged that Field Marshal General von Witzleben not only advocated a separate peace with the Western Allies but was also in contact with the Seydlitz Committee in Moscow. This committee sponsored broadcasts by 17 captured German generals, including Colonel General von Seydlitz and Field Marshal General von Paulus. These broadcasts, backed by Soviet authorities, urged peace and future German-Russian cooperation. The committee was enlarged by a number of prisoners of war of lower rank and a few civilian refugees from Germany. In calling on the Germans to break away from Hitler, less emphasis was placed on outrages committed by the Germans than on military blunders attributed to the führer. Neither the broadcasts from Moscow nor ruthless oppression within the Reich led to any noticeable internal resistance against the German government. The Western Allies' propaganda designed to bring about a German uprising was equally unsuccessful.

On Oct. 18, 1944, Hitler decreed the organization of a *Volkssturm* (people's militia) to include all men between the ages of 16 and 60, capable of bearing arms. On Nov. 12, 1944, Joseph Goebbels, the propaganda leader, proclaimed: "The Home Army is ready to defend Germany house by house and street by street." In reality, the Volkssturm did not contribute effectively to the defense of German soil nor did it solve the Wehrmacht's manpower problems. In June 1942, the draft age had been lowered to 17½ years, and in October 1943, men up to the age of 60 had become eligible for military service. New drafts in the fall of 1944 produced a total of 615,000 men, compared to 2,050,000 in the spring of 1942, and 1,150,000 in the spring of 1944.

By September 1944, according to statistics discovered inside the Reich after its capitulation, total German losses amounted to 3,875,000 dead, permanently disabled, and missing. This figure did not include civilian casualties or wounded who were capable of returning to duty, even if this duty was no longer in the front line. The organization of the Volkssturm failed to offset losses during the summer campaign of 1944. The total number of German draftees reached 13,000,000 in late 1944. The Reich's own resources, as well as those of annexed countries and of German minorities in occupied territories, were taxed to the limit.

The Italian Campaign Through 1944.—Between mid-June and the last of July 1944, more than a division a week was withdrawn from the Allied forces in Italy to get ready for Operation Anvil. The United States 4th Corps (Maj. Gen. Willis D. Crittenberger) moved into the line to replace the 6th Corps. The French Corps of four Moroccan and Algerian divisions was withdrawn between July 2 and 21 and replaced by the 2d Corps. A number of antiaircraft units, no longer required as a result of Allied air superiority, were retrained as infantry. The 442d United States Infantry Regiment, composed of Americans of Japanese descent, was sent to the front. During the late summer, the 92d Infantry Division, one of the United States Army's two Negro divisions, reached Italy and was assigned to the 4th Corps. On September 15, a combat team of a newly formed Brazilian Expeditionary Force joined the Fifth Army. By the end of the year, the Brazilian force was increased to a full division and fought with distinction with the Allied forces in Italy.

German reserves in northern Italy were adequate to fill the gaps torn in the ranks of the Tenth and Fourteenth Armies. Field Marshal General von Kesselring was greatly helped by the terrain. The historic road of conquerors of the Apennine Peninsula led from north to south. The Allies had to fight their way in the opposite direction across many natural barriers. Although the pursuit of the German armies beyond Rome was pressed to the limit, it failed to disrupt the Wehrmacht. Heavy, unseasonable rainfalls delayed the Allied advance. Kesselring organized formidable rear guard positions on both sides of Lake Bolsena, covering the Rome-to-Florence highway, and a good trans-peninsular road. It took the Allies three days to break up the rear guard stand, while the Wehrmacht continued to reorganize a defense well to the south of the crucial Po Valley.

On June 22, the Germans hurled a surprise counterattack against Allied forces near Lake Trasimeno, in the center of the peninsula. Three more days were spent beating off the assault. On

the west coast, the advance reached Cecina on July 2, although the Germans fought the attackers almost to a standstill.

Inland, the Fifth Army captured Siena. A few miles beyond the historic city, French units were halted outside Poggibonsi, an important road crossing south of Florence, but a renewed assault captured Poggibonsi. Further advances eased the pressure on the Fifth Army's left wing. The wrecked harbor of Leghorn (Livorno) was captured on July 18, and the outskirts of Pisa were reached on July 26. The Eighth Army, bearing the brunt of the fighting near Lake Trasimeno, took Arezzo and Ancona, on the Adriatic coast.

Mopping-up operations cleared the Germans from the south bank of the Arno River and paved the way for the occupation of Florence on Aug. 12, 1944. This priceless shrine of Italian art and architecture was not bombed, but the damage inflicted upon Florence by German demolitions and street fighting was moderately severe.

Another German line—the Gothic—ran across the peninsula from north of Pisa on the Mediterranean to Rimini on the Adriatic. It was technically similar to German positions encountered previously. In its eastern part, the line covered the city of Bologna, gateway to the upper Italian plains, where the Allies could make use of their superiority in mechanized equipment, and the defenders could find less shelter from air attack than in mountainous regions.

The Allied objective was to penetrate to Bologna and beyond and to wage a battle of annihilation against Kesselring's forces south of the forbidding barrier of the Alps. The available forces, however, were inadequate for a speedy victory. Further regroupments lasted until late in August 1944. The bulk of the Eighth Army concentrated along the Adriatic, while the Fifth Army massed its main forces north of Florence and south of Bologna.

On August 26, a Canadian night attack forced the crossing of the Metauro River and pushed toward the Adriatic hinge of the Gustav Line. Through mine fields, antitank ditches, and scattered pill boxes, the Eighth Army drove through Pesaro in the direction of Rimini. Heavy rains swelled the small rivers into torrents, preventing extensive tank operations. The Eighth Army infantry fought its way across rivers and ridges step by step. On September 21, Greek units captured Rimini. It took the attackers six days to cover the last four miles on their way to the city and nine more days to advance ten miles beyond. At that point, the Wehrmacht held towering hill positions, protected by the swollen Fiumicino River and deep mud. The Eighth Army was unable to break through.

British and Indian forces from the Eighth Army were then transferred to assist the Fifth which was fighting a furious battle for Imola and the approaches to Bologna. During September 1944, Allied advances on the west coast went beyond Pisa, but were stopped short of La Spezia. Despite strenuous Allied efforts, Bologna was not reached in 1944. Twenty German and four Italian Republican divisions, plus fortifications and mud, barred the way to the north.

On Dec. 12, 1944, Field Marshal Sir Harold Alexander replaced Field Marshal Sir Henry Maitland Wilson as supreme commander in the Mediterranean area. After the death of Sir John Dill, Field Marshal Wilson became senior representative of the British chief of staff in Washington, D.C. Lt. Gen. Mark W. Clark assumed command of the Allied armies in Italy and Lt. Gen. Lucian K. Truscott of the Fifth Army.

The Surrender of Finland.—It was generally expected that the Red armies, coinciding with Allied landings in Normandy, would strike the next blow between the edge of the Pripet Marshes and the Carpathian Mountains, almost due east of the Upper Silesian industrial area and the German capital beyond.

Political considerations, however, had a growing influence on Soviet strategy as the war moved closer to the Reich. Future Russian spheres of interest became priority targets. Finland was next on the Soviet offensive schedule.

Col. Gen. Dietl's successor in command of the German Lapland Army, Col. Gen. Lothar Rendulic, made no attempt to aid the Finns in their last ditch stand against the Russians. Instead, the Germans gave an unconvincing display of might in the Finnish hinterland to keep their satellites in the war.

In June 1944, two Red armies were massed against Finland: Govorov's Leningrad Army and Meretskov's Karelian Army. The battered Finnish forces, deprived of modern equipment previously supplied by the Germans, were under the field command of Lt. Gen. Hjalmar Siilasvuo of 1939–1940 fame.

The main Russian attack was aimed at the Karelian Isthmus. The former Mannerheim Line had been incompletely reconstructed. In front of its ruins, the Finns had built the State Line, much weaker than their former defenses. On June 10, Marshal Govorov's forces, following overwhelming artillery and air preparations, penetrated the State Line on a 25-mile front. For five days, the Finns threw in all the forces they could muster, including boys and elderly men (members of the Schutzkorps) in a vain attempt to close the breach. Battered on the ground, from the air, and from the sea, where the antiquated Red Fleet hurled heavy shells against shore fortifications, the Finnish lines collapsed. The former Mannerheim Line did not delay Govorov's drive. Koivisto fell on June 18 and Viipuri two days later. On June 21, Meretskov's army attacked in the direction of the Murmansk-Leningrad railroad, supported by an amphibious thrust across Lake Onega and a flanking drive by Govorov's troops beyond the Sir River. Petrozavodsk was captured on June 29 and the railroad was cleared. The fate of Finland, gasping for life in a Russian stranglehold, was sealed, but the Russians were in no great hurry to inflict the *coup de grace*.

President Ryti resigned on August 1, and Field Marshal Mannerheim was named as his successor in a procedure of dubious legality. On August 7, the new president declared: "Fighting for the existence and future of the country goes on." A new government was appointed with Anders W. Hackzell, who had conservative affiliations, at its head. "Fighting for the existence of the country" was a euphemism covering an effort to obtain lenient terms. On August 25, the Finnish minister to Stockholm, George A. Gripenberg, handed Russian Ambassadress Mme. Alexandra Kollontai his government's request for the opening of armistice negotiations. The Russian government insisted on the severance of

Finnish-German relations and the withdrawal of German troops from Finnish soil no later than September 12 as primary conditions. Prime Minister Hackzell announced in a broadcast that his government had requested the Germans to withdraw no later than Sept. 15, 1944. On September 4, he issued an order to all Finnish troops to cease firing. Relations with the Reich were severed.

A Finnish peace delegation, headed by the prime minister, left for Moscow on September 6. Eight days later, Hackzell was incapacitated by a stroke and was succeeded by Foreign Minister Enckell. Conditions of the armistice, concluded September 19, were substantially identical with the terms previously offered, except for the cession of Petsamo to Russia. A Russian-dominated Allied Control Commission, established in Helsinki, gained considerable influence in Finland's internal affairs.

On September 15, the German Lapland Army made an unsuccessful attempt to seize Suursaari, a strategic island in the Gulf of Finland. In the north, skirmishes developed between Rendulic's main forces and the Finns when the latter attempted to enforce the German withdrawal. The Lapland divisions were finally driven from Finnish territory early in 1945 with Russian assistance.

The Collapse of the Fatherland Line.— Only 15 panzer divisions, organized into three panzer armies, were left on the Russian front in the summer of 1944. The general deployment of the German troops gave evidence of the absence of strategic aims beyond holding as much ground as long as possible. Two German armies, including Rumanians, held the southern sector from the Carpathians to the Black Sea. Their former commander, Field Marshal Gen. Paul Ludwig von Kleist, was succeeded by Field Marshal Gen. Ferdinand Schoerner. From the Carpathians to the Pripet, two German armies plus two of the panzer armies were under the command of Field Marshal von Model, Mannstein's successor. The Third Panzer Army and two more armies (Field Marshal Gen. von Busch) held the central front between the Pripet Marshes and the Dvina River, formerly under the command of von Kluge. The defense of the Baltic States was entrusted to Colonel General Lindemann, in charge of two armies previously commanded by Field Marshal General von Kuechler.

Eighty Russian divisions, outnumbering the Germans almost 3 to 1, faced Kluge's forces. According to later reports, Hitler's furious insistence upon holding territory regardless of its military value, particularly the defensive system referred to as the Fatherland Line, accounted for the fact that the Wehrmacht's front, instead of being straightened out and shortened from Kowel roughly through Vilnius to Riga, to save manpower and improve communications, bulged widely in an arc running east and north.

Russian superiority was brought to bear heavily on the central front. The Red forces were divided into the First Baltic Army (Bagramian) from Nevel to Vitebsk, the Third White Russian Army (Gen. Ivan D. Chernyakhovski) from there to Orsha, the Second White Russian Army (Zakharov) adjoining Mogilev, and Rokossovski's White Russians continuing the line to Kowel. The opening Russian drive aimed at Vitebsk. On June 23, Bagramian struck to the north and Chernyakhovski to the south of the town, both breaking through the German lines. Their pincers closed, trapping five depleted divisions. On June 27, the garrison of Vitebsk was wiped out. Moscow reported the capture of 10,000 German prisoners and 20,000 Germans killed. The Wehrmacht crumbled under spreading Russian blows. Orsha fell to Chernyakhovski on June 27, Mogilev to Zakharov on June 28, and Bobruisk to Rokossovski on June 29. The Germans suffered another major defeat when a trapped force of 34,000 was annihilated at Bobruisk.

Russian armies rolled on through trenches, minefields, antitank ditches, and blockhouses on a 250-mile front, meeting little resistance. In the north, Bagramian aimed at Daugavpils (Dvinsk). The three other assaulting armies converged on the communication hub of Minsk, which fell on July 2. Again formidable German forces, estimated at 55,000 by the Russians, were trapped. The Wehrmacht belatedly attempted to consolidate a shortened line, sacrificing men and matériel in stubborn rear guard actions for road and railway junctions. Zakharov's advance beyond the Berezina River was delayed, but the other Red armies swept on toward Vilnius, Baranowicze (Baranovichi), and Daugavpils. The railway junction of Baranowicze fell to Bagramian on July 8, and Rokossovski captured Kowel on July 5. From Kowel, the White Russian Army advanced in the direction of Brest-Litovsk, an old fortress town and vital hub in the former czarist-Russian military railroad system. Local counterattacks, stepped up by the German Central Army Group, failed to gain ground, but they slowed down all Russian drives and gave evidence that stiff fighting was still ahead.

The German defenders of Vilnius, holding out until July 13, fell to an encircling drive. Bagramian turned the defenses of Daugavpils and invested the city on the same day. He was assisted in this operation by Yeremenko's Second Baltic Group, which had joined the offensive two days earlier and had broken through enemy lines south of Pskov, threatening the railroad to Riga. The Russian attack spread toward the Estonian border regions, where Maslennikov captured Ostrov, while the bulk of Govorov's forces, withdrawn from Finland, unhinged the northern anchor of the German positions, captured Narva, and crossed into Estonia on July 26. Lindemann's army group in Latvia and Estonia was caught in a Red vise when Bagramian, swinging northward beyond Vilnius and Kaunas, closed in on the Gulf of Riga and reached the Baltic shore on August 1. German counterattacks to break the ring started almost immediately.

This phase of the fighting north of the Pripet, however, was overshadowed by the long awaited offensive in southern Poland, which opened on July 16 when Konev's First Ukrainian Army attacked the German lines between Luck (Lutsk) and Tarnopol on a 125-mile front. The Germans tried to chop up the Red columns penetrating through their positions by widespread local counter-thrusts, but the impact of the Russian drive brushed such attempts aside. Four Wehrmacht divisions were routed in the capture of Rawa Ruska on July 20, and the last railroad link between southeastern Poland and the northern and central regions of the country was severed. Another Russian offensive in the direction of Stanislawow was launched to pin down the enemy on an even broader front in the Carpathian

STOCKHOLM
SWEDEN
DAGÖ (HIIUMAA)
ÖSEL (SAAREMAA)
GOTLAND
BALTIC SEA
GULF OF RIGA
TALLINN
RAKVERE
NARVA
ESTONIA
Lake Peipus
TARTU
PSKOV
OSTROV
REZEKNE
LATVIA
RIGA
Dvina R.
SIAULIAI
DAUGAVPILS
LITHUANIA
NEVEL
VITEBSK
ORSHA
KAUNAS
Niemen R.
DANZIG
EAST PRUSSIA
VILNIUS (WILNO)
MOGILEV
Berezina R.
SUWALKI
MINSK
BOBRUISK
GRODNO
BARANOWICZE
Pripet R.
BIALYSTOK
Vistula R.
BERLIN
POZNAŃ
WARSAW
BREST-LITOVSK
PINSK
SIEDLCE
Bug R.
Pripet Marshes
CHELM
KOWEL
BRESLAU
PRAGUE
Carpathian Mts.
JAROSLAW
RAWA RUSKA
PRZEMYŚL
LWÓW
TARNOPOL
STANISŁAWÓW
Dniester R.
VIENNA
BUDAPEST
DEBRECEN
HUNGARY
Tisza R.
SZOLNOK
ORADEA
R. IAŞI
CHISINAU (KISHINEV)
SOPRON
SZÉKESFEHÉRVÁR
Lake Balaton
SZEGED
ARAD
Maros R.
RUMANIA
GALATI
BELGRADE
YUGOSLAVIA
BUCHAREST
CONSTANTA
KRAGUJEVAC
Danube R.
BLACK SEA
VARNA
NIŠ
BULGARIA
SOFIA

range. In a brilliant move which required regrouping during the attack, General Popov reinforced Konev's southern wing to enable Konev's forces to aid Rokossovski. Stanislawow was overrun, and German and Hungarian puppet divisions abandoned a considerable part of Galicia province. Lwow, outflanked in the north and south, fell on July 27 after a brief fight. Przemyśl, a fortress on the San River of World War I fame, and nearby Jaroslaw were captured the following day. The Wehrmacht clung to the western bank of the San, despite Red bridgeheads established across the river.

The foremost objective of Russian operations in Galicia was to outflank future German defenses on the Vistula River to the north. This goal was reached by establishing bridgeheads in the region of Przemyśl. A German attempt to hold positions on the Bug River, in order to delay the Russian advance toward the Vistula from the east, was frustrated. On July 22, the Russians stormed across the Bug near Chelm and seized Brest-Litovsk on July 28. The way was cleared for a sweeping drive by Rokossovski's columns toward Warsaw through the railroad city of Siedlce, captured July 31. Continued advances by Zakharov's army beyond Bialystok (occupied July 18) broadened the Red attacking front to the north. The Second White Russian Army's progress strengthened Chernyakhovski's drive against East Prussia, enabling him to enter Suwalki and to press on toward the Masurian Lakes. After crossing the Nemunas (Niemen) River on July 15, taking Grodno on July 16, and assisting in the capture of Bialystok, Chernyakhovski's divisions captured Kaunas in Lithuania on August 1.

Rokossovski's advance stopped in front of Warsaw, after investing Praga, an eastern suburb of the Polish capital. Russian guns were heard in Warsaw, and Polish patriots staged an uprising on August 1 to help the Red Army to liberate their city. Their struggle, lasting for 63 days, was one of the most heroic and depressing chapters of World War II.

Sixteen German divisions, scraped together from occupation forces and reserves, strengthened German lines around the Polish capital, but they could not prevent the Red forces from reaching the Vistula River south of Warsaw and establishing a wide bridgehead across that river. This bridgehead constituted a deadly threat to the German defenders on the left bank of the Vistula.

In the Baltic region, Yeremenko's forces pressed on to Riga, mopping up Daugavpils and capturing Rezekne, while Bagramian took Siauliai. On August 25, Maslennikov seized Tartu in Estonia and cleared the western shores of Lake Peipus. These operations, however, did not destroy the Lindemann army group. One week after the vise closed on the Gulf of Riga, German counterattacks reopened a corridor from the west.

In late August 1944, the center of gravity of the Russian attacks switched southward and action along the Vistula subsided. This was again due not only to military but also to political considerations.

EUROPEAN CONTROVERSIES

While the Polish government in London adamantly claimed that no change in Poland's prewar eastern border could be considered, and the governments of the United State and Great Britain hoped for some compromise, Moscow insisted upon establishing control of Poland within frontiers to be largely determined by the Russians.

On Dec. 31, 1943, according to Soviet-sponsored sources, a group of representatives of peasants, trade unionists, youth organizations, and partisans met in occupied Warsaw to establish an anti-Mikolajczyk, National Council of Poland and a Polish People's Army. The same sources reported that, in May 1944, participants in the meeting made their way to Moscow. There, in cooperation with the Russian-sponsored Union of Polish Patriots, they formed a Polish Committee of National Liberation (PCNL). Other members of the National Council of Poland, including Edward Osubka-Morawski, a former factory worker, also went to Russia to confer with the Soviet government and Polish organizations.

The Polish government in exile in London was accused in Russian broadcasts of opposing the establishment of friendly relations with the USSR and of sheltering anti-Soviet and anti-Semitic reactionaries. The Russian radio stated that unless the Mikolajczyk government was purged of these reactionaries, its return to Poland would not be allowed. Moscow also announced the organization of a Polish Army Corps in Russia to fight alongside the Red Army.

On June 5, 1944, Polish Premier Stanislaw Mikolajczyk arrived in Washington to seek support and advice. He met with President Roosevelt and State Department officials and declared that he believed his country could count on the backing and friendship of the United States. Mikolajczyk, however, found no support for his government's boundary claims, and it was difficult to comply with the advice he received to seek a settlement with Moscow. This advice was repeated by Prime Minister Churchill and Foreign Secretary Eden on June 22, after Mikolajczyk's return to London.

On July 1, the Moscow Poles declared that the London Polish government in exile was illegal and called for the establishment of a provisional government. When Chelm, east of Lublin and west of the Polish boundaries as defined by Russia, fell to the Red Army on July 23, Moscow announced that the National Council of Poland in Moscow had asked the PCNL to take charge of the civilian administration of the liberated areas. Two days later, the Soviet government announced that the Red Army was interested only in routing the German armies and helping the Polish people to liberate themselves from the German invaders. The USSR also promised that an independent and democratic Poland would be established as a sovereign, friendly, allied state. The next day, the Soviet High Command and the PCNL signed an agreement. On Jan. 1, 1945, the PCNL, established in Lublin, proclaimed itself the provisional government of Poland. A spokesman of the Polish government in London had previously called the PCNL representatives, headed by Osubka-Morawski, a group of usurpers, nobodies, turncoats, and communists. The ambassador representing the Mikolajczyk government in the United States denounced the PCNL as a typical puppet government imposed by Moscow.

Through the intervention of Prime Minister Churchill, Mikolajczyk and two aides were invited to Moscow, where they arrived on July 31, 1944. Stalin and Molotov requested that they dis-

cuss a merger of their regime with the PCNL and the National Council representatives. Speaking on behalf of the Russian-sponsored groups, Osubka-Morawski offered two cabinet posts to the representatives from London. Most members of the government in London were excluded as unacceptable to the PCNL and to Russia. Counter-proposals, made after Mikolajczyk's return to England, included the broadening of the Polish cabinet in London by including some of the Leftist extremists. The London Poles also offered to postpone discussion of boundary issues. A provisional parliament was to be set up, and free elections were to be held at the earliest opportunity.

Neither the London government's concessions, nor American and British attempts to mediate, led to any progress toward a reconciliation. The PCNL insisted upon immediate acceptance of Russian territorial claims, predominant Leftist influence in a future government, and far-reaching economic reforms along communist lines. This attitude strengthened ultraconservative elements in the London cabinet who opposed Mikolajczyk's policy. On November 24, Mikolajczyk resigned and refused to enter another London Polish cabinet, formed by Tomasz Arciszewski. He did not immediately reply to an invitation by Osubka-Morawski to come to Lublin. Events inside Warsaw had further complicated the situation.

The Ordeal of Warsaw.—Despite the brutal vigilance of the German occupation authorities, a secret army of Polish patriots had been formed to fight for their country's liberation. Its numbers rose to almost 300,000 across the country. Forty thousand members of the Polish Home Army stayed in Warsaw in disguise. Lt. Gen. Tadeusz Komorowski, called General Bor, was in command.

Although loyal to the London government, the Polish Home Army considered the defeat of the German invaders more important than political considerations and was ready to cooperate with the Red Army and Soviet-sponsored organizations. Toward the end of July 1944, broadcasts from Moscow were heard in Warsaw as follows: "Poles, the time of liberation is at hand! To arms! Make every Polish home a stronghold in the fight against the invader! There is not a moment to lose!" The appeals were made in the names of Molotov and Osubka-Morawski and were not addressed to any particular group in Poland. General Bor and his aides outlined an operation code-named Storm, to seize control of the capital.

The German Second Army, defending the eastern approaches to Warsaw, was reinforced by troops moving up through the capital. It seemed most important to prevent the Wehrmacht from using Warsaw as a pivotal center. On July 30, officers of General Bor's Home Army, on patrol beyond the Vistula, met a Russian tank column and were told by exuberant Russian officers that the Soviet forces expected to be in Warsaw any day.

In accordance with Operation Storm, the Home Army moved to assigned quarters and blocks at important strategic points and opened fire on the Germans on August 1, at 5 P.M. Polish equipment consisted chiefly of rifles, hand grenades, and a few automatic weapons. Ammunitions and food were scarce in the looted city. The Germans attempted to crush the uprising within a few hours by using their heaviest tanks and medium artillery. Failing to subdue Bor's men, they called upon the Luftwaffe, which raided Warsaw on August 3 without opposition from the Red Air Force.

The Polish Home Army's attempts to establish contact with Marshal Rokossovski and arrange for cooperation were unsuccessful. The Western Allies dropped some light arms and ammunition from planes. German squads meanwhile dynamited their way through Polish-held blocks and launched robot tanks against the Home Army. A fanatical defense held the Germans in check, although transit through Warsaw still remained blocked.

On August 14, the Russian news agency issued a statement to the effect that Polish circles in London had sponsored the Warsaw uprising and had failed to coordinate this action with the Soviet High Command and were therefore responsible for its results. The Poles, despite the loss of Soviet cooperation, decided to fight on in the hope that the Red Army would eventually resume its advance.

The offer of assistance from the Polish Home Army forces outside Warsaw could not be accepted because of a lack of supplies. Civilians inside the capital aided Bor's men in every possible way. On the seventeenth day of the struggle, the Germans brought huge siege guns to bear against a center of resistance in the Stare Miasto district. Of 1,100 houses, overcrowded with 200,000 people, 400 were destroyed, and 300 more were burned in three days. For two more weeks the Poles clung to the ruins. Realizing that the Poles were increasingly dependent on airborne supplies, unmarked German craft, joining Allied supply raids, dropped poisoned biscuits.

On September 13, Russian vanguards entered Praga suburb, and Russian planes dropped some arms and ammunition. Next day, broadcasts from Moscow were heard: "The hour of liberation is near . . . Relief is coming . . . Keep fighting. . . Whatever may have been the motives of those who started the uprising prematurely, and without agreement with the High Command of the Red Army, we are with you with all our hearts!"

It was extremely difficult to keep fighting, as disease was spreading, ammunition was scarce and food even scarcer. Some blocks had to be abandoned. A large quantity of airborne supplies dropped by British and American planes fell into evacuated areas and were captured by the Germans. Two days later, the last stores of grain were exhausted. On September 24, transmitters of Marshal Rokossovski's army contacted Bor's radio station for the first time. The Russians asked for information about German artillery positions but failed to make any commitments. The Red forces gave no help when the Home Army's Czerniakow stronghold, separated only by the Vistula River from Red outposts in Praga, was wiped out by the Germans.

The water system was destroyed, and the few remaining wells were under constant artillery fire. Thirst added to the sufferings of fighters and civilians. Medical stores were exhausted, and surgical operations had to be performed without anaesthetics and dressings. There was no milk, and almost no babies survived. The Poles continued to fight under these indescribable conditions, many of them risking their lives to capture German robot tanks in order to get explosives. They ignored demands to surrender.

On September 27, a radio message informed Marshal Rokossovski that hunger and German pressure could not be endured for more than 72 hours. The fighting Poles were already confined to a few blocks. No reply came, and German attacks were intensified. Finally, on October 2, General Bor was forced to capitulate but refused to extend the capitulation to the Home Army outside Warsaw, despite German attempts to exploit his bitterness toward the Red Army. Nearly 250,000 Poles, most of them civilians, perished in the 63-day ordeal.

The Allied Conquest of Rumania.—Prince Barbu Stirbey, unofficial Rumanian peace envoy, got in touch with Allied diplomats in Turkey late in 1943. Prince Stirbey had the backing of influential leaders of former Rumanian political parties and the confidence of young King Michael. After some informal talks, the prince was allowed to proceed to Cairo, where he disclosed that Rumania was ready to surrender to American and British forces if they reached the country. It was hinted that such a capitulation would not be effectively opposed by Marshal Antonescu but that Rumania was not willing to surrender to the Russians. Prince Stirbey was informed that no such agreement could be considered and that his suggestions would be reported to the Soviet government. On March 27, 1944, Moscow replied that Russia would accept nothing short of Rumanian surrender to the Red Army, but that the integrity of the kingdom, except for Bessarabia and northern Bucovina, would be guaranteed.

The Germans learned of Stirbey's mission and threatened reprisals if Rumania attempted to break the alliance. Fear of these reprisals and distrust of Russia's intentions delayed further progress in the negotiations. It was obvious, however, that Rumania had no desire to make a last ditch stand for Germany's benefit.

When operations in Poland slowed down, Russian armies attacked between the Carpathians and the Black Sea. On Aug. 20, 1944, Malinovsky's Second Ukrainian Army resumed its advance southward in the direction of Iasi, while Tolbukhin's Third Ukrainian Army pressed westward toward Chisinau (Kishinev) and the Galati Gap, harassing the defenders of Iasi's right flank. After three days of fighting, the Second Ukrainian Army captured Iasi and achieved a breakthrough between the Siret and Prut rivers. The fall of Iasi and the cutting of a railroad linking that city with Chisinau led to the fall of that city on August 24.

This German defeat gave the signal for a coup d'état in Rumania. On August 25, King Michael, who was the head and symbol of anti-German forces which included the overwhelming majority of the people, summoned Marshal Antonescu and the members of his cabinet to a meeting in his palace. There they were summarily arrested.

Prior to the arrests, the king requested Field Marshal Sir Henry Maitland Wilson to support the coup by dispatching Allied airborne units to Bucharest. If the Allied commander had complied, the Rumanian capital could have been occupied by troops of the Western Allies before the Red Army arrived there, but the Western Powers had already agreed to give the Russians priority in Rumania. No Allied troops arrived. King Michael appointed a predominantly military government. The Germans bombed Bucharest and vainly attempted to establish a puppet government composed of members of the Iron Guard. On August 25, Rumania declared war on Germany. The Rumanian Army turned vengefully against its former partner. The contemptuous treatment and frequent abuse that most of its officers and men had suffered from the Wehrmacht, plus German looting and ruthlessness in Rumania, made the war-weary Rumanians eager to do as much damage as possible to the Germans. Rumanian resentment against Hungary, another unwelcome partner which had profited territorially at Rumania's expense, was equally bitter.

A few Rumanian divisions, sandwiched into German lines, pulled out and thereby wrecked the Wehrmacht's defenses. Red divisions poured through the gaps. Twelve German divisions in Bessarabia were wiped out. Another disaster hit Schoerner's armies when the Rumanians in the Galati Gap joined the onrushing Red forces and threw the Germans into headlong flight. Galati and its Danube harbor fell to the Ukrainian Third Army on August 27. The Germans suffered a still greater loss when the Russians occupied Ploesti and its oilfields on August 30. Rumanian troops also marched beyond the Carpathian range to harass the retreating Germans and to recover the northern part of Transylvania.

Red Army forces entered Bucharest on August 30, to the dismay of the Rumanian government. The Russians rapidly mopped up the rest of Rumania, including the naval base of Constanta on the Black Sea. In addition to the 12 German divisions destroyed in Bessarabia, 10 other divisions were severely mauled.

A Rumanian armistice mission, arriving in Moscow on August 30, learned that the country would be occupied, despite recognition of its co-belligerent status. As a co-belligerent, Rumania was ordered to provide 12 divisions. Rumanian territory was to be administered according to instructions issued by the Russian High Command, and an Allied Control Commission with a Russian chairman was installed in Bucharest. Andrei Y. Vyshinski, Russian vice commissar of foreign affairs, became Soviet commissioner in Bucharest. He directed the country's policies through Rumanian Leftists, who facilitated the use of Rumania as a springboard for the further expansion of the Soviet zone of influence.

The Occupation of Bulgaria.—In spite of Bulgaria's refusal to join the war against the USSR, the Russian government did not accept the contention, reiterated by Bulgaria's prime minister on Sept. 1, 1944, that the country had maintained unreserved and reliable neutrality. The Western Allies, resenting Bulgaria's hostile and rapacious attitude and the brutal treatment of Allied airmen forced down in Bulgarian territory, were unresponsive to Constantin Muraviev's attempts to restore peaceful relations. Muraviev was plainly anxious to forestall a Russian invasion and indicated that he would much prefer control of his country by the Western Powers.

On September 5, the Soviet Union declared war on Bulgaria, claiming that the country was continuing to assist the Germans. Two days later, while his troops were preparing to cross the Danube from Rumania, Marshal Fedor Tolbukhin urged the Sofia government to break with Germany and join the Allies. Muraviev complied on September 8 by declaring war on Germany.

Russian troops, however, moved into the country. The continued presence of German vessels in the Bulgarian Black Sea port of Varna was cited to justify their intervention. On September 9, while the Red Army advanced without meeting resistance, the Muraviev government and the regency council were displaced by pro-Soviet elements. Tolbukhin's forces entered Sofia on September 19, and an armistice with all the Allies was concluded on Oct. 28, 1944. The subsequent occupation of Bulgaria by very substantial Russian forces allowed the communist-dominated Fatherland Front to rule Bulgaria, despite the country's industrial backwardness and the almost total absence of feudal estates.

The Confused Balkan Campaign.—Prior to the Russian drive through the Galati Gap, the German front in the east ran between the Baltic and the Black Sea. Thereafter, the southern wing was unhinged, and the front, according to strategic precedents, should have been expanded to the Aegean Sea. The Balkan Army under Col. Gen. Baron Weichs had neither the strength nor the freedom of movement for such an extension. Harassed in Yugoslavia and Greece by guerrilla fighters, threatened with the prospect of Allied landings on the Aegean, Mediterranean, and the Adriatic coasts, Weich's army could not establish a reliable southern anchor. A total German collapse in the Balkans would soon have followed if the Russian and Partisan forces in the Balkans had been able to draw a line rapidly across the peninsula, and if the Western Allies and Russia had cooperated, regardless of zones of influence.

Guerrilla fighters in the Balkans could not be organized easily into regular armies. In Greece, rivalries between political groups prevented cooperation between them. In Yugoslavia, where the Chetnik organization was in the last stages of dissolution, Tito's Partisans were spread over mountainous regions remote from communication centers. Besides, guerrilla armaments were inadequate for regular modern warfare. Tolbukhin's Red Army had to concentrate most of its power for a drive up the Danube Valley against Hungary and could not divert many divisions in other directions. The British were getting ready to land in Greece, but their forces were not strong enough to go much beyond that country's borders, nor were they supposed to trespass on territories in the Russian zone of influence, which included all of the Balkan states with the exception of Greece.

All these circumstances enabled the Germans to "organize chaos" by breaking up their Balkan forces into relatively small units, part of which slowed down British, Russian, and partisan actions and fought their way out of traps and encirclements to the north, while others reinforced the Wehrmacht and what remained of its Hungarian satellites in Hungary.

On September 18, Red Army forces crossed into the Vardar River Valley from southern Bulgaria to establish contact with Tito's men. Twelve days later, Red divisions penetrated the Iron Gate and reached northeastern Yugoslavia. Joining with the Partisans, they took Pančevo on October 7. Belgrade (Beograd) came within artillery range the next day. Progress was not fast enough to prevent substantial German forces from crossing into Hungary. Weather again favored the Wehrmacht, as heavy rains transformed the Balkan dirt roads into quagmires.

Early in October, the British carried out various landings in southern and western Greece. Assisted by patriots, they occupied Patras on October 7 and continued toward Athens. The Greek capital was freed on October 15. Albanian guerrillas, led by Enver Hoxha, the "Albanian Tito," took over Vlora.

The Wehrmacht was driven from badly damaged Belgrade on October 15. Shortly thereafter, Niš, a railroad city west of the Bulgarian border, was taken, and the Belgrade-Kragujevac highway was cut in a drive across the Balkans. From Niš, Yugoslav Partisans pressed through Macedonia, while British forces in Greece, coming up from the opposite direction, made their first fighting contact with the Wehrmacht 240 miles north of Athens on October 31.

The British in Greece were bitterly opposed by Leftists. EAM-ELAS leaders called for the end of what they termed "British intervention," and their partisans fought against the government and the British. The government's counteraction, carried out by regular troops with British assistance, was equally sharp. Particularly heavy fighting raged through the week of December 10–17, when the British cleared Athens and the port of Peiraeus (Piraeus) of rioters.

The Russian Drive West.—Events in Rumania hastened the invasion of Hungary and exposed the Hungarians to Rumania attack. Although this situation had been foreseen, the Hungarian government had no opportunity to prepare countermeasures. Its military forces, inadequate to resist a strong Russian-Rumanian drive for any protracted period, could not even organize an effective delaying action. The Wehrmacht High Command directed Hungarian troop movements, and the bulk of the Hungarian forces were shifted to the border regions of their country to face an attack from the north rather than from the east.

On Aug. 29, 1944, Hungarian Regent Nicholas Horthy appointed a "non-political cabinet of generals," headed by Col. Gen. Vitéz Géza Lakatos (Vitéz meant "hero," an honorary title bestowed upon distinguished veterans of World War I). A secret Hungarian peace mission was sent to Moscow. No agreement was reached, however, as Russia was determined to award northern Transylvania to Rumania, and the Hungarians were anxious to retain it. On October 15, as the military situation grew desperate, Regent Horthy, in an appeal to the Hungarian people, stated his intention of making a separate peace. The regent declared that Germany had pressed Hungary into belligerency, had deceived the country, and had already lost the war. Admiral Horthy was taken into German custody.

Generals Béla Miklos de Danok and János Voeroes, commanders of the Hungarian First and Second armies, refused to take orders from the Arrow Cross government illegally established by the Germans in Hungary. Some of their troops laid down their arms and others went home. General Miklos was appointed head of a rival Hungarian cabinet in Debrecen on December 21. On December 30, his government, supported by a provisional assembly, asked for armistice terms and declared war on the Reich, but it lacked the means to make the declaration effective.

The Russians drove through the Carpathian mountain passes and broke into the plain of

southern Transylvania in the direction of Arad. They were only 100 miles from Budapest when the Wehrmacht made a stand east of Debrecen on September 3.

On October 1, Russian and Rumanian forces penetrated a line between Szeged and Oradea, and other Russian troops surged forward from eastern Czechoslovakia. The most effective drive came from the south. Advancing along the left bank of the Danube toward the capital on a 55-mile front, forces of the Second Ukrainian Army reached a line running from the southern outskirts of Budapest to Szolnok. On November 4, German resistance was overcome, and a siege arc was formed which was roughly six miles from the capital.

On November 12, Red forces crossed the Tisza River, 70 miles northeast of Budapest, and pressed on westward to broaden the siege front and to increase the pressure on the Germans in Slovakia and Austria. On December 9, Szallassy's puppet government fled to Sopron, a few miles from the Austrian border and, on December 10, the Russians reached Lake Balaton, less than 50 miles from Austria.

The Germans attempted to prevent further progress in the encirclement of Budapest by making a stand in the mountains northeast of the city. According to German reports, 18 Red divisions smashed this stand on December 24, and Russian troops pushed on to the left bank of the Danube beyond Budapest, 104 miles from Vienna. South of the river, Székesfehérvár, communications hub between Lake Balaton and the Danube, was taken. The arc around Budapest tightened and widened, and street fighting raged in the southern and eastern suburbs on Dec. 31, 1944.

Govorov's forces resumed their attack on the Estonian front on September 17 and reached the railway junction of Rakvere on September 22. General Maslennikov's Third Baltic Army blasted its way toward Riga from the north in an attempt to re-close the trap on the Lindemann army. To the right, the southern shore of the Gulf of Finland was cleared when Tallinn, Estonia's capital, fell on Sept. 23, 1944. By October 1, all Germans were driven from Estonia except for the outlying island of Ösel, where an isolated garrison held out for seven more weeks.

Riga fell on October 14, but the bulk of Lindemann's forces made their escape through the Corridor along the Baltic. Bagramian's First Army, Yeremenko's Second Army, and Maslennikov's Third Baltic Army, in concentric operations, isolated 12 of Lindemann's divisions in an arc closing around Latvia's peninsula. The trapped Germans, despite strong pressure, held out all through 1944.

Chernyakhovski's army, supported by Bagramian, was also unable to seize East Prussia in 1944. Russian attacks gained little ground, and no breakthrough was achieved. The front in central Poland remained stalemated.

A SUMMARY OF STRATEGIC BOMBING IN EUROPE

The United States Strategic Bombing Survey gives seven reasons for the defeat of the Luftwaffe:

1. It was originally designed for direct support of ground operations and lacked a long-range bomber force.

2. The full capacity of the German aircraft industry was utilized only after the initiation of the combined bomber offensive in June 1943.

3. Attacks on German airplane production in 1943 and in February 1944 contributed significantly to the winning of air supremacy in the critical air battles early in 1944.

4. Shortage of aviation gasoline resulted in the curtailment of flying training, reflecting a deterioration of the quality of personnel, a primary cause of the defeat of the German Air Force.

5. The Luftwaffe never regained control of the air after it had lost it.

6. Air attacks on the German petroleum industry in the summer of 1944 prevented the revival of the Luftwaffe's using the conventional type of aircraft.

7. The creation of a small force composed of high-performance, jet-type aircraft, manned by qualified personnel and operating on low-grade fuel, was not achieved in time. Ball bearings became a priority target after Aug. 17, 1943, when Schweinfurt, site of the most important German ball-bearing factories, was raided by Flying Fortresses. Between August 1943 and December 1944, more than 11,000 tons were dropped on ball-bearing plants, 52 per cent of which hit Schweinfurt, 12 per cent hit Steyr in Austria, 8 per cent hit Cannstatt, 7 per cent hit Erkner, 6 per cent hit Leipzig, 5 per cent hit Wuppertal, and 10 per cent hit other manufacturing centers. By the second quarter of 1944, production had dropped to 50 per cent of its pre-raid level, but it recovered in full by September 1944. Actual loss of production through the entire period of air attacks did not exceed two to three months' normal output.

Allied air attacks upon the Reich and its plants and supplies in occupied territories reached their peak in the last phase of the war. Strategic bombing operations were independent of tactical bombing which supported ground operations. The Red Air Force did not participate effectively in strategic bombing.

A total of 2,697,473 tons of bombs were dropped by the combined Western Allied air forces over Europe throughout the war, 54.2 per cent of which were dropped by the United States AAF and 45.8 per cent by the RAF. German territory was hit by 50.3 per cent of the total number; France by 21.8 per cent; Italy and Sicily by 13.7 per cent; Austria, Hungary, and the Balkans by 6.7 per cent; and other countries by 7.5 per cent. Classified according to targets, 32.1 per cent of the bomb tonnage hit land transportation; 23.7 per cent hit industrial areas; 11.1 per cent hit military targets; 6.9 per cent hit airfields and aircraft; 4.2 per cent hit naval vessels and water transportation; and 2 per cent hit V-weapon launching sites.

The weight of bombs dropped by the Allied Strategic Air Forces in the European theater since the beginning of 1940 was disclosed in a survey on the effects of strategic bombing on the German war economy by the Overall Economic Effects Division, published Oct. 31, 1945.

Tons of Bombs

	1940	1941
1st quarter	31	4,684
2nd quarter	2,451	11,281
3rd quarter	5,983	13,551
4th quarter	5,082	7,590

	Tons of Bombs	
	1942	1943
1st quarter	6,753	30,777
2nd quarter	14,994	51,122
3rd quarter	17,672	66,159
4th quarter	11,037	58,130
	1944	1945
1st quarter	114,360	369,687
2nd quarter	333,556	April 111,462
3rd quarter	403,808	.....
4th quarter	349,810	.....

The United States Army Air Forces in Europe flew a total of 754,818 bomber and 991,750 fighter sorties; the RAF flew 687,462 and 1,695,049 respectively. Losses of bombers were listed as 9,949 for the United States AAF and 11,965 for the RAF, fighter losses as 8,420 American and 10,045 RAF. Air personnel lost in action included 79,265 Americans and 79,281 of the RAF.

In the spring of 1945, 7,177 United States and 6,956 RAF bombers were assigned to combat units. Fighter planes numbered 6,203 for the AAF in May 1945, and 7,728 for the RAF in August 1944. A total of 57,445 enemy aircraft was destroyed (or probably destroyed) by the Western Allied air forces, 35,783 of them by the AAF.

Records of the German Air Ministry show that by January 1945, a total of 250,253 civilians had been killed and 305,455 seriously injured by air attacks. Total German civilian air raid casualties throughout the war numbered 305,000 killed and 780,000 injured. Records were kept for identified victims only. Persons reported missing and unidentified casualties were not listed.

Sixty-one German cities of 100,000 inhabitants or more were bombed. Of their combined population of approximately 25,000,000 (35 per cent of the German total) 7,500,000 were made homeless by the destruction of 3,600,000 dwelling units. A survey made in 10 raided German cities gave the following percentages of houses destroyed by bombs: Hamburg—31, Augsburg—29, Wuppertal—29, Düsseldorf—22, Bochum—14, Dortmund—12, Hagen—12, Oberhausen—11, Leipzig—10, and Bremen—7. Fires added to the bombing damage, bringing Hamburg's destruction to almost 60 per cent. These cities recovered up to 80 per cent of their contribution to Germany's production within one to five months after the heaviest damage was inflicted and, except for Hamburg, Bochum, and Düsseldorf, regained full production within three to eleven months. Berlin's destruction was estimated at 60 to 70 per cent, caused mostly by fire.

In 1939, the Luftwaffe had 8,395 planes, less than 60 per cent of which were fighters. In 1944, according to official German reports, the Luftwaffe accepted 39,807 planes from German manufacturers, almost 80 per cent of which were fighters. The 1944 figure is questionable. The poor showing of the German Air Force in 1944 and 1945 would be hard to explain if so many planes had been produced.

Earlier plane acceptances by the Luftwaffe were listed as 4,733 in 1939, 10,826 in 1940, 11,776 in 1941, and 15,566 in 1942. Combined American and British production of combat planes amounted to 11,485 in 1940, 21,564 in 1941, and 42,300 in 1942.

Field Marshal Gen. Erhard Milch of the Luftwaffe later commented on Allied raids as follows: "It is true that air attacks on the airplane factories did hold up our production, but they did not reduce it. I have never understood why you did not attack the engine factories in 1944. If you had attacked them at once, it would have been far worse for us."

Actually, the Allied air raids on the German engine industry reached their peak in July 1944. In April 1944, German production of the principal types of engines reached a high mark of 6,000, but it dropped to 3,400 in August and to 2,700 in October. In December 1944 the number rose again to 4,200 and continued to meet requirements until May 1945.

Imports of oil products to Germany never reached their last peacetime level of 5,165,000 metric tons during the war, but the development of domestic crude oil and synthetic production made the Reich's oil supply situation fairly comfortable until the end of 1943.

Figures for 1940–1943 (not including booty) were as follows:

(Figures are in thousands of metric tons)

Year	Imports	Domestic Oil	Synthetic Production
1940	2,075	1,465	3,348
1941	2,807	1,562	4,116
1942	2,359	1,686	4,920
1943	2,766	1,883	5,748

Prior to May 1944, only 4,000 tons of bombs hit oil targets, but raids on German oil supplies were then stepped up. In May, 5,146 short tons were dropped on oil targets; 17,697 in June; 21,404 in July; 26,320 in August; 10,997 in September; 12,542 in October; 35,023 in November; 13,900 in December 1944; 12,505 in January 1945; 22,635 in February; 30,937 in March; and 6,451 in April. Total production and imports of oil fell from a monthly average of 918,000 tons in the first quarter of 1944 to 319,000 tons in the last quarter of that year. Imports of oil products from Rumania dropped from a monthly average of 189,000 tons in the first quarter of 1944 to 50,000 in June. They ceased entirely in August, when the Red Army occupied Ploesti. By Jan. 27, 1945, 17 out of 36 refineries still in German hands were out of production, and nearly all of the remainder were running at a fraction of former capacity.

Synthetic rubber production reached an all-time peak of 12,787 tons in March 1944. Plant bombing reduced that figure to 2,000 tons in December 1944. It recovered to 3,500 tons in February 1945.

From May 1944 to the end of the war, 62,915 tons of bombs were dropped on chemical plants. The production of nitrogen, a most important war chemical, fell from 75,000 tons a month early in 1944 to 20,000 in December 1944. The production of powder, 24,000 metric tons in May 1944, declined to 16,600 metric tons in December 1944, and to 11,000 in February 1945. Explosives produced amounted to 51,000 tons in June 1944, 22,800 tons in December 1944, and 12,000 tons in February 1945.

German panzer production (tanks, self-propelled guns, and assault guns) was systematically attacked during August, September, and October 1944, and in February and March 1945. Output reached its peak in 1944 and was not considerably reduced before 1945, according to the following German statistics of production:

1944	Tanks	Assault and self propelled guns
1st quarter	2,030	2,107
2nd quarter	2,372	2,420
3rd quarter	2,239	2,598
4th quarter	1,703	3,533

1945	Tanks	Assault and self-propelled guns
1st quarter	998	2,934

In 1942, submarine bases became priority targets of air attack. In 1943, priority shifted to ship yards. After the summer of 1943, raids against German submarine construction subsided and were resumed in strength only between November 1944 and April 1945. The 1944 attacks had little effect. Among the raided yards were *Blohm & Voss,* the *Hochwaldtswerke, Deschimag, Germaniawerft,* and *Deutsche Werke.* German U-boat production in 1939 was 23 craft, or 11,939 tons. In 1944, it was 387 craft, or 275,306 tons. Slowed-down engine production and general transportation difficulties accounted for the fact that less than half of the U-boats produced in 1944 became operational. In December 1944, 36 submarines of types 21 and 23 were completed against a planned figure of 40. In January 1945, production fell to 24, in February to 16, and in March to 12, against planned construction of 42, 44, and 46 respectively. The Strategic Bombing Survey states, however, that the difference between planned and actual production cannot be ascribed entirely to direct air attacks on the industry.

Plants producing guns and ammunition numbered about 5,000 and were so widely scattered that the organized bombing of such factories presented an almost insoluble problem.

Bombing of German rail transportation was intimately interrelated to the development of ground operations. In the fall of 1944, when the Allied Expeditionary Force invested the Reich's western boundaries, heavy raids hit the *Reichsbahn* system in the Saar area and in the Cologne plain, gradually spreading through the entire territory from the Ruhr to the Swiss border. These attacks were supported by raids on inland waterways. On September 23, the Dortmund-Ems and the Mitteland Canals were blocked, halting traffic between the Ruhr and points on the north coast and in central Germany. By October 14, the Rhine River was similarly blocked at Cologne. Carloadings of the Reichsbahn fell from 899,091 cars during the week ending Aug. 19, 1944, to 703,580 during the week ending October 28, and 547,309 for the week of December 23. During the week ending March 3, 1945, the figure declined to 214,001.

Transportation troubles affected German coal production. Output of hard coal in the Ruhr fell from 10,417,000 tons in August 1944 to 4,778,000 tons in February 1945.

Serviceable German merchant shipping tonnage declined from 1.1 million in 1941 to 0.7 million in 1944. As coastwise shipping at no time handled more than 3 per cent of the German rail tonnage, these losses had no noteworthy effect.

Truck transportation was highly important. In 1944, producers were subjected to precision raids. Monthly truck production, averaging 9,095 during the first six months of 1944, fell to 8,522 in July, 7,872 in August, 6,013 in September, 4,796 in October, 4,093 in November, 3,203 in December, recovered to 4,319 in January 1945, then hit new lows in February and March of 2,917 and 2,082 respectively.

Loss of working time through air raid alarms, shortages of gas and power, and transportation difficulty added to actual bombing damage, reducing German steel production from a monthly average of approximately 2½ million metric tons from January 1943 through July 1944 to one million in December 1944. Although strategic bombing constituted the most important factor in the reduction of German output, general disorganization, spreading with repeated military disasters and Allied advances, played a notable part in the decline of German production.

ISLAND-HOPPING IN THE PACIFIC

The United States Navy's shipbuilding program for 1944 exceeded 3,000,000 tons. The average age of United States fighting ships was not only much lower than that of the Japanese, but the United States Navy, mostly built according to lessons learned in recent battles, became the best balanced in the world. The personnel of the Navy consisted of 300,101 officers and 2,833,904 enlisted men and women on Dec. 31, 1944, in addition to 84,627 officer candidates and 8,893 nurses. There were also 169,832 in the Coast Guard and 472,682 in the Marines.

Fighting ships added to the navy in 1944 included a number of carriers, the new *Iowa* class battleships *Missouri* and *Wisconsin,* the large cruisers *Alaska* and *Guam* with 12-inch guns, and a number of heavy cruisers of the *Baltimore* class.

Jet-propelled fighters were built in 1944 to modernize the navy's air arm. The Sea Hawk replaced earlier models as a standard scout observation plane, and the Helldiver became the outstanding dive bomber. The Avenger (torpedo bomber) was being replaced by more modern craft, and the Catalina long-range patrol bomber was supplanted by the Mariner and Liberator for scout work and by the Ventura and Privateer as bombers.

The commander in chief of the United States Pacific Fleet and Pacific Ocean Areas, Admiral Chester W. Nimitz, had his headquarters at Pearl Harbor. Eventually Hawaii became too remote from the theater of operations, and his headquarters were moved to Guam in January 1945. The Northwest Sea Frontier, including the coasts of Oregon and Washington, was abolished on April 15, 1944, and the 17th Naval District was created, including the territory of Alaska and its waters. All sea frontier and correlated activities on the United States west coast were consolidated under the commander of the West Sea Frontier, Vice Admiral David W. Bagley. On Nov. 8, 1944, the duties of the commander of the West Sea Frontier were substantially enlargened, and Admiral Royal E. Ingersoll took over nine days later, while Bagley was placed in charge of the Hawaiian Sea Frontier. The Philippine Sea Frontier was established after the invasion of the Philippines was under way. Rear Admiral James L. Kauffman assumed command on Nov. 13, 1944, under the command of the Seventh Fleet.

The Marianas Campaign.—After a 700-mile advance from Tarawa and Makin to Kwajalein, and another 400-mile advance to Eniwetok, an even more ambitious move was undertaken: a 1,200-mile jump across the Central Pacific to the Marianas. Its objective was to recapture Guam and to seize the Japanese strongholds of Saipan and Tinian. Previous Pacific battles had been serious, but the forces involved in the Marianas were larger than in most of the previous engagements. On Saipan, 30,000 Japanese faced 48,000 United States Marines and 20,000 soldiers in an area of slightly more than 71 square miles. On Guam, 18,500 Japanese opposed 40,000 marines

and 20,000 soldiers. The Japanese garrison of 4,500 at Tinian faced the marines from Saipan after the occupation of the latter island was completed.

Despite United States superiority, the invaders faced a formidable task. Limited space hampered the deployment of large numbers of men. Use of heavy matériel was restricted by unloading difficulties. Under these conditions, substantial losses were to be expected, but high casualties were a necessary price to pay for control of the Marianas, crossroads of the Pacific. These islands formed part of an almost continuous chain extending 1,350 miles southward from Tokyo through the Bonin and Volcano Islands. Another island chain led from the Marianas through the Palau group toward the Philippines. The Mariannas offered an ideal opportunity to establish bases for air attacks on Japan proper.

The initial plan of attack, code-named Operation Forager, called for the 2d and 4th Marine divisions (5th Corps) to hit Saipan on June 15, while the 3d Corps, including the 3d Marine Division and the 1st Provisional Brigade (4th and 22d Marine regiments) were to attack Guam, 100 miles to the south, on June 18, 1944.

Admiral Spruance was in command of naval operations. The amphibious forces were under Vice Admiral Richmond K. Turner, and Lt. Gen. Holland M. Smith, USMC, was in charge of the expeditionary forces which were to attack Saipan. The ground forces for the assault on Guam were under Maj. Gen. Roy S. Geiger. Smith was to assume command of all invasion forces in the Marianas when beachheads were established, and Maj. Gen. Harry Schmidt was to replace him as commander of the 5th Corps.

The ships which would carry and assist the expeditionary forces were assembled and trained at many points in the Pacific area. They included more than 600 vessels: battleships, aircraft carriers, cruisers, high speed transports, destroyers, and tankers. The total number of navy, marine, and army personnel exceeded 300,000. More than 2,000 United States aircraft took part in the operation.

From the beginning of June 1944, land-based aircraft from the Admiralty Islands, Green Island, and Hollandia made neutralizing attacks on Japanese bases, including Truk, Palau, and Yap. Fast carriers and battleships of the Fifth Fleet under Vice Admiral Marc Mitscher ranged up and down the Western Pacific, hitting Japanese airfields at Iwo Jima, Rota, Guam, and Tinian. On June 11, carrier planes opened the assault on the Marianas to destroy aircraft and their facilities and to soften up defenses. Off Saipan, 124 enemy planes were destroyed. A Japanese convoy west of Pagan Island had 10 ships sunk and an equal number damaged, and another convoy, consisting of one cargo ship escorted by four destroyers, was sunk. On Saipan, cane fields, which were potential hiding places for snipers, were shelled and set on fire.

Saipan.—After assembling at Eniwetok on June 8, the invasion forces reached the shores of Saipan on June 15, 1944. The fleet's guns opened the barrage at 5:45 A.M. The attack was directed against the island's west side. Two beaches were selected, north and south of the sugar mill town of Charan (pop. 2,500), separated by a 500-yard gap. Troops had to reach the shore in "amtracks," the only craft capable of climbing over a forbiddingly jagged reef. Tanks and heavier equipment could not be unloaded until a deep water channel was secured. To the north of Charan, the 2d Marine Division was to drive on Garapan, the island's capital (pop. 10,000) and toward Mt. Tapotchan (height 1,554 feet), an ideal observation and defense position. South of Charan, the 4th Marine Division was to drive across the island in the direction of Magicienne Bay, and fan out northward to assist the 2d Marine Division. The 27th Infantry Division, put ashore on D-day plus 1, aimed at Aslito airfield to the south of the 4th Marine Division's projected line of advance.

At 7:00 A.M., an air attack paved the way for the marines, who reached the beaches at 8:40 A.M. and suffered heavily from mortar and small caliber gun fire. Many Japanese pillboxes had not been destroyed. Light tanks plagued the invaders and added to their mounting casualties. Japanese artillery observers, overlooking the beaches and nearby waters from hill positions, directed fire with great precision. At nightfall, savage counterattacks started from the direction of Garapan. Twenty-nine of the Japanese tanks involved in the counter-blow were destroyed by antitank devises. On the first and second day, some progress was made, and Aslito airfield was taken, but the 4th Marine Division alone had lost 2,200 men by June 17. The severity of the fighting on Saipan led to a last-minute postponement of the invasion of Guam. The 3d Corps was sent back to Eniwetok where it joined the "area reserve."

The Japanese concentrated in cave positions in the hills, letting themselves be burned and killed by flame throwers rather than fall back or surrender. Half of the island was occupied after one week of terrific fighting. The capture of Mt. Tapotchan was one of the most difficult objectives of the campaign. In a drive east and north against the mountain and the island's capital city, the 2d Marine Division was on the left wing, and the 4th on the right. The center was held by two regiments of the 27th Infantry Division. Subsequent events led to angry controversy over whether the army forces had delayed the general advance by overcautious tactics or if they had cooperated effectively.

On June 25, the 2d Marine Division entered Garapan, while the 8th and part of the 29th Marine regiments reached the summit of Mt. Tapotchan. The attackers used bulldozers to clear the way to hidden Japanese emplacements and TNT to blast them into ruins. On June 28, a communiqué by Admiral Nimitz listed United States casualties on Saipan: killed—marines 1,289, army 185; wounded—marines 6,337, army 1,023; missing—marines 827, army 61.

A number of Japanese civilians, mostly government officials with their families, resided on Saipan. Many of them committed suicide in an orgy of self-destruction. On Marpi, Saipan's northern point, entire families drowned or killed themselves with hand grenades; infants were thrown from high cliffs; and children unquestioningly obeyed when they were ordered to kill themselves with explosives. Civilian deaths were estimated at about 800.

After the fall of Garapan and Mt. Tapatchan, although the situation of the defenders was hopeless, their fighting spirit remained unbroken. A last *banzai* (hurrah) attack was ordered by their commander, Lt. Gen. Yoshihi Saito. The general issued the following message to his troops: "During the more than 20 days since the American

devils attacked, the officers, men, and civilian employees of the Japanese Army and Navy have fought well and bravely . . . We have fought in unison up to the present time, but now we have no matériel with which to fight, and our artillery has been completely destroyed . . . We are dying to no avail under the violent shelling and bombing. Whether we attack or whether we stay where we are, there is only death . . . However, in death, there is life. We must use this opportunity to exalt true Japanese manhood. I will advance with you to deliver still another blow to the American devils, and leave my bones on Saipan, the bulwark of the Pacific. As it is said in the *Senjikun* (battle ethics) : 'I will never suffer the disgrace of being taken alive and I will offer up the courage of my soul and calmly rejoice in living by the eternal principles.'" As the general was too old and too clumsy to lead the charge personally, he ordered his adjutant to shoot him.

Three thousand Japanese soldiers made the charge on July 7. It temporarily pierced the lines of the 27th Infantry Division, but the situation was soon restored, and the attack was smashed. The 4th Marine Division's advance was still delayed by nests of resistance, but the 2d made good progress. On July 9, Saipan was declared secure, although mopping up operations continued for some time. Over 20,000 Japanese bodies were buried; at least half that number had already been burned, drowned, or otherwise disposed of. Of the 1,707 prisoners counted, most were noncombatants by non-Japanese standards. The price of the victory was extremely high: the marines lost 2,382 killed or missing, the army 1,059; 8,769 marines and 2,696 army men were wounded.

The Battle of the Philippine Sea.—United States naval forces off Saipan were attacked by carrier-borne torpedo bombers on D-day but suffered only minor damage. On the same day, Admiral Spruance received a report that a large group of Japanese carriers, battleships, cruisers, and destroyers was headed toward the Marianas. The United States commander decided to take the offensive. A large proportion of his carriers and battleships, however, could not move too far from the landing grounds, because they were needed to protect amphibious forces offshore. On June 15 and 16, some of the fast carriers and battleships much farther to the north, attacking bases on Iwo Jima and Chichi Jima, were ordered to join the main forces west of Saipan.

The possibility could not be ignored that the Imperial Navy was about to make its supreme attempt to turn the tide in the Philippine Sea between Saipan and the Philippines, but the Japanese actually threw into battle only a part of their remaining vessels. Four battleships (mostly modernized old ones) and six carriers of the *Hayataka* class (converted passenger ships) formed the bulk of the fleet. The engagement began on June 19, when 545 Japanese carrier-based craft raided the American fleet. The Japanese planned to continue to Guam and Tinian to refuel and then to make a second run. In violent air battles, partly fought over Guam, the Japanese lost 402 aircraft compared to 17 United States planes. Minor damage was inflicted upon four United States ships, including one battleship and two carriers. With their air power decisively reduced, the Japanese attempted to escape westward through the channel between the Philippines and Formosa. As the United States Fleet could not move too far away from the Marianas, air attacks on the Japanese Fleet had to be made at long range. Early on June 20, Japanese surface units were located. It was nearly sunset, however, when the United States carrier-based planes assaulted the enemy, sinking two carriers, two destroyers, and one tanker. One battleship, three carriers, three cruisers, one destroyer, and three tankers were severely damaged. Sixteen United States planes were shot down, but 73 more were lost due to lack of fuel and landing crashes. Scouts sighted the remainder of the Japanese Fleet again on June 21, but fighter planes failed to make contact, and the chase was abandoned.

Fast American carriers and battleships continued operations to prevent the Japanese from augmenting their strength in the Bonins and the Volcanoes. On June 23 and 24, Pagan Island was heavily raided. Air attacks hit Iwo Jima on June 24 and July 4, assisted on July 4 by shelling from cruisers and destroyers. Chichi Jima and Haha Jima were also hit by air raids on July 4. From their remaining bases in the Marianas and the Carolines, Japanese planes harassed the ships off Saipan until July 7. The battleship *Maryland,* one escort carrier, two fleet tankers, and four smaller craft were damaged. One LCI was sunk. Bombers of the Seventh Air Force (Maj. Gen. Robert W. Douglass), based on Saipan, joined the navy's aircraft in striking at the Bonins and the Volcanoes.

The Recapture of Guam. — On June 16, when the invasion of Guam was supposedly impending, surface ships shelled the island of 206 square miles. Shelling and bombing were resumed in full strength on July 8. Saipan-based planes joined aircraft from escort carriers. Destruction of air facilities on Guam, Rota, and outlying bases gave the Americans full control of the air. Preparatory attacks accounted for the far-reaching destruction of prepared defenses on the beaches. On July 21, amphibious operations were launched against Guam. The 3d Marine Division, the First Provisional Brigade, and the 77th Army Infantry Division went ashore east and south of Apra harbor. Beach conditions were unfavorable, and landing craft had to transfer loads to amphibious vehicles or to pontoons at the edge of a reef. Landings began at 8:30 A.M. Some mortar and machine gun fire was encountered, but initial resistance was rather light on a whole. As the troops advanced beyond the landing grounds, the Japanese furiously defended the rugged terrain and their remaining pillboxes. From July 21 to July 30, the United States forces, sustaining heavy losses, fought for Apra harbor. Agaña, the capital of Guam, was captured on July 31. The capture of Orote Peninsula made the Apra area available for speedier unloading. With more supplies ashore, the invasion forces pushed across the island to the east coast and thence northward to the tip of Guam. Organized resistance ceased on August 10. Even after Guam was once again a major base, a few hundred Japanese diehards held out in hills and undergrowth, occasionally ambushing American men and vehicles, until their country surrendered. These few were all that remained of the 18,500 Japanese defenders of Guam. United States casualties were listed as 1,484 killed and 4,957 wounded for the marines and 591 killed and 2,818 wounded for the army.

Tinian.—The 2d and 4th Marine divisions rested for 13 days after Saipan was declared safe

In the meantime, their next objective, 32-square mile Tinian, was heavily hit by sea and air bombardment. On July 24, amphibious operations, under the command of Rear Admiral Harry W. Hill, led the Marines across a channel four miles wide which separated the southern tip of Saipan from the northern end of Tinian. The Japanese did not expect the assault from that direction. Their commander made an attempt to evacuate his 4,500 men in small boats but was prevented from doing so by United States warships offshore. The Japanese, although surrounded and greatly outnumbered, dug in for a last ditch stand on Tinian Island. It took the marines nine days to seize the island and annihilate its garrison. American losses amounted to 416 killed and 1,735 wounded.

The Air Assault on Japan.—Full strategic control of the Marianas was established by the seizure of Saipan, Tinian, and Guam, although there were 12 more islands in the archipelago. The Japanese defeat led to the resignation of Prime Minister Tojo and his replacement by Gen. Kuniaki Koiso. The new premier, another typical exponent of militarist policies, tried to increase the country's war effort rather than lead it back to peace. The Battle of the Marianas was the turning point in air operations in the Pacific and greatly hastened Japan's collapse. Up to 1944, even when the Japanese were losing the battle in the air, their home islands and their industrial reserve arsenal in Manchuria were comparatively safe. With the Americans in the Marianas, the safety period came to an end.

Decisive progress was made in American plane construction. The B-17 Flying Fortress of the early days of the war was surpassed by the B-29 Superfortress which could carry bomb loads of more than 10 tons, had a range of more than 5,000 miles, and a cruising speed of 300 mph. Large-scale production of B-29's, well under way in June 1944, was one answer to the problem of battering Japan proper. The other was suitable bases for the big planes. Early in 1944, it was planned to establish B-29 bases in China. Half a million native laborers were put to work with incredibly primitive tools on the construction of runways one and one half miles long. Bombs, gasoline, and other supplies had to be flown in over the "Hump." Installations in China were precarious, as Japanese bases were not far away. The general trend of the war in China was unfavorable in 1944.

The capture of Saipan and Guam solved the problem. The islands were reasonably safe from air attack, and water transportation permitted an easy and abundant supply of everything needed for intensive raids. The most modern equipment was at hand to build airdromes in a short time.

The first test raid by B-29's was carried out against Bangkok, Siam, from Asiatic mainland bases. On June 15, another blow hit the Japanese steel center of Yawata. On November 24, Superfortresses took off from the Marianas for the first air attack on Tokyo since General Doolittle's memorable raid. Systematic bombing of Japanese and Manchurian cities and industries continued from that time until the end of the war. As many as 800 B-29's took off simultaneously from the Marianas. The high inflammability of Japanese "tinder box cities" accounted for terrific damage. Japanese authorities ordered a partial evacuation of Tokyo, and 630,000 persons left the city. No underground plants existed in Japan, and decentralization of industry lagged far behind the German example.

Planning the Next Moves.—The Central Pacific drive could fan out in two directions; one through the Volcano Islands and the Bonins straight north toward Japan, the other to the west and southwest to the Palau Islands first, and then, joining General MacArthur's advance, to the Philippines. Plans to occupy by-passed Truk were finally abandoned after the seizure of the Marianas. The island of Yap, between the Palaus and Guam, was considered a more important objective, and the 24th Army Corps (7th, 77th, and 96th divisions) was assigned to take it. In August 1944, however, when the 24th Corps was already at sea, the operation was called off. The island was to be by-passed, and the 24th Corps was loaned to General MacArthur by Admiral Nimitz. The drive toward the Philippines, with the seizure of the Palaus and Morotai as the initial operations, was given first priority.

General MacArthur's original plan to invade the Philippines scheduled the opening invasion of Mindanao, in the southern Philippines, for Dec. 20. The Octagon Conference of the Joint Chiefs of Staff, meeting in Quebec, Canada, received a copy of a communication from Admiral Halsey to Admiral Nimitz on Sept. 13, 1944. He recommended an early attack on Leyte, in the central Philippines, instead of Mindanao. General MacArthur's views were requested, and he replied that he was prepared to shift his plans to land on Leyte and to advance the date of the invasion of the Philippines by a full two months. Immediately thereafter, both General MacArthur and Admiral Nimitz were urged to execute the Leyte operation on Oct. 20, 1944.

The earlier plan assumed air support of the Philippine campaign by Maj. Gen. Claire L. Chennault's 14th Air Force in China, but General Stilwell informed the War Department that the Japanese offensive in central China would soon result in the capture of eastern Chinese airfields. The success of United States carrier-based air attacks, however, was considered adequate to reduce Japanese air strength in the Philippines to a degree which made support by the 14th Air Force unnecessary.

From October 1944 to February 1945, the bulk of the Pacific Fleet was engaged in operations connected with the Philippine campaign. No large forces were available for continued operations in a northerly direction and amphibious troops in the Central Pacific were out of combat during that period.

The Palau Islands Campaign.—The Palau Islands, western outposts of the Carolines, consist of 7 large and 20 smaller islands. Admiral William F. Halsey, commander of the Third Fleet, directed the sea operations in which nearly 800 vessels participated. The Third Fleet, considerably reinforced by newly commissioned ships, gained unmatched fighting strength. Vice Admiral Wilkinson commanded the joint expeditionary forces conducting the Palau landing operations. Vice Admiral Mitscher remained commander of the fast carrier force. Maj. Gen. Julian C. Smith, USMC, commanded the troops, including the 1st Marine and 81st Army Infantry divisions.

To divert and destroy Japanese forces which might have been able to interfere, planes from the fast carriers raided Chichi Jima, Haha Jima,

and Iwo Jima from August 31 through September 2. Chichi Jima and Iwo Jima were also shelled by cruisers and destroyers. Forty-six Japanese planes and six ships were destroyed at a loss of five United States aircraft. Yap Island was raided by carrier planes on September 7 and 8.

The air assault on the Palau Islands opened on September 6. Extensive damage was inflicted in two days of frequent raids. On September 9, the onslaught switched to Mindanao Island in the southern Philippines. On September 10, a cruiser-destroyer raid destroyed a Japanese convoy of 32 small freighters in that area. Between September 12 and 14, the carrier task force attacked the Visayas, destroying 198 Japanese planes. Operations on September 14 and 15 hit Mindanao, the Celebes, and Talaud. These actions not only paved the way to the invasion of the Palaus but also to landings on Morotai.

The First Marine Division of 25,000 men sailed to attack Peleliu. The 81st Army Division of about 10,000 proceeded to nearby Angaur. A Japanese garrison of no more than 8,000 was expected on Peleliu, but there were 10,500 troops there. Defensive installations, hit by a carrier task force raid between March 29 and 31, 1944 (which cost the Japanese 214 planes and 28 ships) were battered by September attacks. Still, parts of them remained formidable. Terrain conditions—precipitous coral reefs, sharp rocks, and swamps—favored the defenders.

Covered by intensive bombing and naval shelling, the marines went ashore on September 15, securing a two-mile beachhead. The defenders staged vicious counterattacks out of the cover of dense tropical vegetation. On D-day plus 1, the Peleliu airfield and most of the southern part of the island were captured. Further progress was slow. A rough ridge, forming the north-south backbone of the island—called Bloody Nose Ridge by the marines—offered natural obstacles which the Japanese astutely employed as emplacements for automatic weapons. The tactical scheme of the Japanese defense of Peleliu was superior to that encountered in previous island campaigns. After the capture of Angaur, army forces assisted the marines on Peleliu. On Sept. 26, the Japanese were trapped on Bloody Nose Ridge. They continued to resist until Oct. 12, and mopping up operations lasted beyond that date. The battle of Peleliu was among the bloodiest of the Pacific war.

On Angaur, six miles south of Peleliu, Japanese troops offered comparatively weak resistance. Landings took place on September 17. Three days later the opposition was overcome except for one spot on high ground where it continued for a brief period. On September 22, parts of the 81st Division joined the marines on Peleliu. A heavy bomber field was established at Angaur. On September 28, troops from Peleliu landed on Ngesebus Island to the north. Light resistance ended the next day. Konguran and Ulithi, other islands in the group, were seized later.

Babelthuap, the largest island in the Palaus, was not invaded. It was heavily garrisoned and had a rough terrain, which would have made its capture a costly venture. By-passing worked effectively. Babelthuap was neutralized permanently by the occupation of Peleliu and Angaur. Japanese bodies, numbering 13,354 were accounted for, and 433 prisoners were taken in the Palau campaign. The marines had 1,241 killed and 4,883 wounded, and the 81st Division had 264 dead and 1,465 wounded.

Capture of Morotai.—Between General MacArthur's New Guinea bases and the southern Philippines, Japanese positions on the Molucca Islands threatened the advance. It was decided to invade Morotai, northernmost island of the group, a formidable Japanese strongpoint with a good airstrip. Early in September, army planes of the Fifth Air Force and the Thirteenth Air Task Force staged violent assaults on Morotai and other Moluccan islands. On September 15, a force of 800 Allied ships, under the command of Rear Admiral Barbey, steamed into Morotai Straits. General MacArthur was aboard Admiral Barbey's flagship, the *Nashville*. Practically no enemy opposition was encountered as parts of the United States 11th Corps (31st Infantry Division and 126th Infantry Regiment of the 32d Division) went ashore. Coral obstacles and depressions in the reef adjacent to the landing areas, however, caused unloading difficulties. The airfield was seized, and the 40-by-25-mile island was declared secure. This claim was premature.

The Japanese garrison, realizing the immense superiority of the invaders, withdrew to the interior and continued to raid United States positions after the main forces left. It became necessary to bring in the United States 136th Infantry Regiment (33d Division) from New Guinea. In a difficult campaign, lasting from Dec. 26, 1944, to Jan. 14, 1945, the garrison was destroyed, losing 870 killed and 40 captured. United States casualties amounted to 46 dead and 127 wounded.

"I SHALL RETURN"

On September 10, Vice Admiral Mitscher's task force became active in the Philippines. Japanese air opposition above the southern islands was surprisingly weak. Admiral Halsey therefore ordered Mitscher to the central and northern areas. In the Visayas, 123 Japanese planes were destroyed on the ground and 75 in the air; 5 ships and 35 small craft were sunk, and 6 ships and 36 small craft were damaged. On September 21 and 22, the task force was almost within sight of Luzon. Japanese airfields in the suburbs of Manila, and Clark Field, 70 miles north of the capital, were attacked. On the ground, 110 Japanese planes were destroyed, and 95 in the air.

Then carrier-based dive bombers and torpedo bombers struck at Japanese shipping in Manila Bay and Subic Bay for the first time since the fall of Corregidor. Results observed were 40 ships and 6 small craft sunk; 11 ships were left in a sinking condition; 35 ships, 11 small craft, and 2 floating drydocks were damaged. Eleven United States planes were downed in action. Scattered Japanese attacks on the United States task force failed to inflict much damage. Admiral Nimitz reported that the operations of the Third Fleet had broken the Japanese air force in the Philippines, as operations of the Fifth Fleet had broken the enemy's carrier-based air force in the battle of the Philippine Sea. The Japanese air force in the Philippines, however, was not permanently paralyzed.

D-day for the invasion of Leyte was Oct. 20, 1944. The date set for the landings fell in the monsoon season, when torrential rains frequently swamped the eastern sections of the islands and made the establishment of air fields extremely difficult. Landings on the west side of Leyte were

not feasible, as the Japanese controlled the approaches.

Col. Ruperto Kangleon, leader of the guerrillas on Leyte and Samar, reported to the American command that the Japanese had only 24,000 men on both islands, most of them belonging to the reinforced 16th Infantry Division of ill repute as "butchers of Bataan." Total Japanese forces on the Philippines amounted to 260,000 men.

Admiral Nimitz offered General MacArthur the full support of the Third Fleet. The Central Philippine Attack Force, organized to carry on naval operations, was composed of the Seventh Fleet augmented by units of the Pacific Fleet, and 16 escort carriers were assigned to give tactical air support during the landings.

The Central Philippine Attack Force was under Admiral Kinkaid, who took orders from General MacArthur. It was subdivided into the Northern Attack Force (Seventh Amphibious Force, Rear Admiral Daniel E. Barbey), the Southern Attack Force (Third Amphibious Force, Vice Admiral Wilkinson), and a number of fire support, mine sweeping, and supply groups. The entire force comprised 650 ships, capable of landing four army divisions on D-day. To the extent that it was not engaged in amphibious operations, the Third Fleet, under Admiral Halsey, was to continue air strikes on Luzon, Formosa, and the Visayas, and to protect the landings against Japanese naval attacks. The Sixth Army in charge of land operations was assigned to the field commander, Lt. Gen. Walter Krueger. It was made up of the 10th and 24th Army corps.

On October 10, Admiral Halsey's forces were bearing down on the Ryukyu chain between Japan and Formosa. Searching planes and submarines were dispatched ahead of the main units to destroy Japanese scouting planes and picket boats. Okinawa Island was raided October 10. Airfield facilities suffered considerably, and many ships were sunk. On October 11, fighter planes attacked airfields at Aparri on the northern end of Luzon. Carrier planes struck at Formosa and the Pescadores on October 12, hitting aviation facilities, warehouses, wharves, and coastal shipping. On the first day 193 Japanese planes were downed and 123 more on the second day of the attack. Japanese torpedo planes hit the heavy cruiser *Canberra* and the light cruiser *Houston.* Both ships were safely brought to a base for repairs. On October 20, support was given to the amphibious operations, and long-range searches were made for the enemy fleet.

The Invasion of Leyte.—On October 17, the first American force en route to the Philippines appeared in the mouth of Leyte Gulf. The naval advance guard was commanded by Rear Admiral Arthur D. Struble. The 6th Ranger Battalion (commander—Lt. Col. Henry A. Mucci; acting commander—Maj. Robert W. Garret) sent patrols ashore at Dinagat, Sulau, and Homonhon, to secure the approaches to Leyte. Some resistance was overcome on Dinagat and Sulau. Underwater and minesweeping units cleared shipping lanes. On October 20, the main invasion fleet, assembled in New Guinea and in the Admiralties, steamed into Leyte Gulf after travelling between 1,000 and 1,500 miles.

The 10th Corps (Maj. Gen. Franklin S. Sibert), in the northern sector, was to strike toward the provincial capital of Tacloban and airfields at Calaisan Point with the 1st Cavalry Division. The 24th Infantry Division (less one regiment), on the left of the cavalry, was to push into Leyte valley. The 96th Infantry Division, right wing of the 24th Corps (Maj. Gen. John R. Hodge), was to invade beaches near Dulag. On the left, the 7th Infantry Division aimed at Burauen and its air bases. The beachheads selected were 11 miles apart and both were about 3½ miles wide. The gap was to be closed as soon as possible. The 21st Infantry Regiment, detached from the 24th Division, was assigned to occupy Panaon Island, off the southern tip of Leyte, close to Dinagat and Mindanao.

A lone Japanese plane appeared as the warships lined up along the shore to open the shelling. Among the vessels were the *California, Pennsylvania,* and *West Virginia,* badly damaged at Pearl Harbor, and the *Phoenix* and *Boise,* which had narrow escapes when the Japanese invaded the Philippines. General MacArthur was on board the *Nashville* again. Most of the beaches were undefended, and only a few elements of the 24th Infantry Division ran into heavy mortar fire before their landing craft hit shore.

General MacArthur went ashore four hours after the assault troops. Broadcasting through a signal corps microphone, the general proclaimed: "This is the voice of freedom! General MacArthur speaking. I have returned. By the grace of Almighty God our force stands again on Philippine soil, consecrated by the blood of our two peoples. Rally to me . . . Let the indomitable spirit of Bataan and Corregidor lead on."

Initial objectives were secured on schedule. The Japanese, quickly regrouping their air forces, attacked the invasion fleet offshore. During the voyage, one small ship was sunk in a storm, and the United States destroyer *Ross* struck a mine. More serious damage was suffered off the beaches, where Kamikazes were used for the first time.

Formation of the Kamikaze Special Attack Corps was announced in October 1943. The Japanese used different types of Kamikazes between October 1944 and August 1945. The first was a medium bomber or fighter plane, stripped of its armor and most of its equipment, and loaded to the limit with high explosives. The pilot, without a parachute, steered his craft into the selected target. The hit ignited the explosives. A later version was a missile resembling the German V-1, carried to the vicinity of the target by a bomber and then released to be rocket-propelled into the target at a speed of 500 miles an hour. This steering also was done by a pilot without parachute. The later type, referred to as Jinray by the Japanese and as Baka by the Americans, had a fuselage length of 19 feet 10 inches, a wingspan of 16 feet 5 inches, and an explosive charge of 2,645 pounds of Trinitroanisol. Kamikaze pilots had no chance to survive. Among Allied ships damaged offshore in the opening stages of the Leyte invasion were the cruisers *Honolulu* (hit by an aerial torpedo) and *Australia.*

The airfields of Dulag and Tacloban were quickly captured, and work was begun to put them into operation on October 25 as scheduled. The escort carriers, which had provided most of the tactical air support, had no facilities to carry fuel, bombs, torpedoes, or ammunition for prolonged operations. Frequent refueling and reloading were necessary, and army aircraft had to take over from newly established bases. The big carriers of the Third Fleet were busy neutralizing

Japanese airpower on neighboring islands and guarding adjacent waters against a naval threat. They were to support ground operations only in an emergency.

Adverse weather conditions and inadequate planning delayed the completion of the air bases. On October 25, severe storms transformed the ground into a sea of mud before steel mats for the runways were completely laid. Japanese planes, operating from better bases on the western part of Leyte, carried out 17 raids against Tacloban in one day. On October 27, when runways were ready and escort carriers could no longer be relied upon, a sufficient number of army planes was not available. A successful Japanese sneak attack accounted for the loss of 27 P-38's. General MacArthur was forced to ask Admiral Nimitz to order the Third Fleet back to protect the beachhead.

Field Marshal Count Hisaichi Terauchi, Japanese commander in chief in the southern areas, controlled 17 armies with a total of 925,000 men. He succeeded in reinforcing the troops on Leyte via the west coast. On November 1, four large transports unloaded in Ormoc Bay. Two days later, three more transports came through, followed by seven on November 7, and four on November 9. On November 11, the Japanese met disaster when four transports were sunk, in addition to five destroyers and one destroyer escort. The Third Fleet air arm delivered heavy blows at Japanese air and naval forces all through November. Air combat losses of the fast carrier task force amounted to 97 planes through November 1944.

Ground operations on Leyte, after a successful beginning, were not progressing according to plan. Inadequate air installations and continuous bad weather hampered maneuvers. A fast twin envelopment operation had been planned to annihilate the Japanese before they could be reinforced or man defensive positions in rugged terrain. But the reinforced Japanese did succeed in entrenching themselves in last ditch dugouts. One month before the Leyte invasion took place, Field Marshal Terauchi's staff transmitted estimates of American intentions to Lt. Gen. Shigenori Kuroda, in charge of the 14th Area Army in the Philippines, stating that a two-pronged attack on Luzon would open the Philippine offensive. General Kuroda prepared for such an attack rather than a maior assault on Leyte. Field Marshal Terauchi, later blaming Kuroda for the miscalculation, relieved him and replaced him with Gen. Tomoyoki Yamashita. The latter began his activity by transmitting a laconic imperial order to General Makina, commander of the 16th Division: "Enemy ground forces will be destroyed."

In reality, the destruction of United States forces was out of the question, even after the Japanese 1st Division from China landed piecemeal at Ormoc Bay. But it was possible to rally in the difficult terrain of the Leyte mountains.

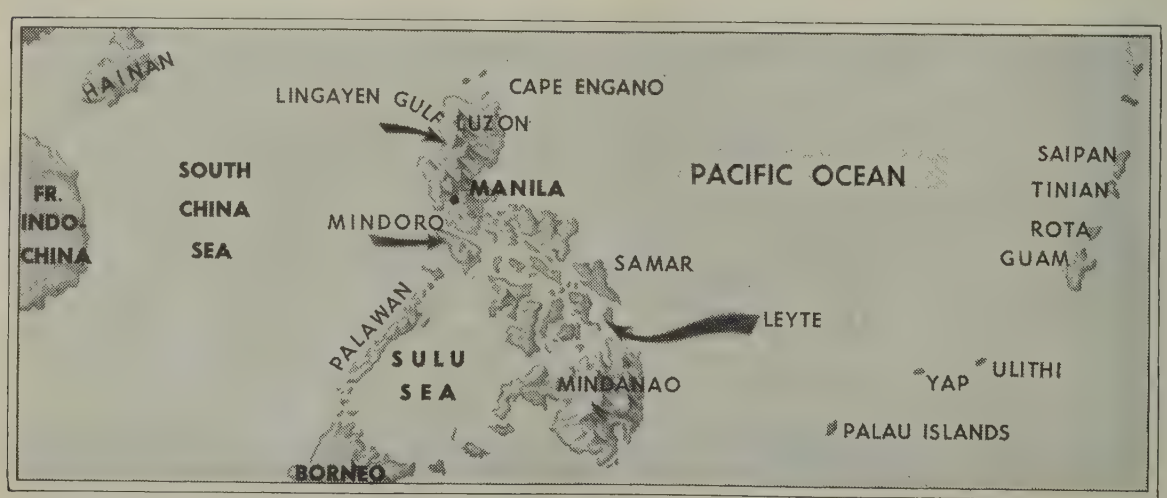
By Nov. 5, Dagami and Burauen were in American hands. The 10th Corps, sweeping across San Juanico Strait, had seized the south coast of Samar and landed troops on the north coast of Leyte in a short amphibious operation. The vicinity of Limon was reached, but annihilation of the Japanese was not achieved.

The support of carrier-based planes enabled General MacArthur to send large bodies of reinforcements to the beaches after November 13. They included the 32d (Red Arrow) Division, the 11th Airborne Division, and the 77th Division.

Pressure against the Japanese, who abandoned more than two thirds of the island in order to rally more solidly, was stepped up. The decisive operation took place near Ormoc Bay, in the western sector of Leyte, which had been thrown open by the Third Fleet's offensive.

Action had to be swift to take the Japanese by surprise and avoid interception. An American destroyer squadron, raiding Japanese shipping in the nearby Camotes Sea on December 2 and 3, inflicted some damage but lost the new 2,200 ton destroyer *Cooper*. On the night of December 7, 80 ships commanded by Rear Admiral Arthur D. Struble steamed into Ormoc Bay, carrying parts of the 77th Infantry Division to a beach three miles south of the town of Ormoc. The landing, meeting only sporadic opposition, was already well established when Japanese torpedo planes attacked the amphibious forces. The United States destroyer *Mahan* and the destroyer transport *Ward* were so heavily damaged that they had to be sunk by United States guns. Still another destroyer, the *Reid,* was sunk in Ormoc Bay on December 11.

On December 10, the city of Ormoc was captured. The Japanese garrison on Leyte was completely surrounded and compressed into a narrowing perimeter in the northwestern corner of the island. On Dec. 26, 1944, General Mac-



Arthur's communiqué reported the end of the Leyte campaign except for mopping up operations. It was stated that 54,338 Japanese dead were counted on the ground. Additional casualties, most of them suffered at sea, brought the total to 113,221. Operations were turned over to Lt. Gen. Robert L. Eichelberger's Eighth Army who accounted for an additional 26,000 Japanese dead during the first half of 1945. During the later stages of operations, the Fifth Air Force under Lt. Gen. George C. Kenney contributed greatly to the Japanese defeat.

The Attacks by Sea.—The bulk of the Japanese fleet was based at Singapore. Reconnaissance reported that it still included 7 battleships, 17 cruisers, and 26 destroyers. As the Allied offensive was moving closer to the approaches of Japan, the Japanese Naval High Command decided to make a desperate attempt to reestablish control of the limited areas in which the Imperial Fleet was still able to operate.

The Japanese planning and timing were better than in previous land operations. They assumed that the Allied landings at Leyte would result in crowded beaches on D-day plus 5. By then the escort carriers would have to leave for refueling, and air protection would be reduced. If caught by an attacking force, the highly vulnerable landing craft would not be able to reload and escape. The Third Fleet was the most dangerous obstacle to the Japanese attackers. Therefore, the Third Fleet was to be lured far enough away to prevent it from taking part in the action. A Japanese force of carriers and carrier-battleships (an experimental type of converted battleship) coming down from north of Luzon was to engage the Third Fleet. After establishing contact, the Japanese vessels would withdraw northward, decoying the fast task force away from Leyte Gulf. In the meantime, another Japanese fleet, mostly ships with heavy guns, would split into two groups. One of these groups would penetrate Leyte Gulf from the north and the other from the south, to annihilate the United States invasion fleet between pincers, and then, leaving the gulf in a northerly direction, the combined groups would attack the Third Fleet from the rear. The Japanese hoped that their opening moves would not be detected.

On the morning of October 23, however, the United States submarines *Darter* and *Dace,* on offensive patrol in the South China Sea, sighted a huge Japanese surface force. The submarines radioed all details and then launched a torpedo attack, sinking two heavy cruisers and damaging a third. The *Darter* later ran aground on a reef, but her crew was saved by friendly Palawan guerrillas. The *Dace,* joined by another submarine, the *Guitarro,* continued to shadow the Japanese. On the morning of October 24, search planes from Third Fleet carriers located the Japanese southern and central groups. As they did not include carriers, Admiral Halsey deduced that another force, including carriers, was not far away. On the afternoon of that day, his deduction was confirmed by the report that one large carrier, identified as the 29,000 ton *Zuikaku,* three light carriers, two battleships with flight decks (battleship carriers), five cruisers, and six destroyers were on their way southward in the vicinity of Cape Engaño, the northern tip of Luzon. The fast United States northern task force was attacked by planes based on Luzon and on Japanese carriers. About 110 Japanese aircraft were downed, but the United States light carrier *Princeton* was so heavily damaged that it had to be abandoned, the first carrier loss suffered by the United States Navy in almost two years. Explosions on the Princeton killed 229 men and injured 420 on the light cruiser *Birmingham* while the latter was attempting to help the stricken carrier.

The southern Japanese task force was reported to consist of two battleships, two heavy and two light cruisers, and 13 destroyers. The central force included two new superbattleships, the *Yamato* and the *Musashi* (listed at 42,000 tons each), and three lesser battleships.

Three groups of fast carrier task forces from the United States Third Fleet went into action on October 24. One group, under Rear Admiral Frederick Sherman, was about to engage the Japanese carrier force in the north. Part of the second group (Rear Admiral Gerald F. Bogan) was supporting Admiral Sherman, while another part turned its attention to the Japanese central group. The third group (Rear Admiral Ralph Davidson) established contact with the Japanese southern group on the morning of October 24. Air attacks on the Japanese southern force, closing in on Surigao Strait, failed to produce conclusive results. Admiral Kinkaid assigned a powerful force of the Seventh Fleet (under Rear Admiral Jesse Oldendorf), to meet the Japanese in the south. Admiral Oldendorf ambushed his opponents with six United States battleships (mostly old), nine United States and Australian cruisers, and a number of lesser craft. Shortly after midnight on October 25, the Japanese southern force, entering Surigao Strait, was engaged in a battle fought by naval gunners. Both Japanese battleships and three destroyers were sunk almost before they could open up. One heavy cruiser escaped with severe damage but was sunk later by army bombers. All of the other participating Japanese ships were subsequently sunk or badly damaged by aircraft. Only one United States ship, the 2,100 ton destroyer *Grant,* suffered serious damage. Not a single shell from the Japanese southern force hit the invasion fleet off Leyte.

The Japanese central force, heading for San Bernardino Strait and the east coast of Samar, on Leyte Gulf, came within range of Third Fleet aircraft on October 24 at 8:00 A.M. The *Musashi,* one cruiser, and one destroyer were sunk. Other ships were hit, although not as badly as originally presumed. As no further attack was expected from that force, Admiral Halsey threw the full strength of his available fast carriers and battleships against the Japanese northern group. Several carriers had to refuel, but 10 of them and 8 battleships were ready for action. No capital ships were left behind to guard against a return of the Japanese central force.

Most of the United States escort carriers were still in the vicinity of Leyte, supporting ground operations to the limit of their dwindling resources. A group of six escort carriers, three destroyers, and four destroyer escorts, under Rear Admiral C. A. F. Sprague, was near Samar when the Japanese central force, having resumed its previous course, suddenly reappeared. The escort carriers were not armored, their planes lacked fuel, bombs, and torpedoes, and they carried only light and medium guns. The Americans fought gallantly against overwhelming equipment: 14- and 16-inch guns against 5-inch. The

engagement began at 6:45 A.M. on October 25. By 8:00 A.M., the "jeep" carrier *Gambier Bay,* the destroyers *Hoel* and *Johnston,* and the destroyer escort *Roberts* had been sunk. Soon after, the escort carrier *St. Lô* was destroyed by air attack. Other United States ships, including the *Suwanee, Santee, White Plains,* and *Kitkun Bay,* were heavily damaged, and 105 planes from escort carriers were lost. But the Japanese commander decided to withdraw from the engagement before Rear Admiral Sprague's force was annihilated, fearing that his ships were about to be trapped by the United States Seventh and Third Fleets. The Japanese had lost one cruiser and one destroyer, and another cruiser was heavily damaged.

On October 25, Admiral Halsey's forces hit the Japanese carrier group in the vicinity of Capa Engaño. All Japanese carriers with the exception of the converted battleships were sunk, and heavy damage was inflicted on the remaining units by air attacks, followed by cruiser and destroyer action against crippled ships. Forty American aircraft were lost in all these operations.

When Admiral Halsey learned of the attack on the United States escort carriers, he dispatched units to deal with the Japanese central group. But when the American carriers and battleships arrived, all Japanese ships except the damaged cruiser had gone. On October 26, the central Japanese fleet was located again. Two cruisers were sunk, and the battleship *Yamato* suffered damage from two bombs hits. Another Japanese battleship, bombed in the pursuit, was sunk on November 21 off the China coast by the United States submarine *Sealion.*

The Japanese Navy's supreme bid to regain the upper hand ended in total failure. Reduced to a negligible fraction of its former strength, its position had become hopeless beyond recovery.

The Invasion of Mindoro.—The seizure of Mindoro Island was decided upon as the next amphibious operation in order to obtain better air bases and to carry the attack closer to Luzon. Air bases on Mindoro also would threaten Japanese shipping in the South China Sea.

This was a fairly risky venture. The naval attack force, on its way to Mindoro (nearly 300 miles northwest of Leyte) had to pass the inner seas of the Visayas close to numerous Japanese airstrips. Moreover, not all of the 50 or more airfields on Luzon from which the convoy could be intercepted had been eliminated by preparatory attacks.

From December 14 to 16, Third Fleet carrier planes hit Luzon's air and naval installations. Two hundred sixty-nine Japanese planes were destroyed, 27 vessels were sunk, and 60 were damaged. On their way to selected landing beaches near San José, the amphibious forces were attacked from the air, but damage was less than expected. Units of the 24th Division and the 503d Parachute Infantry Regiment under Brig. Gen. William C. Dunckel were greeted enthusiastically by Filipino guerrillas when they landed. Scattered Japanese air attacks on the invasion craft offshore continued on D-day (Dec. 15, 1944), but no resistance was encountered on land, and engineers immediately began to work on air strips. On December 17, a violent typhoon did more damage to United States landing craft than Japanese air attacks. Three United States destroyers, the *Hull, Spence,* and *Monaghan,* were lost.

On December 26, a Japanese naval force, consisting of one battleship, one heavy cruiser, and six destroyers, was driven off by air attack while attempting to raid the invasion fleet off Mindoro. American air installations on the island were already in operation.

The Recovery of Luzon.—General Krueger's Sixth Army moved next to Luzon, main island of the Philippines. The logical point to invade the island was in the north. The Americans, effectively supported by Luzon guerrillas, cleverly misled the Japanese area commander, General Yamashita. Navy mine sweepers operated conspicuously off the island's southern coast; army air forces from Leyte hit southern areas, and guerrillas ostensibly grouped in the same region. United States transport planes dropped dummies over Batangas and Tayabas to simulate an airborne invasion which Japanese headquarters claimed to have repulsed.

General Yamashita decided to spread his forces, originally massed in the north, over wider areas and to keep them mobile, thereby weakening his position in critical sectors. This dispersion of Japanese strength, plus the immense superiority of American mechanical equipment, gave the Sixth Army a decisive advantage in future operations.

The United States Army never planned to make initial landings in the south. Lingayen Gulf was the primary objective. From there, a good military highway led to Manila through the central plain, which was about 100 miles long by 30 to 50 miles wide, and well suited to mechanical warfare. The central plain included the capital city, numerous airfields, a network of roads and railways, and most of the island's wealth and population. Its seizure would provide bases to support further operations and would add threat to Japanese shipping in the South China Sea.

Although the Japanese Air Force was depleted, it still threatened sea lanes through which the assault force had to travel. Aircraft of the Third Fleet struck at Formosa again on Jan. 3 and 4, 1945, destroying 316 planes. On January 6, Task Force 38 (Third Fleet) accounted for 225 Japanese planes on Luzon. Three days later, United States carrier-based planes were back over Formosa and the Ryukyū Islands as far north as Okinawa, destroying 108 more planes. About 110 ships and barges were also hit. On January 12, powerful forces of the Third Fleet steamed into the South China Sea. Naval and air blows, continuing for four days, struck Saigon, Cam-ranh, Quinhon, Canton, Hongkong, Hainan, and Swatow. The Japanese suffered heavy losses. No Japanese aircraft was able to approach within 20 miles of the task force on its 3,800-mile trip.

The Luzon Attack Force, commanded by Vice Admiral Kinkaid under the overall command of General MacArthur, was composed of the Seventh Fleet augmented by Pacific Fleet forces. Numbering more than 850 ships, it was divided into the Lingayen Attack Force (Vice Admiral Wilkinson), the San Fabian Attack Force (Vice Admiral Barbey), a reinforcement group (Rear Admiral Connolly), a fire support and bombardment group (Vice Admiral Oldendorf), and surface and air covering groups (Rear Admirals Berkey and Durgin). On the way to Lingayen Gulf, between January 2 and 5, the attack force was repeatedly hit by Japanese planes and Kamikazes. The escort carrier *Ommaney Bay* and

three fast minesweepers were sunk, and a number of other units were damaged.

Action at Lingayen Gulf began on Jan. 6, 1945. For three days, Admiral Oldendorf's group, including battleships, cruisers, and destroyers, bombarded the area while mine sweepers cleared the beaches. Assault waves were preceded by rocket-firing and mortar-carrying landing craft, which blasted the beaches while heavy caliber rifles switched their fire farther inland. The San Fabian Attack Force, (6th and 43d divisions of the 1st Corps, commanded by Maj. Gen. Innis P. Swift), was assigned to hold and extend the left sector. The Lingayen Attack Force (37th and 40th divisions of the 14th Corps, under Maj. Gen. Oscar W. Griswold), to its right was to penetrate the central plain and race toward Manila at full speed.

On January 9, the Sixth Army's attack forces went into Lingayen Gulf. By the end of the day, 68,000 troops had gone ashore and controlled a 15-mile beachhead, 6,000 yards deep. The landings found every major hostile unit in motion except the Japanese 23d Infantry Division and its supporting 58th independent mixed brigade. The Japanese 2d Armored Division attempted to block the road to Clark Field. The 10th and 105th divisions rushed from Manila to guard the eastern edge of the central plain but did not arrive soon enough to hamper the American advance.

Beyond the beaches, the 1st Corps met stiffer resistance than the 14th. Artillery positions blocked a terrain which the Japanese had intended to hold as a line of strategic retreat. This resistance did not seriously delay American progress. A potential Japanese defense line in the Agno River bend was not manned when fast-moving United States forces reached the river. Despite continuous Japanese air attacks on the invasion fleet, reinforcements poured ashore. The 25th, 32d, and 33d divisions, the 158th Regimental Combat Team, the 6th Ranger Battalion, the 1st Cavalry Division, and the 112th Cavalry Regiment joined the invaders of Lingayen Gulf. Disorganized Japanese forces attempted suicidal stands, but they were broken up in sharp but brief engagements.

The fully motorized 1st Cavalry Division was one of the fastest American units. The 37th Division, too, advanced with great speed and other divisions did not lag far behind. By January 21, the advance had carried 58 miles to Tarlac, and patrols reached Clark Field on January 24. Japanese units north of Lingayen Gulf were prevented from infiltrating the American left flank by strong protective forces deployed in the sector. Fighting stiffened after Clark Field was reached, and sizable United States forces were engaged in guarding communication lines in that area.

Another major amphibious operation was successfully carried out to circumvent a large-scale Japanese retreat into Bataan Peninsula, which would have prevented the Americans from using Manila harbor. The 24th and 38th divisions of the 11th Corps were released from mopping up operations on Leyte. On January 29, some of their forces went ashore in the San Narciso area northwest of Subic Bay, and on January 30, others landed on Grande Island in the bay. The landings, protected by naval forces under Rear Admiral Struble, led to the seizure of Subic within a few hours.

Another amphibious and airborne threat from the south enveloped Japanese troops in and around Manila. The 11th Airborne Division, landing from boats, invaded Nasugbu near Manila on January 31. Three days later, the 511th Parachute Infantry Regiment, flying over the heads of 11th Division forces, dropped at the Tagaytay ridge on the way to the capital and reached Nichols Field on February 6.

During the night of February 4, units of the 1st Cavalry Division, racing through Novaliches, reached Grace Park in the northeastern section of Manila and freed Allied civilian internees in Santo Tomas, while the 37th Division broke Japanese resistance on the Pampanza River. On February 6, the liberation of Manila was announced, although fighting in the thickly walled section continued until American infantry penetrated the center of the city on February 23. The Japanese seized Filipino civilians as hostages and frequently used them as shields. Corregidor came under air attack on January 23. In less than one month, 3,128 tons of bombs hit "the rock."

On February 15, while minesweepers cleared Manila Bay, small American forces went ashore, against negligible opposition, at Mariveles Bay on Bataan. On February 16, a combined sea and airborne operation hit Corregidor. Formations of C-47 army transports dropped the 503d Parachute Regiment over the fortress island. Troops of the 34th Infantry Regiment hit the shore in assault boats. The Japanese offered suicidal resistance, in American-built tunnels, for nearly two weeks. Finally, the defenders blew up the tunnel system and themselves. Not counting those killed or buried alive under the debris by the explosion, 4,215 Japanese lost their lives on Corregidor. A total of 3,038 Americans had been engaged in the operation; 136 were killed, 531 wounded, and 8 were missing. Manila Bay was open to shipping by early March.

The Fifth Air Force, after supporting the Luzon campaign from outlying bases, established itself at newly won bases in the Philippines. It was subsequently merged with the Thirteenth Air Force (Maj. Gen. St. Clair Street) to form the Far East Air Force under Lt. Gen. Kenney. General Kenney's planes ranged over Timor, the Celebes, Java, and Borneo, further reducing Japanese ability to supply isolated forces in these islands. On Luzon, as in most of the Philippine Islands, native guerrillas, joined by a few escaped American prisoners of war, were extremely helpful to MacArthur's forces by killing many Japanese, disrupting communications, and supplying the Americans with useful information.

The War in China, 1944.—Major operations in the Chinese theater of war in 1944 did not get under way until April 18. The armies of Generalissimo Chiang Kai-shek made no serious attempt to seize the initiative. Their lack of equipment was still appalling, and the internal quarrel between the Nationalist government and the Chinese Communists—who failed to fight the Japanese on a large scale—was also a severe handicap.

Despite their Pacific setbacks, the Japanese were offensive-minded in China. The idea persisted that, even in case of total defeat in the Pacific and the invasion of the Japanese home islands, the war might be continued on the Asiatic mainland.

A Japanese drive, opening April 18, aimed at improving land communications by seizing complete control of the Peiping-Hankow railway By May 12, the attackers had seized a 174-mile stretch from Chenghow to Sinyang. Chinese

forces opposing the aggressors fought valiantly, but their organization was poor.

On May 28, the Japanese pushed toward Changsha. Their offensive now had the objective of eliminating United States air bases in China. With almost no modern equipment on hand, damaged air fields could not be rebuilt quickly. Changsha was captured on June 21. On June 30, the Japanese progressed to Henyang, forcing the evacuation of one of the United States 10th and 14th Air Force bases. If the operation in the Marianas had failed, the outlook for a sustained and devastating American air offensive against the Japanese mainland and Manchuria would have been very poor.

On September 7, the 14th Air Force base at Lingling, 75 miles southwest of Henyang, was lost. Tanchuk, site of another airfield, was evacuated on October 1. On October 28, it became necessary to destroy the major base at Kweilin to save its installations and equipment from falling into the hands of the advancing Japanese. On November 13, the Linchau field suffered the fate of Kweilin. American bases were pressed back almost 400 miles. The Japanese offensive expanded by a drive from Canton northward. A land corridor to Indo-China was established, and unoccupied China was temporarily split in two.

Gen. Joseph W. Stilwell attributed the loss of United States airbases and other Chinese setbacks partly to Chiang Kai-shek's reluctant over-all strategy and his apparent unwillingness to give Stilwell an opportunity to improve Chinese training and organization. General Stilwell's criticism led to his removal from the command of the China-India-Burma theater of war. Although the general was occasionally very outspoken, he was a distinguished commander who had contributed greatly to the crushing of the Japanese offensive in India earlier in the year.

THE CLIMAX IN EUROPE

The opening of Antwerp harbor, the rehabilitation of French Atlantic ports, and an increased flood of supplies from French Mediterranean ports to Allied battlelines solved the urgent supply problem of the Allied Expeditionary Force (AEF). In the near future, reinforcements of men and equipment would eliminate weak spots in the Allied deployment and increase the pressure on the Wehrmacht to the breaking point. Improving weather conditions enabled the Allies to make the most of their air superiority. Mud, snow, and high water, aiding the German defensive, could not last forever. Allied strategic bombing was having a serious effect on German war production. The German fuel situation was becoming increasingly critical. German casualties could no longer be replaced, either in numbers or in fighting efficiency, by new inductions.

If the Wehrmacht did not venture an offensive before the end of 1944, its opportunity would be lost. Weather conditions prevented the Allies from using their air strength to full advantage. Operations on the Russian front still continued on a reduced scale, permitting the deployment of substantial German armored forces in the west. Moreover, General Eisenhower's calculated risk in weakening the front between Trier and Monschau (known to German Intelligence) suggested a line of attack familiar to the Germans, who had penetrated into France from this direction before.

Unless the German offensive succeeded quickly, it was bound to end in failure. Fuel was short, and there were not enough reserves available to maintain a prolonged drive against continued resistance. The capture of huge Allied stores, not far to the rear, was the only solution to the problem of keeping the panzers rolling.

Battle of the Bulge.—Field Marshal General von Rundstedt, reinstated with unusual powers as commander on the western front, took personal charge of the impending attack.[1] Rundstedt secretly massed the Fifth and Sixth Panzer Armies and the reorganized Seventh Army opposite the weak Allied sector. The attack force included 14 infantry and 10 panzer divisions and a relatively large air force. The Germans employed one panzer brigade, operating with captured American equipment, to spearhead combat units and to spread panic and confusion in and behind the Allied front line. Groups of combat parachutists were to be dropped in the Malmédy area. Paratroop saboteurs, many of them in American uniforms, were to attack key bridges and Allied headquarters as far back as Paris. German Army and SS (Schutzstaffel) units were instructed to be ruthless. Orders were given to the SS to stage a *Rabatz* against the Americans, which in SS slang meant an orgy of cruelty. These orders were carried out by the German armed forces, as shown by the subsequent mass slaughter of United States prisoners of war.

According to General Eisenhower's report, the German plan was to break through the thin Allied line of defense in a sudden blitz drive to the Meuse in the Liège-Namur area. Having seized Liège (the main supply center feeding the Twelfth Army Group from the north), the Wehrmacht hoped to drive rapidly to Antwerp. If the Allies were to lose the use of this port, the British armies, together with the United States Ninth Army and part of the First Army in the north, would be split from the American and French forces in the south. The Germans could then destroy these forces piecemeal.

Even if destruction was not achieved, Rundstedt expected the AEF to fall back as far as the Seine River to restore communications between the northern and southern groups. This would reduce the AEF to a precarious defensive.

On the morning of Dec. 16, 1944, thick fog covered the countryside. The four United States divisions deployed in the critical 75-mile Eifel-Ardennes sector (the 4th, 28th, and 106th Infantry, and the 9th Armored Divisions), were attacked by superior German forces, including considerable armor. The Wehrmacht penetrated Allied lines, chopping up the defenders into isolated groups, most of which were routed, mopped up, or bypassed. Fortunately for the Allies, the road center of Saint-Vith, vital to the deployment of German forces, was held for several days by units of the 7th Armored Division which had been rushed to the spot. The initial German advance was therefore somewhat delayed. When news of the German penetration reached Allied Headquarters, the 10th Armored Division from the south, as well as the 7th from the north, was thrown into the battle. The 101st

[1] Information gained some months after the surrender of Germany indicated that Field Marshal Walter Model, commander of German Army Group "B" exercised command during the Battle of the Bulge and was responsible for planning the operation. Rundstedt was nominally in command of all German forces on the western front, including Army Group "B."

Airborne Division was sent to Bastogne, another vital road junction well behind Allied front lines, when the break-through occurred.

General Eisenhower immediately suspended further Allied attacks. All available reserves were ordered to strike the rapidly deepening penetration on both flanks. The shoulders of the bulge were to be firmly held in order to prevent a German penetration west of the Meuse or in the Liège-Namur area. General Patton's Third Army prepared to counterattack in the direction of Bastogne. This push was to be followed by another assault by Field Marshal Montgomery's forces.

A gap, 45 miles wide at its base, was torn in the Allied lines between Echternach and Monschau. On December 19, the penetration grew steadily deeper, but the shoulders of the bulge held firm. General Bradley's left flank was separated from the right. The position of his headquarters in Luxembourg limited the scope of his command and communications to the area south of the German wedge. General Eisenhower fixed a boundary running east and west through the breach from Givet to Prüm. All forces north of this boundary, including the bulk of the United States First and Ninth Armies and part of the Ninth Air Force, were placed under the operational command of Montgomery and Air Marshal Coningham. Bradley retained command of the forces on the southern flank, composed mainly of the United States Third Army and the considerably reinforced 19th Tactical Air Command. Air activity was hampered at first by weather conditions, greatly to Germany's advantage.

The United States 82d Airborne Division, moved up from Reims, was assigned to the command of the Twelfth Army Group, and the 101st in Bastogne was reinforced by armor. The United States 11th Armored Division, newly arrived from England, was directed to protect the center (which was still critically bared on December 19) and, if necessary, to meet a head-on German attack on the Meuse. Infantry divisions, assembling in England, were rushed to the continent ahead of schedule. The Germans continued to advance in the center of the penetration. In the north, the Meuse bridges were protected by the 17th Airborne and the 11th Armored Divisions, but the crossings south of Givet remained alarmingly weak. All available rear echelon troops and service units, including six French battalions, were moved to the river to hold the crossings. After December 22, the fog began to lift, and Allied air forces opened paralyzing attacks.

The 101st Airborne Division at Bastogne had an immortal share in the final repulse of the German attack. Completely surrounded for five days, the 101st refused to surrender and defended the road center against almost impossible odds. If Rundstedt had been able to take Bastogne, his offensive might have achieved at least a part of its aims.

General Patton's counterattack against the southern flank of the penetration began on Friday, December 22. The general's problem was compounded by the need to guard against a German threat from the Trier region and to husband his forces until Field Marshal Montgomery could join the attack from the north. The drive began to gain ground on December 24.

The Allied air forces continued to range far and wide over enemy-held areas, depriving the Wehrmacht of fuel, food, and ammunition. The Luftwaffe, in greater strength than at any time since the landings in Normandy, flew up to 800 sorties a day. Although the Allies suffered substantial losses. their air superiority was securely maintained.

On December 26, the German offensive was finally halted. It had penetrated over 60 miles westward, to within four miles of the Meuse River near Celles and a few hundred yards from an Allied depot with millions of gallons of gasoline. None of the major German objectives were reached.

On the same day, the 4th Armored Division of the Third Army established contact with the defenders of Bastogne. The initiative passed to the Allies. General Eisenhower planned to cut into the flanks of the salient toward its communication centers, and to destroy as many German forces as possible by coordinated ground attacks from the north and south. On Jan. 3, 1945, the counterattack from the north was launched by the First Army. The United States Third Army, continuing its pressure in the Bastogne area, launched another attack from the south toward the road center of Houffalize. By January 10, the gap between the attacking forces had narrowed to a distance of 10 miles. The Germans resisted strongly to keep the eastern exit of the bulge open. Rundstedt avoided another Falaise trap but sustained heavy losses in men and matériel. On January 16, attacking forces from the United States First and Third Armies established firm contact at Houffalize and turned eastward in pursuit of the retreating Germans. Saint-Vith was recaptured by the First Army on January 23. By the end of the month, the Allies were practically back to the point of departure Advance forces attacked beyond this point in the direction of Bonn on the Rhine.

During the month after the opening of the German attack, losses suffered by the Wehrmacht were estimated at 120,000 major casualties, 600 tanks and assault guns, and 1,620 planes. By the time that the Allied counteroffensive had restored the initial position, German casualties had increased by another 100,000, and 110,000 prisoners were taken.

While the tide of battle was turning in the north, the Germans opened another drive in the south. It was originally planned to throw the southern Allied armies into confusion after the breakthrough split their lines. As the big offensive was about to collapse, its objective became less ambitious—to regain the plains of Alsace-Lorraine westward to the Vosges. The Sixth Army Group in that sector was left with minimum forces to defend its lines, since General Devers' troops were helping Patton's drive. The Allied High Command considered withdrawing the 6th Corps to the Vosges Mountains, thus exposing Strasbourg to capture, in order to establish strong defensive positions that could be held by fewer troops. The French, informed of the plan, insisted vigorously that Strasbourg should not be abandoned. French commanders said they would fight for Strasbourg without assistance rather than evacuate the city.

General Eisenhower finally decided that French civilian unrest, likely to result from the loss of Strasbourg, might seriously interfere with the security of rear areas and Allied communications. The 6th Corps merely withdrew from a

sharp salient. Its left flank then rested on the Vosges and its right extended protectingly toward Strasbourg.

On Jan. 1, 1945, the Germans attacked between Sarreguemines and Neunhofen with a force of 14 divisions and advanced more than 15 miles into Alsace. On January 7, German spearheads, crossing the Rhine north of Strasbourg, gained ground in the direction of the Colmar pocket. Stubborn American and French resistance stabilized the line before strategically essential ground was lost, and Strasbourg and the Alsatian plain were saved. The German drive was finally stopped on January 20.

Allied casualties in the Battle of the Bulge were reported as 55,421 by January 21, including 18,418 prisoners, a number of whom were murdered by their captors. There was a loss of 2,000,000 tons of stores from a depot containing 7,000,000 tons. The Germans directed many V-1 and V-2 missiles at Liège and at Antwerp.

The Allied offensive against Germany was to be resumed, taking advantage of the weakening of the opposing forces. Close cooperation with the Russian High Command and mutual understanding of respective plans became more essential than ever. It was not until late in 1944 that the first liaison with Moscow could be effected, and it accomplished little beyond establishing bombing lines. General Eisenhower's willingness to supply the Russians with all such information concerning his overall plans as the Soviet Army might desire, failed to evoke an equal response.

The Allies were greatly concerned about the reduced activity of the Soviet Army during the crucial days of the Battle of the Bulge. At Christmas time, President Roosevelt finally obtained Marshal Stalin's agreement to receive a representative of the AEF in order to discuss the correlation of their respective efforts in future campaigns. In January 1945, Air Chief Marshal Tedder, accompanied by Maj. Gen. Harold R. Bull and Brig. Gen. Thomas J. Betts, journeyed to Moscow. Stalin was told about the nature and timing of Allied plans and, in turn, explained about a great offensive, involving 150 to 160 divisions, which the Soviet Army was preparing to launch.

The Big Soviet Drive.—Most sectors of the eastern front remained static during the last days of 1944 and the earliest days of 1945. The German counteroffensive inside the Danube bend northwest of Budapest (which is the united towns of Buda and Pest) bogged down after taking Székesfehérvár, failing to reach the ring of encirclement around the Hungarian capital. Violent fighting continued within the boundaries of the city, with Malinovski's forces attacking Buda on the right bank and Tolbukhin's army attacking Pest on the left bank of the Danube. Pest was cleared block by block by January 18, but Buda was not taken until February 13. Russian reports listed German losses in the battle for Budapest as 49,000 killed and 110,000 captured.

The comparative inactivity of the Russians in Poland was primarily due to difficulties in reorganizing communications and carrying out necessary regroupments for attack. Despite continuous lend-lease deliveries, Russian transportation was strained to the limit. Late model American trucks and less modern Russian motor transports were used side by side with horse-drawn vehicles, including droshkies (old fashioned cabs) of the czarist period. While the Western World anxiously awaited the outcome of the German offensive in the west, the Russian offensive lineup was completed. The Soviet High Command chose to delay rather than to strike immediately. In the event of a major German victory in the west, offensive Wehrmacht forces might have been freed for action on the eastern front, and it seemed advisable to the Russians to maintain a consolidated position.

The Germans estimated the Soviet strength at 340 divisions. The Wehrmacht's forces in the east were estimated at 200 divisions. The average strength of a Russian division was greater than that of a German division but less than that of a complete division of the AEF.

Russian forces were divided into eight army groups. From north to south, the First Baltic Army (Col. Gen. Ivan C. Bagramian) besieged the remnants of the German Sixteenth and Eighteenth Armies in the Latvian pocket. The Third White Russian Army (Col. Gen. Ivan D. Chernyakhovski) held the border region of East Prussia under pressure. The Second White Russian Army (Marshal Konstantin K. Rokossovski) faced the Polish Corridor from positions north of Warsaw. The First White Russian Army (Marshal Georgi K. Zhukov) was aligned along the Vistula River near the Polish capital. The First Ukrainian Army (Marshal Iva S. Konev) extended along the Vistula south of Warsaw to the Carpathian range, including the Sandomierz bridgehead. The Fourth Ukrainian Army (Marshal Ivan Y. Petrov) operated in the mountainous regions of northern Slovakia. The Second Ukrainian Army (Marshal Rodion J. Malinovski) held the sector which included the southern foot-hills of the Carpathians and ranged to Budapest. The Third Ukrainian Army (Marshal Fedor I. Tolbukhin) covered the area from Budapest to the Drava River, inside the Danube bend. On its left flank, Yugoslav Partisans harassed rear guards of the German Balkan armies and Croatian puppet forces. Russian staff officers worked strenuously to train the partisans for regular warfare. Supplied with armor, artillery, and aircraft from the USSR (some of which were of American make), the Yugoslavs increased their fighting strength.

Konev's army was the strongest of all the Russian groups, and Zhukov's came next. Their combined numbers were only a little less than 50 per cent of the Soviet total. Marshal Zhukov proved to be one of the ablest commanders of the Soviet Army in World War II.

Prior to their attack, the Russian armies in Poland displayed cardboard dummies of tanks and guns, designed to mislead the Germans about the impending drive. It was obvious, however, that the Soviet Army would concentrate in the bridgehead area between Sandomierz and Baranow. On January 12, preceded by a colossal barrage from greatly superior Russian artillery, Konev's attack was launched from the bridgehead. The first trench line was practically undefended. Resistance in the second line, reinforced by concrete blockhouses and dug-in tanks, failed to stop the attackers. Konev's offensive was aimed at Kraków, in southwestern Poland close to the German and Czechoslovak borders. Its progress outflanked the Wehrmacht to the north, and threatened German forces in the Carpathians with encirclement. On January 14, Zhukov joined Konev's offensive; on January

SWEDEN
LATVIA
DENMARK
BALTIC SEA
LITHUANIA
GDYNIA
DANZIG
KÖNIGSBERG
ELBING
EAST PRUSSIA
ROSTOCK
KOLBERG
SWINEMÜNDE
ALTDAMM
STETTIN
Oder
KÜSTRIN
BYDGOSZCZ
TORUŃ
BERLIN
POTSDAM
FRANKFURT
River
POZNAŃ
Bug
River
WARSAW
LECZYCA
LÓDŹ
Elbe
POLAND
SENFTENBERG
PRASZKA
BARANÓW
LEIPZIG
DRESDEN
BRESLAU
River
OPPELN
SANDOMIERZ
GERMANY
River
KARLSBAD
LIDICE
PRAGUE
Vistula
TARNÓW
PLZEŇ
KRAKÓW
REGENSBURG
MORAWSKA OSTRAVA
BRNO
BUDĚJOVICE
BANSKÁ BYSTRICA
PASSAU
Danube
BRATISLAVA
BRAUNAU
VIENNA
LINZ
River
WASSERBURG
Lake Neusiedler
WIENER NEUSTADT
BUDAPEST
SALZBURG
SOPRON
GYÖR
HUNGARY
BERCHTESGADEN
SZOMBATHELY
SZÉKESFEHÉRVÁR
Tisza
Drava
Lake Balaton
ITALY
YUGOSLAVIA
River
RUMANIA
MONFALCONE
River
TRIESTE
ZAGREB
FIUME
Danube
SUŠAK
Sava
Drina
River
River
BELGRADE
ADRIATIC SEA
River

15, the Third White Russian Army attacked on the right wing, while the Fourth Ukrainian Army, on Konev's left, stepped up pressure to prevent the Germans from sending divisions from northern Slovakia to the relief of Kraków. The attacking front widened to 560 miles. Zhukov threw pincers across the Vistula and around the Polish capital.

On January 17, the First White Russian Army, including Russian-trained Polish forces loyal to the Moscow-sponsored Polish government, captured the ruins of Warsaw. In the meantime, Konev's drive made rapid progress. On January 19, Premier Stalin, in five orders of the day, announced the capture of Kraków, Lódź, Tarnow, Praszka, and Leczyca. After seizing Warsaw, Zhukov pushed on to Poznań. His advance was even faster than Konev's who covered an average of 18 miles a day, while Zhukov progressed 150 miles in six days.

The Germans had begun to construct huge fortifications to bar the southwestern approaches to Danzig, the Corridor, and southwestern East Prussia. This "Blue Line" was never finished. Rokossovski's armored spearheads in that sector cut through the skeleton Blue Line. The Wehrmacht made no determined effort to extricate its forces in East Prussia from the rapidly closing Soviet vise. The German High Command also failed to organize a straight line of defense from the Baltic to the Carpathians. Almost amateurishly, the proud military scholars did not even try to shorten their line to minimize some of the effects of their numerical inferiority. The Germans again established hedgehogs, which were utterly useless in a region where beleaguered cities could be bypassed almost at will on good highways.

On January 22, a Soviet official communiqué announced the seizure of 1,750 populated places. On January 24, the number of captured places was claimed to be 3,500, almost half of which were in German territory. These figures included everything from tiny hamlets to good-sized cities, such as Bydgoszcz (Bromberg) inside the former Polish Corridor. On January 26, Konev's armies, after switching the main weight of their attack against Silesia, were operating well inside that province and captured Oppeln, key industrial center of Upper Silesia. On January 25, Breslau, provincial capital of Silesia, was invested from the east and Zhukov's troops encircled Toruń (Thorn) and Poznan. Toruń fell on February 1. An earlier Russian special order of the day announced that Russian forces had reached the Baltic coast between Elbing and Königsberg. The siege of East Prussia by Chernyakhovski and Rokossovski exposed Pomerania and Brandenburg to invasion. On January 27, advancing vanguards of Konev's and Zhukov's forces were 91 miles from Berlin. By the end of the month, the Russian avalanche had swept over a distance of 280 miles since January 12.

Adolph Hitler, in a message to the stunned German people on the 12th anniversary of his rise to power (January 31), claimed: "the horrid fate that is now taking shape in the east will be warded off in the end." When this statement was made, Russian positions on a 50-mile front along the Oder River were only 46 miles from eastern suburbs of the Reich capital. They had been 1,400 miles away when the Wehrmacht was battling inside Stalingrad.

Air transportation, which was successfully employed by the AEF to keep spearheads rolling, was not adequately available to the Russian armies. The Soviet foot soldiers showed magnificent endurance in prolonged advances, but inevitably they became fatigued, and the advance had to slow down in order to readjust the lines before pushing on in full strength. The center of the Russian front between the Carpathians and the Baltic was further to the west than the wings. The flanks had to be advanced to create a broad front for renewed attack. The supply system was thrown off balance. The Wehrmacht, however, was unable to take advantage of the temporary Russian vulnerability to improve its positions.

Hitler empowered Heinrich Himmler to take drastic steps to consolidate German defenses. Himmler's measures, ruthless as they were, fell short of that objective.

The Soviet High Command made good progress in strengthening Russian positions and consolidating the supply system. The most advanced lines remained static while the wings were moved up, and German islands of resistance were eliminated. Chernyakhovski pressed toward Königsberg, provincial capital of East Prussia, and Rokossovski continued in the general direction of Danzig. A part of Konev's forces progressed toward the Moravian gap, southwest of Kraków, in the general direction of Morawska Ostrava, a Czechoslovak center of heavy industry. The Fourth Ukrainian Army to the south, then under the command of Colonel General Yeremenko, approached the gap from the east and southeast.

Nearly 1,000 American Flying Fortresses, supporting Russian operations east of the German capital, raided Berlin on February 4. A considerable part of the German strategic reserves in men and armor (tanks were prepared for action still with wet paint) were massed in and around the big city. The shattering air attack reduced their mobility and accounted for many casualties.

During the first weeks of February, fighting continued on the left bank of the Danube. The Wehrmacht used its latest and most powerful tanks, the King Tiger and the Royal Tiger, both equipped with high velocity 88-mm. guns, in this secondary theater of war. The Russians countered with their Joseph Stalin Super (K V), mounting 122-mm. cannon. The Russian tank proved superior to the German, but the most effective Soviet tank was the medium T-34. After the fall of Budapest, Russian siege forces joined front line troops in preparing a drive into Austria and to Bratislava, the capital of Slovakia.

General Chernyakhovski was killed in action on February 18 and was replaced by Marshal Alexander M. Vassilevski who wiped out the East Prussian pocket in slow and methodical moves. After splitting the defenders, he eliminated the Braunsberg bridgehead on March 20. On April 9, Königsberg and its garrison of 92,000 men surrendered to the Russians.

On March 23, the bay between Danzig and Gdynia was reached by Rokossovski's forces. Gdynia was captured on March 28 and Danzig two days later. A total of 45 German submarines were seized in their pens. The Soviet Fleet joined in the struggle for the Baltic harbors, as the capture of Kolberg by Zhukov, on March 18, provided a good operational base. Its

share in the Russian victory, however, remained negligible.

The First White Russian Army extended the Oder front down to the river's estuary. East of the lower course of the Oder, Pomerania, the Corridor, and East Prussia were mopped up, and Poznań was cleared by March 1. First White Russian vanguards reached the Baltic east of Stettin on March 4. Driving westward along the shore, they seized Kolberg and reached Altdamm, on the east bank of the Oder estuary opposite Stettin, on March 20. One week earlier, the Oder positions farther to the south were consolidated, and an important bridgehead was established when the ancient fortress city of Küstrin surrendered after a 35-day siege. Konev's forces closed the ring around Breslau, which continued to resist until May 7. In the south, the Oder was outflanked by Soviet divisions pushing into western Upper Silesia through six lines of field fortifications.

In March 1945, Col. Gen. Ferdinand Schoerner, German field commander in Silesia, was appointed commander in chief on the eastern front and promoted to the rank of field marshal general. Under his command, the German eastern armies continued their vain efforts to establish effective defenses.

The Yalta Conference.—President Roosevelt, Prime Minister Churchill, and Premier Stalin met at Yalta in the Crimean Peninsula from Feb. 4 to 11, 1945, to reach agreements about the future conduct of the war and to attempt a solution of the many political problems still unsettled despite previous discussions. The timing of the conference was not propitious for the western powers. The AEF had not yet resumed its advance, while the Soviet armies were rolling on toward the heart of Germany. The Russian government pursued its political aims with great energy and not in the spirit of compromise. Russia's bargaining position was further strengthened by the Far Eastern situation. It was estimated that the war in the Pacific would last at least 18 months beyond the end of the European war. Russian participation in the war with Japan was urgently desired to minimize anticipated heavy sacrifices by the western Allies and to speed Japan's surrender.

China was not represented at Yalta. The Soviets still insisted on keeping the appearance of strict neutrality in the Far East and gave this as the reason for excluding representatives of the Chungking government. General deGaulle, heading the provisional government of France, emphasized his right to participate in the parleys in order to present French claims against Germany. The general was not invited to Yalta, however, and he refused to accept President Roosevelt's invitation to a conference in North Africa after the Crimean meetings.

At Yalta, Russian border claims in Poland were accepted in principle. Full recognition was given to the Moscow-sponsored provisional government of Poland, and London and Washington withdrew recognition from the Polish government in exile in London. It was agreed, however, that the provisional government should be reorganized on a broader democratic basis with the inclusion of democratic leaders from Poland itself and among the Poles abroad.

Poland was compensated for its territorial losses to the USSR at Germany's expense. Most of Germany east of a general line running from Stettin southward to the western border of Silesia provinces was awarded to Poland, nominally as an occupation area, but it was obvious that this decision largely determined the country's future western boundaries. Extensive transfers of population were necessary to protect Poland from a dangerously large German minority. Russia claimed part of East Prussia, including the big city of Königsberg, for itself. This claim was not contested.

A *pro forma* compromise was reached in the case of Yugoslavia. Gen. Draža Mihajlović and his Četniks were abandoned to their fate, despite their services to the Allied cause. Tito was to form a coalition government, including Ivan Subašić, former governor of Croatia and head of the royal cabinet in exile. Elections were to determine the future regime in Yugoslavia. The formula seemed to satisfy the western Allies.

An international organization to preserve future peace was also discussed at Yalta. The Yalta Conference firmly established Russian zones of influence in eastern and central Europe. The ultimate fate of Germany was left unsettled, but the conference agreed on divided zones of occupation of the country after its defeat and defined the boundaries of the regions to be occupied by the Soviet Army and the AEF. It was also agreed at Yalta that Austria would be occupied by the Allied armies and broken up into zones for an indefinite period. This contradicted the Moscow declaration of 1943 and compromised Austrian freedom before it was gained.

The USSR agreed to enter the war in the Far East within three months after the end of the war in Europe. On April 5, 1945, Moscow notified Japan of its intention not to renew the treaty of nonaggression expiring on April 25 of that year. (For further discussion of Yalta Conference, see PACTS AND CONFERENCES.)

The Invasion of Austria.—On March 24, Malinovski and Tolbukhin took the offensive in Hungary and southern Slovakia. Two days later, Yeremenko joined their drive westward.

Malinovski pierced the German lines on a front 62 miles wide and pressed forward in southern Slovakia in the direction of Bratislava. Yeremenko took Banská Bystrica and progressed toward the Vah River. Tolbukhin's opening assault, assisted by a Soviet Danube flotilla, swept through Székesfehérvár and around the northeastern tip of Lake Balaton toward the Austrian border. Large bodies of mounted Cossacks joined in the pursuit of the routed Germans. In rapid succession, Györ, Szombathely, and Sopron fell to Soviet forces. On March 30, 1945, Russian spearheads reached the region of Lake Neusiedler on the border of Austrian Burgenland Province.

On April 1, the Soviet Army entered Austria, the first victim of German aggression, more than seven years after it was invaded by Hitler's forces. The left wing of the Third Ukrainian Army captured the southwestern Hungarian oil center of Nagykanizsa. After taking Bratislava on April 4, Malinovski's Second Ukrainian Army moved into Moravia Province in the direction of its capital city of Brno (Brünn), textile center and site of important armament plants. The occupation of eastern Austria was left to Tolbukhin. After taking industrial Wiener Neustadt, the Third Ukrainian Army approached Vienna from the south on April 5. On April 10, street fighting was under way in the Austrian

capital. According to Russian accounts, the Viennese population gave valuable assistance to the attackers. Vienna was spared the prolonged ordeal of Budapest, both because the fighting spirit of the Wehrmacht had diminished and because the German defenders failed to block the city's canal system. The Austrian capital is criss-crossed underground by an intricate system of canals wide enough everywhere to let men pass and to permit the passage of the men-drawn cannon used by the Soviet Army. Guided and informed by Viennese experts, Soviet troops infiltrated the rear of German strongholds through the canals. On April 13, Vienna was free from the Germans.

While the fight inside the city was going on, Russian forces advanced through Lower Austria Province toward the Enns River. The advance halted there, and a junction was effected with United States forces. Further to the south, other Soviet units approached Styria Province. Contact was established with the Eighth Army from Italy along a line fixed by agreement, and mopping up operations in Austria were begun.

Yugoslav Drive.—On the southern wing, the Croatian provincial capital of Zagreb was taken by Tito's forces. On April 11, the Russian hold on Yugoslavia was further strengthened by the signature of a treaty of friendship, mutual assistance, and postwar collaboration which supplemented the existing alliance between the Moscow and Yugoslav governments.

The Yugoslavs, with Russian consent, were anxious to create a territorial *fait accompli* by seizing Istria, Gorizia Province, the city of Trieste, and even parts of Austrian Carinthia. On April 25, the Partisans, crossing from Sušak into Fiume, advanced across the neck of the Istrian Peninsula toward Trieste, less than 50 road miles away. Continuing along the Gulf of Trieste, they passed Monfalcone, where contact was made with British troops from the southwest. Other Yugoslav patrols, after crossing Slovenia, invested Carinthia. Tito's troops were subsequently compelled to evacuate Carinthia and Trieste and to withdraw to a predetermined line of demarcation.

Regroupment on the Western Front.—The German High Command transferred part of the remnants of Rundstedt's attack force to the eastern front. The Sixth Panzer Army was withdrawn, taking away seven panzer and panzer grenadier divisions, two panzer brigades, and three infantry divisions, all of them badly mauled. The replacements dispatched to the west in their place were mostly second-rate troops. As long as the front remained basically static, the Wehrmacht retained considerable defensive strength, particularly as long as the weather favored the defenders. February thaws made the ground extremely soft and waterlogged (attackers sometimes had to advance waist deep in water).

Allied strength of 71 front-line divisions in January rose to 85 divisions in March, 6 of which were airborne. Five to eight additional French divisions were being organized for later use. It was estimated that the Wehrmacht might be able to concentrate 100 divisions in the west if the Russian offensive should fall below expectations. Otherwise, only 80 divisions were expected to face the AEF. German divisions were greatly inferior in numerical strength to replenished Allied divisions.

General Eisenhower envisaged three stages in the campaign for final victory: first, the destruction of enemy forces west of the Rhine; second, the seizure of bridgeheads across the Rhine; and third, the destruction of remaining enemy forces east of the Rhine and the advance into the heart of the Reich.

When the Battle of the Bulge was virtually concluded, the American First Army reverted to the Twelfth Army Group under the command of General Bradley.

Reaching the Rhine.—Three phases were decided upon for operations west of the Rhine: Phase I, to consist primarily of Operations Veritable and Grenade, included the advance of the Canadian Army and the United States First Army to the Rhine below Düsseldorf. In addition, the Americans were to seize the line of the Erft west and northwest of Cologne. In Phase II, while Rhine crossings were being prepared farther to the north, the Wehrmacht was to be driven back to the river north of its confluence with the Moselle. At the same time, Allied southern forces, initiating an offensive to capture the Saar basin, were to begin their advance to the Rhine. Phase III envisaged consolidation and expansion of bridgeheads in the north, holding action on the central front, and completion of the advance to the Rhine in the south.

The first phase was to be under the control of the Twenty-first Army Group. The United States Ninth Army, built up to four corps (12 divisions), remained under the command of Field Marshal Montgomery. The date for the attack was set at no later than February 8. The Canadian First Army, employing seven infantry and four armored divisions (including the British 1st and 30th corps), was to conduct a strong offensive southeast from the Nijmegen area between the Rhine and the Maas as far as the line from Xanten to Geldern, clearing the whole area and establishing a firm flank along the Rhine. The Twelfth Army Group was to extend as far as Jülich, and the Ninth Army was to hold a front on the Roer River from Jülich to Roermond. A strong attack was to be launched toward the Rhine.

It was hoped that dry ground conditions would facilitate the drive. When the attack was launched on February 8, conditions were the reverse of what had been desired. Overcoming violent resistance in the *Reichswald* (Reich's forest), and in the outskirts of Kleve, the Canadian Army cleared that town on February 12 and the forest on February 13. On February 15, the Rhine was reached opposite Emerich. The city of Goch, held by the German First Parachute Army, resisted until February 21. Operation Grenade began on February 23. It had been scheduled originally for February 10, but the Germans, by opening the sluices of the Schwamenauel Dam, had caused the level of the Roer to rise about four feet. The attack had to wait until the floods subsided.

In clear moonlight, the 7th Corps of the First Army began the crossing of the Roer south of Düren. Before daybreak, the 19th and 13th Corps of the Ninth Army crossed the river in the Jülich sector. German resistance slackened as the drive gained momentum. Jülich fell on February 24 and Düren on February 25. The First Army pushed on toward Cologne and the Ninth toward München-Gladbach and Grevenbroich. By March 1, the Germans had lost

München-Gladbach, Grevenbroich, Neuss, Venlo, and Roermond. The German First Parachute Army, stubbornly opposed the Canadian Army between the Rhine and the Maas rivers, but the combined Veritable-Grenade operations were successfully completed. On March 4, the Allied armies made contact in the Geldern area, and six days later the Neuss-Homberg bridgehead was eliminated. The number of German prisoners taken by the AEF since D-day exceeded 1,000,000.

The First Army's continued advance toward Cologne formed part of the next phase, referred to as Operation Lumberjack. The Sixth Army Group south of the Moselle was still to remain basically on the defensive, while the Twenty-first Army Group was to complete its preparations for a major assault across the Rhine north of the Ruhr. The First Army was to seize high ground east of the Erft River and close to the Rhine south of Düsseldorf. Farther south, after the capture of the road center of Euskirchen, the drive was to converge with the Third Army's advance toward the Rhine. General Patton's objectives included the crossing of the Kyll River, seizure of the Mayen-Coblenz area, clearing the enemy from the west bank of the Rhine between the Moselle and the Ahr, and, tentatively, the establishment of a bridgehead across the Moselle River. The strategy of converging major thrusts was designed to prevent an organized German withdrawal across the Rhine.

Three panzer formations trying to stem the advance toward Cologne were dispersed by air attack. The city was invested on March 5 and firmly held two days later by troops of the 7th Corps. German *Volkssturm* battalions engaged in the battle lacked training and morale. On March 7, the west bank of the Rhine was cleared as far north as Düsseldorf.

The 3rd Corps reached the Rhine at Remagen on March 7. When fast-moving forces of the 9th Armored Division approached the river at 4:30 P.M., they found the huge Ludendorff railroad bridge still standing. Demolition charges had damaged it, but the bridge was passable. General Eisenhower stated that this offered "one of those rare and fleeting opportunities which occasionally present themselves in war, and which, if grasped, have incalculable effects in determining future success." The golden opportunity was seized, and General Bradley put five divisions across the river. The Wehrmacht was not prepared to meet this unexpected emergency. Reserves thrown piecemeal into attempts to destroy, or at least to contain, the rapidly expanding bridgehead were repulsed. The superhighway east of the Rhine was severed by the First Army. By March 24, the First Army held an area 25 miles wide and 10 miles deep east of the Rhine near Remagen, manned by three corps. The end of the war was in sight.

The center span of the bridge collapsed on March 17. By that time, supplementary floating bridges were in service, and the Allied forces east of the Rhine continued to expand.

Poor weather did not prevent Allied tactical air forces from supporting ground operations and beating off attempts by the Luftwaffe to interfere in the battle. German ground forces were isolated by air action. The largest air operation in the early months of 1945, known as Clarion, was carried out by almost 9,000 aircraft from bases in England, western Europe, and Italy. It covered an area of 250,000 square miles, including Berlin, Dresden, and Vienna.

While the 3d Corps was establishing the Remagen bridgehead, the 5th Corps on its right struck out to establish contact with the advancing Third Army. The German Fifth Panzer Army was too disorganized to hold up the American advance. Bad Godesberg and Bonn fell on March 10. The next day, elements of the First and Third Armies made contact at Andernach, trapping the Fifth Panzer Army's five understrength divisions. The Third Army had achieved substantial successes before the junction. Its 20th Corps eliminated resistance in the Saar-Moselle triangle on February 23, crossed the Saar River, seized Trier on March 2, and, after defeating German Seventh Army forces, gained the first bridgeheads across the Kyll River on March 4. The 7th Corps, spearheaded by the 11th Armored Division, broke through north of Kyllburg on March 7, and the 4th Armored Division of the 12th Corps charged across the Moselle River toward its confluence with the Rhine. By March 10, the left bank of the Rhine from Coblenz to Andernach was cleared. Phase II of the operations was virtually completed, and Phase III was well under way.

In the south, attacks by the French 1st Corps, aimed to destroy the German Colmar pocket, made little headway at first. After the United States 21st Corps (3d, 28th, and 75th Infantry and 12th Armored Divisions) joined the drive, the German Nineteenth Army began to crumble. Organized resistance west of the Rhine in that zone ceased on February 9, after the Germans had suffered more than 22,000 casualties.

The strength of the Sixth Army Group increased as the Seventh Army grew to 15 divisions. Operation Undertone, closing in on the Rhine from Coblenz southward, began on March 15. The 20th Corps (Third Army) struck from bridgeheads across the Saar and the Moselle into the Hunsrück hills. The 6th and 15th Corps (Seventh Army), including French elements, attacked northward between Haguenau and Saarbrücken. The German First Army lost Haguenau on March 15, and Zweibrücken and Saarbrücken five days later. Farther to the east, however, the defenders of the Siegfried Line offered stronger opposition.

General Patton launched an attack across the lower Moselle River into the rear of the Germans facing the Seventh Army. When Patton's 12th Corps crossed the Moselle, the Wehrmacht was unprepared to oppose its advance. Koblenz, Bingen, and Mainz were occupied by March 22. Taking advantage of German confusion, General Patton established an improvised bridgehead across the Rhine near Oppenheim, south of Mainz, in an ideally planned and executed night attack on March 22. The Fifth Division, which made the crossing in landing craft of the LCVP type, suffered only slight casualties.

Phase III was successfully concluded by March 25. The Wehrmacht had suffered severe casualties, its structure was shaken beyond hope of reorganization, and the Allies had two well established bridgeheads across the Rhine. not envisaged in original plans.

In March 1945, German emissaries in Stockholm, made overtures for a truce to the British Embassy. One school of thought in Germany advocated a separate peace with the western powers and concentration of remaining Wehr-

macht forces to halt the Russians. The separate truce proposal was summarily rejected.

The Rhine Crossing.—In the latter part of March, the AEF had been built up to nearly 4,000,000 men. Fresh divisions had arrived from the United States. French Colonials, withdrawn during the winter, were back in line, and the Twenty-first Army Group was reinforced by three divisions from the Eighth Army in Italy.

Operation Plunder, the assault across the Rhine north of the Ruhr, involved three Allied armies under the command of Field Marshal Montgomery. The United States Ninth and the British Second were to cross the river between Rhineberg and Rees, capturing Wesel and preparing for another crossing at Emerich. The Canadian Army was to hold the line of the Rhine and the Maas westward to the sea. After the successful establishment of the Second Army's bridgehead, the Canadian 2d Corps was to join the British Second Army to take Emerich, where a bridge was to be constructed. To aid the Second Army, the First Allied Airborne Army was to drop the United States 17th and the British 6th Airborne Divisions north and northwest of Wesel in an operation code-named Varsity.

Preparatory to the operation, air attacks were to isolate the Ruhr and to cut off the northwestern area of Germany. The air program began on February 21. Within one month, 40 major blows were struck by heavy and medium bombers. The RAF used a superbomb weighing 22,000 pounds for the first time. On March 11, 5,000 tons of bombs hit the rail center of Essen; on March 12, 5,487 tons hit Düsseldorf. Fighters and fighter bombers of the RAF Second Tactical Air Force and the United States 29th Tactical Air Command supported attacks on communications. Of 18 vital railroad bridges in the assigned area, 10 were destroyed, 2 were blocked by damage, and 2 were seriously damaged. Luftwaffe bases in northwest Germany were raided to keep German jet planes out of the air. Between March 21 and 24, American and British air forces flew over 42,000 sorties against Germany.

The Rhine crossing was essentially an amphibious operation, involving naval personnel. Training of naval crews on river courses where bank and current conditions were similar to those of the Rhine began in England in October 1944. LCM and LCVP craft were especially suitable for the operation. Five LCVP units of 24 each were formed in England and moved to the continent under the administrative control of Vice Admiral Alan G. Kirk. The craft measured 45 feet in length and were 14 feet wide. The LCM could load a Sherman tank or 60 men, the LCVP a bulldozer or 35 men.

At 10 P.M., on March 23, 1945, the offensive opened with a one-hour artillery barrage against German positions on the east bank of the Rhine. At 11 P.M., the British 1st Commando Brigade spearheaded the crossings, seizing Wesel. During the night, in the Second Army zone, the 15th Division led the 12th Corps assault north of Xanten, and the 51st Division led the 30th Corps around Rees. In the Ninth Army zone, the 30th and 79th Divisions launched the assault south of the Lippe Canal. On March 24, Allied bridgeheads were expanded, and additional forces were ferried across the river in the presence of Prime Minister Churchill and General Eisenhower.

Airborne Operation Varsity was the most successful of its kind up to that time. The British 6th Airborne Division was flown in from bases in East Anglia in 669 planes and 429 gliders of the RAF 38th and 46th Groups. The United States 17th Airborne Division came from Paris in 903 planes and 897 gliders of the 9th Troop Carrier Command. Fighter escort was provided by the RAF Fighter Command and the Ninth Air Force and cover over the target area by the British Second Tactical Air Force. The United States Eighth Air Force established a tight screen east of the Rhine. A total of 46 Allied planes were lost. The Airborne landings lasted from 10 A.M. to 1 P.M on March 24. On the next day, the 6th Airborne Division joined the 15th Division's advance, while the 17th linked with Ninth Army forces. Rees fell on March 25. The 16th Corps on the Ninth Army began to press southward into the Ruhr. Emerich was taken by the Canadians on March 30.

The Central Group of Armies under General Bradley conducted operations designed to establish a firm grip in the Frankfurt region, from which an advance in strength could be made toward Kassel. The First Army drove south from the Remagen bridgehead.

General Patton's Third Army, farther to the south, had extended its Rhine bridgehead to a length of 9 miles and a depth of 6 miles by March 24, taking 19,000 prisoners in 24 hours. Parts of the 12th Corps seized Darmstadt on March 25 and continued their drive to capture bridges across the Main at Aschaffenburg. The Germans fell back across the Sieg River under pressure from the 3d, 5th, and 7th Corps advancing from the Remagen bridgehead.

The 8th Corps of the Third Army established bridgeheads across the Rhine at Boppard on March 25. On the following day, two more crossings were effected at St. Goarshausen and Oberwesel. Third Army forces seized Wiesbaden on March 29. Aschaffenburg was reached on the same day, and Frankfurt was cleared of its weary defenders. The Seventh Army established bridgeheads near Worms on March 26. A junction with the Third Army was effected south of Darmstadt on March 27, and Mannheim surrendered on March 29.

On April 1, the French 2d Corps crossed to the east bank of the Rhine at Philippsburg to strike toward Stuttgart and clear the right bank of the Rhine as far as the Swiss border.

Field Marshal General von Rundstedt was replaced by Field Marshal General von Kesselring as commander in chief in the west. General Eisenhower later said this about the situation facing the new commander:

> Allied spearheads were thrusting eastward, isolating corps and divisions, and cutting off one German army from another . . . disintegration of the entire Western front developed rapidly . . . the task of exercising unified command over the German detachments was becoming almost an impossibility . . . Communications were breaking down . . . Kesselring could never be sure what the position at a given moment might be . . . and found himself increasingly unable to exercise any real control over the situation, and the organization of the Western Front collapsed completely.

DOOM OF THE WEHRMACHT

The Wehrmacht in the west was broken into isolated groups: some very strong and others extremely weak. They had only the supplies which the men and their vehicles could carry and, at best, some local reserve stores which did not permit prolonged large-scale action. Between these groups

and the objectives of a strategic retreat, if attempted, lay bombed and shattered communications. In many places, Allied armored vanguards, moving at lightning speed, had advanced beyond German positions. Envelopments continued, and attempted stands by a few diehard units, mostly SS men, invariably resulted in disaster. Local civilian authorities disagreed as to whether or not their localities should be defended. Recently drafted German soldiers tried to make their ways back home in civilian garb. Mass surrenders occurred daily on a scale exceeding the French collapse in 1940. The number of German prisoners taken in the west assumed fantastic proportions.

Early German Offers of Surrender.—The German military organization was based upon three largely independent front areas: west, east, and south. Each had its own supplies, supply lines, and operational reserves, interconnected through central strategic reserves and production centers. As the AEF progressed beyond the Rhine, distances between the various fronts shrank; communications overlapped; reserves became a disorganized mass; and whatever central organization still existed was thrown into chaos. During the last phase of World War II, the Wehrmacht's Supreme Command showed no more skill or initiative than the lesser European forces had when the Germans were battering them into submission.

Propaganda Minister Joseph Paul Goebbels, striking a Wagnerian chord, foretold that the downfall of the Reich would become "a twilight of the gods," destroying victors and vanquished alike. Another propaganda release warned the Allies and German defeatists that hundreds of thousands of "werewolves," members of a mysterious organization of avengers, would ultimately destroy the occupation forces and collaborationists.

Official efforts concentrated on attempts to negotiate a separate peace with the western powers, but the western Allies insisted on unconditional surrender to all Allied powers. If any serious attempts were made by certain German military groups which still favored cooperation with the USSR to contact the Seydlitz (Free German) Committee at Moscow in order to achieve a separate peace with Russia, they were equally ineffective. In February 1945, according to General Eisenhower, Gen. Karl Wolff, chief SS officer in northern Italy, approached Allied representatives with a view to a capitulation confined to the Mediterranean theater. The Allies replied that no terms would be discussed, and nothing short of unconditional surrender accepted.

Heinrich Himmler tried to contact the western Allies during the last week of April 1945. The chief of the Gestapo insisted that Adolf Hitler was "incapacitated" and that he (Himmler) was the designated head of the Reich. With his new authority, he offered to surrender all German forces on the western front. Count Folke Bernadotte of Sweden served as mediator. The Allied reply again stated that nothing but simultaneous unconditional surrender on all fronts would be acceptable. There is reason to believe that Himmler acted without Hitler's knowledge and that his claim that the führer was incapacitated was not correct. Himmler obviously was ready to liquidate Hitler if the Allies had accepted his proposal.

The National Redoubt.—Late in 1944, it was reported that the Wehrmacht planned a last stand in a national redoubt if the rest of Germany were occupied. The so-called national redoubt was partly on non-German (i.e. Austrian) territory, in Alpine regions, extending from Lake Constance to the Enns River and from the Bavarian Alps to the Drava Valley. The defenders would be fairly safe from air attacks in deep ravines and narrow valleys, and from the top of high mountains they would be able to check offensives which could not be effectively supported in that terrain by armor and heavy artillery. The national redoubt blocked communication lines both from north to south and from east to west. Elite troops, fanatically loyal to the Nazi Party, were to undertake lightning sorties from the redoubt into territory occupied by the Allies.

SS General Ernst Kaltenbrunner, a veteran terrorist with scant military education, was one of the authors of the plan. Some of the top Nazis liked the idea, but it was opposed by generals who realized that hardships, disease, and lack of supplies would force the national redoubt to surrender. Even the SS leaders split among themselves, but the plan was adopted in principle. Kaltenbrunner set up temporary headquarters in Bad Aussee, in the Austrian province of Styria. Between 200,000 and 300,000 men were assembled and trained for the type of warfare which was expected, but manning of the redoubt and other preparations for defense remained inadequate. The bulk of the German forces, defeated on the eastern and western fronts, made no serious attempt to reach it. Neither Hitler nor Himmler took up residence there, although Göring was captured in the Austrian Alps.

The Superiority of the AEF.—During the closing stages of the war, the AEF, in which the United States forces were predominant, was the most effective striking force engaged in European operations. Its air arm gave the first display of real air strategy in history, hitting at the most vital sources of enemy power. The Luftwaffe's methods inflicted surface wounds on the enemy. The United States and British air forces struck at his heart. The AEF introduced no revolutionary innovations of strategy on the ground, but followed age-old basic rules, such as penetration, outflanking, and envelopment. A superlative performance, however, was given in the field of elasticity of operations, with rapid, smoothly executed adaptations to the fluctuations of battle. The AEF excelled all other armies in matériel. It had not only the largest number of automatic weapons, artillery, armor, aircraft, and motorized equipment per unit, but the most minute and heretofore neglected details were incorporated into the construction of its mechanized equipment.

The AEF functioned as a gigantic machine of destruction, operated by skilled and intrepid specialists. Its technical perfection was largely due to American production power, unsurpassed by the combined potentialities of all other belligerent nations. Neither the state-owned and controlled industries in the USSR nor the privately owned and state-supervised industries in Germany or Italy could compete with United States production based upon individual initiative.

In addition to personal bravery and discipline —qualities shared by many other armies—the American soldiers displayed a technical skill and

familiarity with the mechanical devices of modern warfare far beyond that of the men of other countries. Even raw recruits could quickly learn to operate intricate mechanisms. The introduction of new types of weapons, frequently delayed in other armed forces by the difficulty of training soldiers to handle them properly, was never a serious problem to the United States Army. Thus, the high American standard of living—which European military traditionalists believed would weaken American fighting spirit—became in reality a source of exceptional strength and military efficiency.

The only field in which Germany surpassed the Allies was that of propaganda. The United States Office of War Information employed a large and expensive staff to incite the German people to rise against the German ruling party and military leaders. Their efforts produced no appreciable results. There were some questionable reports of internal popular resistance to the Hitler regime in Germany, such as the melodramatic story of a mysterious youth organization called "Edelweiss Pirates," but unbiased observers could not find any conclusive evidence of popular anti-Nazi activities. Allied forces had no support from German citizens in their drive through the Reich, whereas a number of cases of civilian violence against Allied troops were reported. These acts of violence, however, were never serious enough to confirm the predictions of Dr. Goebbels' propagandists.

Encirclement of the Ruhr.—On March 30, 1945, the United States Fifteenth Army was activated under the command of Lt. Gen. Leonard T. Gerow (as a part of the Twelfth Army Group), with the function of occupying, organizing, and governing the parts of Germany already conquered. Its area of control was extended as the other armies advanced to the east.

By far the greatest single concentration of German troops in the west was massed in the Ruhr area. Before driving deeper inside Germany, the Allied High Command decided to encircle the Ruhr and eliminate the pocket. The productive capacities of the Ruhr industries were no longer helpful to the Reich's war effort. It was hard to understand why Field Marshal Gen. Walther von Model (in command there) failed to attempt an evacuation of the Ruhr prior to the Allied attack. General Eisenhower attributed this in part to the innate insistence of the Germans upon fighting where they stood in preference to retreating.

The 16th Corps of the United States Ninth Army penetrated the industrial area from the north, while the 19th Corps on its left flank pushed eastward. The 7th Corps of the United States First Army struck from the south. Contact between the First and Ninth Armies was established on April 1, near Lippstadt. The junction sealed off the Ruhr, and mopping up operations began. By April 18, when the Ruhr pocket was liquidated, 325,000 had been captured, including 30 general officers. A total of 21 German divisions were destroyed, including 3 panzer, 1 panzer grenadier, and 3 parachute divisions. The entire German Army Group B and two corps of Group H were annihilated. German resistance to the liquidation of the pocket collapsed after Field Marshal von Model's attempts to strike out from Hamm in the north and from Siegen in the south were frustrated.

After the elimination of the Ruhr, the northern route of advance lay across the north German plain toward the Baltic and the Reich capital. According to General Eisenhower, "Berlin was the symbol of victory before the eyes of every Allied soldier from the day we set foot in Normandy." Berlin, however, did not lie within the limits of advance set for the AEF at Yalta. Although American and British forces could probably have outraced the Russian drive to Berlin, other goals were set for them. German forces located in occupied parts of Holland, in Denmark, in Norway, and along the southwestern shore of the Baltic were to be cut off by a thrust to that sea. German ports, naval bases, and shipyards were to be seized, ending the fading threat of submarines.

In central Germany, the trapping of Army Group B opened an easy avenue of advance from Kassel through Erfurt toward Leipzig and industrial Saxony. In the south, the axis of advance led through Nürnberg and Regensburg into Austria via the Danube Valley.

The greatest Allied strength was engaged in the center, where General Bradley's Twelfth Army Group (which by then included the Ninth Army), was operating. The city of Kassel was cleared on April 4, 1945. From there, the Central Group of armies was to launch an offensive toward Leipzig, establishing its right flank on a line from Bayreuth to the Erzgebirge (Ore Mountains). General Bradley was instructed "to seize any opportunity of capturing a bridgehead over the Elbe River and to be prepared for operations farther east." The Russians, however, were expected to reach the Elbe River or even its left (western) bank before the Twelfth Army Group, which would make operations east of the Elbe unnecessary.

In the south, General Devers' Sixth Army Group was to protect the right wing of the central advance, to prepare for a thrust in the direction of Nürnberg-Regensburg-Linz to prevent German concentrations in that area and, if necessary, to penetrate into the national redoubt from the north.

In its advance to the Baltic, Field Marshal Montgomery's Twenty-first Army Group was to mop up the whole northern area from Kiel and Lübeck westward, to advance toward Bremen and Hamburg, and to protect the Central Group's left flank on the Elbe. The Canadian Army, under Montgomery, was assigned to clear northeast Holland, the coastal belt eastward to the Elbe, and west Holland, in that order of priority.

The Atrocities of Buchenwald.—General Patton's Third Army, spearheaded by the 20th Corps, carried the central drive eastward with remarkable power and speed. Scattered German forces, precariously entrenched behind roadblocks, were quickly overrun. Weimar was reached on April 11, Erfurt on April 12, and Jena the following day. The capture of Weimar gave the Americans possession of the Buchenwald concentration camp, where unspeakable horrors paled any previous description of German atrocities. Camps captured later, such as Gardelegen, Bergen-Belsen, and Mauthausen, confirmed the Buchenwald reports. The overwhelming majority of the victims were non-German nationals and Jews who were not considered Germans by the Reich government regardless of their birthplace. Germans living in the vicinity of the camps denied knowledge of any atrocities, displaying their contempt for Allied credulity. Top German war

criminals assumed the same attitude. The existence of concentration camps was common knowledge in Germany, however, and conditions inside these "death factories" were no secret either. The psychological effect of German atrocities added to the determination of Allied soldiers to bring the war to a swift and victorious end.

Deathblows from the West.—On April 13, the United States 4th Armored Division reached the outskirts of Chemnitz, an industrial city in Saxony close to the northwestern Czechoslovak border. Strong defensive positions in the Erzgebirge Mountains were rapidly overcome by the advancing Americans. The population of former northwestern Czechoslovak border cities, annexed to Germany under the Munich Pact and composed almost entirely of German nationals, displayed hostility toward Allied troops. Czechoslovakia was invested by the western Allied armies on April 18. First Army forces broke down German resistance in Saxony, where the 69th Division of the United States 5th Corps cleared the big city of Leipzig on April 19 after a two-day struggle. A German salient, extending westward from the line of the Mulde River to the Leipzig-Halle area, was eliminated.

To the left (north) of the United States First Army, the United States Ninth Army established a bridgehead across the Weser River at Hameln on April 6. Advancing at the rate of 20 to 30 miles a day, it reached the Elbe south of Magdeburg on April 11. On the east bank of the Elbe River, huge masses of disorganized German troops faced the onrushing Americans. The United States 2d Armored Division established the first bridgehead at Brunswick on April 12. The next day, the 5th Armored Division of the 13th Corps crossed the river south of Wittenberge. Sharp resistance had to be overcome at Magdeburg, but the city was in American hands on April 18. Another Elbe bridgehead was gained and secured at Barby, despite German attempts to destroy bridges by floating mines. The Yalta Agreement set limits to the AEF's advance. With the Soviet Army moving rapidly westward toward the Elbe, there was no sound strategic reason to continue the drive. Only the Barby bridgehead was kept under AEF control.

South of the Harz Mountains, the United States First Army pushed on against generally disorganized resistance. On April 14, the 3d Armored Division of the 7th Corps reached Dessau. About 10,000 Germans, almost encircled in the Harz, raided Allied communications in determined sorties. In one of the last flare-ups of German fighting spirit, the Clausewitz Panzer Division, undertook a swift 50-mile dash back through territory lightly held by Americans to reinforce or relieve the pocket in the Harz Mountains. Before the Clausewitz Division could reach its objective, however, the drive was stopped. On April 21, the Harz Mountains were cleared.

The operations of the Twenty-first Army Group north of the Ruhr proceeded according to plan. The Second Army advanced with the 30th Corps on the left flank, the 12th Corps in the center, and the 8th Corps on the right. North of Münster, the First German Parachute Army disintegrated. On April 6, the 8th Corps, after establishing a bridgehead across the Weser River, continued toward the Elbe, which was reached by the 11th Armored Division near Lauenburg on April 19. The 12th Corps overcame stubborn resistance and reached Harburg on the south bank of the Elbe, opposite Hamburg, on April 20. The drive of the 30th Corps to Bremen was contested. The edges of the big port were reached on April 22. The last vestiges of German opposition were overcome on May 3.

The Canadian Army, moving into Holland, met little resistance in the north of the country. The sea was reached on April 15, and most of that region was liberated six days later. In the west, the Germans made an attempt to hold the Ijssel River line at Deventer and Zutphen. On April 10 the Canadians broke through near Deventer. In the south, the Canadian 1st Corps, attacking from Nijmegen, cleared the lower Rhine by April 5 and took Arnhem 10 days later. The Germans, controlling the Dutch system of dykes and dams, succeeded in flooding water lines and creating the inner "Fortress Holland." Large-scale attacks to penetrate the fortress bastions would have had disastrous effects upon the Dutch people. A prolonged siege, too, would have caused terrific misery. German looting had reduced civilian supplies to almost nothing. The Wehrmacht could have held out for some months, but the Dutch would have been doomed to mass starvation. Besides, the Germans were capable of loosing additional floods, which would put almost the entire country under water and ruin its fertility for a long time. The Allies wanted General Blaskowitz, German commander in Holland, to abstain from further flooding, and pointed out to him that the retention of Holland could not prevent the collapse of Germany. The German commissioner for Holland, Dr. Artur Seyss-Inquart, proposed a truce. A representative of the Supreme Command of the AEF met Seyss-Inquart in the presence of a Russian representative. Agreements were reached as to the immediate alleviation of the needs of the Dutch population by the Allies. No surrender was negotiated, as Blaskowitz insisted, according to Seyss-Inquart, that this could not be considered as long as any form of resistance continued in Germany. The Canadians held fast on the Grebbe Line until the general German surrender relieved Holland.

In the south of Germany, the Sixth Army Group pushed the Seventh Army to a line running roughly from Ludwigsburg via Crailsheim and Nürnberg to Bayreuth, where a junction was established with the Third Army. On April 11, the 21st Corps captured Schweinfurt. The 6th Corps seized Heilbronn and Würzburg, and crossed the Neckar River on April 12, after one week of fighting. On April 16, the 15th Corps reached the Nazi shrine of Nürnberg. German fanatics held the city for four days. The beautiful mediaeval buildings of Nürnberg were almost completely destroyed.

During the last week of March, the 15th Corps of the United States Seventh Army (Maj. Gen. Wade H. Haislip) bridged the Rhine river on a 15-mile front between Gernsheim and Mannheim. Advancing 25 miles, it established contact on April 1 with the 1st Corps of the French First Army (Gen. Jean de Lattre de Tassigny) south of Heidelberg. General de Tassigny's forces took Karlsruhe on April 4 and Baden-Baden on April 12. The French 1st Corps, breaking out from Strasbourg, took Kehl, on the opposite bank of the Rhine, on April 15, and pursued the Germans through the Black Forest.

On March 9, the AEF and the Soviet Army

NORTH
SEA
CANADIAN 1st
BRITISH
BERLIN
U.S. 9th
U.S. 1
3d
FRENCH
1st ARMY
U.S.
ARMY
MEDITERRANEAN
SEA

were still 300 miles apart. By April 7, the two armies were separated by 175 miles, and the distance had shrunk to 78 miles by April 15, due chiefly to AEF advances. Then the Russian offensive against Berlin began, and the AEF came to a prearranged halt along the central Elbe River. The Soviet Army, in its final drive, covered the remaining distance in the central sector.

On April 25, at 4:40 P.M., patrols of the United States 273d Infantry Regiment (69th Division, 5th Corps) met elements of the Russian 58th Guards Division in the Torgau area on the Elbe. The eastern and western fronts were joined; Germany was cut in two; the object of the central thrust had been achieved. Any German chances of recreating an organized front vanished completely. The German administrative system as a whole was paralyzed. Communications could no longer be used even for the purpose of carrying mail.

There were still some 50 German divisions north of Torgau. Their striking power hardly equalled that of five Wehrmacht divisions during the early years of World War II. A force estimated at 100 nominal divisions (each between battalion and brigade strength) was reported south of the dividing line. Prior to the German surrender, the possibility could not be overlooked that some of the southern German forces might attempt to retreat to the national redoubt, or that northern group forces might attempt to reach Denmark and Norway for another last ditch stand.

Even the superlative AEF ground supply organization could not carry all necessary matériel to the front. Airborne supply had to help out again. "Flying boxcars" (transport planes) were very valuable in the closing stages of the war. Overcoming many obstacles, 1,500 C-47's of the 9th Troop Carrier Command supplemented by heavy bombers, which flew over 20,000 sorties in April 1945, carried nearly 60,000 tons of freight, including 10,255,509 gallons of gasoline, to assist ground elements.

Mopping up operations in the north were carried out by the Twenty-first Army Group, with the United States 18th Airborne Corps under its command. The strong German naval fortress on the island of Helgoland had been neutralized by a heavy air attack on April 18.

After the fall of Bremen, the British 8th Corps crossed the Elbe at Lauenburg. The United States 18th Airborne Corps, fighting on the ground, protected the British right flank. The British 11th Armored Division dashed across Schleswig-Holstein on May 1, reaching Lübeck on the Baltic the next day, to seal off the German garrison in Denmark. The British 6th Airborne Division reached Wismar on May 2. On May 3, the British 30th Corps completed the mopping up of the area between the Elbe and Weser rivers. Also on May 3, another junction with the Soviet Army was achieved when the United States 18th Airborne Corps established contact with Russian troops who had driven through Mecklenburg in pursuit of dissolving German units after taking Stettin. Allied forces in the north met no further resistance. Fleeing westward before the Soviet Army, enormous bodies of German troops attempted to cross the central Elbe to give themselves up to the AEF rather than to the Russians. Innumerable civilians joined the panicky soldiers. One AEF corps alone set an all-time mark by taking 300,000 prisoners in the course of a single day.

In the south, the United States Third and Seventh Armies lashed out for the finishing blow on April 22, 1945. On April 25, the 20th Corps crossed the Danube on both sides of Regensburg, which was taken on the following day after some fighting, and drove on toward Austria along the right bank of the river, while the 12th Corps did the same on its left bank. By May 2, the 12th Corps reached Passau, on the border of Upper Austria province. Its 11th Armored Division received the surrender of the provincial capital of Linz on May 5. The 5th Corps of the United States First Army reverted to the left wing of Patton's forces for a drive into Czechoslovakia through the Bohemian Forest. The advance into Czechoslovakia spread to a broad front along the line Budějovice-Plzen (Pilsen)-Karlsbad (Karlovy Vary). Plzen fell to the Third Army on May 6. The Czechs gave the Americans a rousing welcome. It was agreed among Allied commanders that the AEF should not move beyond a line running from Karlsbad to Budějovice, then along the railroad to Linz, on the south (right) bank of the Danube to the confluence of the Enns River, and then up toward the watershed between Upper and Lower Austria provinces.

In Prague, capital city of Czechoslovakia, armed uprisings against the German garrison were carried out by patriots. On May 5, the Czechs seized strategic positions inside the city but were violently attacked by the Wehrmacht. Frantic Czech calls for help reached both the AEF and the Red forces. Although the AEF was only a score of miles away and did not face serious opposition, it could not heed the call because of the agreement with the Russians. The latter finally succeeded in entering Prague before the patriots or the city suffered great harm.

South of the Danube, on the right flank of the Third Army, units of the 20th Corps moved eastward to reach the Inn River opposite Braunau, the birthplace of Adolf Hitler. On their right flank, the 3d Corps bridged the Danube near Ingolstadt on April 26, the Isar on April 28, and reached the Inn River at Wasserburg (Bavaria) on May 2. This sector was subsequently taken over by the Seventh Army.

The 15th Corps advanced toward Munich, capital city of Bavaria, which was taken on April 30 after moderate resistance. One SS panzer division opposed the American drive eastward along the foothills of the Alps. On May 4, the 3d Division of the 15th Corps cleared Berchtesgaden. American soldiers went sightseeing in Hitler's legendary mansion and his "Eagle's Nest." Other American units cleared Salzburg in Austria, while remnants of German units in Salzburg and Upper Austria provinces collapsed.

The United States 21st and the 6th Corps crossed the Danube at Dillingen on April 22 and at Donauwörth on April 24. The drive continued toward the Alps. Infantry moved ahead of armor in difficult terrain, weakly defended by the enemy. On May 3, Innsbruck, provincial capital of the Austrian Tyrol, was reached, and the 103d Division of the 6th Corps moved southward across the Brenner Pass. At Vipiteno, on the southern side of the Brenner, the 103d Division established contact with the 88th Division of the United States Fifth Army, which was pushing

northward after the surrender of the German and Italian Republican Fascist troops.

The French 1st Corps reached Lake Constance on April 22 and established contact with the United States Seventh Army two days later. The industrial city of Stuttgart had been captured by French forces on April 21. Three remaining Wehrmacht pockets in the southern Black Forest, near Stuttgart and near Sigmaringen, were eliminated by April 27. Driving along the northern shore of Lake Constance, the French reached the Austrian border on April 30, and seized Feldkirch, in Vorarlberg Province, on May 4.

Far to the rear of the battlefields, some Wehrmacht enclaves still held out. An attack was launched against the Gironde stronghold on the French Atlantic coast on April 14. German resistance came to an end on the north bank of the Gironde River on April 18, and on the south bank on April 21. The island of Oléron was reduced on May 1. German garrisons at Lorient and St. Nazaire held out until the general surrender.

General Eisenhower said this about the final attitude of the Luftwaffe and the German Navy:

> Of enemy offensive activity in the air there was no sign. As the area left to the Germans decreased, the congestion of planes on the remaining airfields grew worse, and the number of aircraft destroyed on the ground mounted in proportion. The demoralization of the German Air Force personnel was too far developed for any suicidal effort to be made with the jet aircraft squadrons left in Austria and Czechoslovakia, and by the beginning of May practically the only flights undertaken were for the purpose of desertion.
>
> The end of the German Navy was even more unspectacular. Having put to sea only on rare occasions throughout the war, then invariably to be hounded to their destruction or driven crippled back to their bases where the Allied air forces repeatedly undid any repair work attempted, the heavy units lay helpless in the northern ports as these fell into the hands of the advancing armies. Only three of the larger ships were in anything approaching a condition for effective action when the last naval bases surrendered. The coastal craft had ceased to operate during April, and it was left to the submarine forces—the only truly successful naval weapon of which the enemy had enjoyed the use—to carry on the fight to the end.

Final Victory in Italy.—Except for one local drive, the Italian front remained quiet through the first three months of 1945. This drive, opening on January 5, in the eastern sector near Ravenna, was carried out by the Eighth Army on the isthmus between Lake Comacchio and the Adriatic. Meeting strong resistance, it did not fully achieve its objective, which was to eliminate all German positions east of the Senio River. The German command, however, had no illusions about the ultimate outcome, as shown by SS General Wolff's surrender overtures in February.

Allied forces in Italy included 14 British and Dominion divisions (Indians, New Zealanders, and South Africans), 7 United States divisions, 2 Polish divisions and 1 Brazilian division, in addition to smaller Greek and French formations and Italian auxiliaries. They had some support from anti-Fascist Italian partisans in parts of the country still occupied by the Germans and under nominal Republican Fascist rule. Attacks by the Allied Mediterranean Tactical Air Force and the Strategic Air Force were extremely effective. During the year preceding the German surrender, the Tactical Air Force flew a total of 38,787 sorties and almost isolated northern Italy.

On the eve of the final offensive, the Fifth Army (Lt. Gen. Lucian K. Truscott) held approximately two thirds of the total length of the front, from the Ligurian Sea (Mediterranean) to the Senio River. The rest of the trans-peninsular line to the Adriatic was manned by the Eighth Army (Lt. Gen. Sir Richard L. McCreery). German forces numbered 25 divisions in line and strong echeloned reserves. After Kesselring's appointment as commander in chief in the west, Col. Gen. Heinrich von Vietinghoff-Scheel took charge of the Wehrmacht in Italy.

The Eighth Army opened the assault on April 9. It was preceded by a clever infiltration of the rear of the German Tenth Army. Since April 6, small groups of Allied soldiers, travelling in rowboats and other light craft, had been crossing Lake Comacchio and fanning out behind the Wehrmacht's lines. Heavy aerial bombardment with fragmentation missiles and flame-throwing tanks shattered German ranks. Five days after the Eighth Army's attack, the Fifth Army started an offensive, spreading from the western wing toward the center and piercing the Appennine Mountains. After capturing Massa and Vergato, the vanguards of the Fifth Army entered the Po plain, well west of Bologna, on April 20. Under heavy pressure from Polish units of the Eighth Army, in the east, the garrison of that city could not counter the surprise drive from the west. On April 21, Bologna fell to combined Fifth and Eighth Army forces.

A huge gap was torn in the German center. Both wings were unanchored and disintegrated. The Allied drive sped through northern Italy with irresistible might. Moving up the Adriatic coast, the Eighth Army crossed the Po River while the Fifth took La Spezia on the Mediterranean on April 24 and rode into Genoa the next day. Armored columns raced toward the Swiss border near Como to cut off the retreat of all Axis forces in the northwest.

At Como, Benito Mussolini met his fate. The former Fascist dictator and later German puppet had left Milan after its evacuation by the Germans, when anti-Fascist partisans gained increasing control of the city. Accompanied by a few followers, including Achille Starace, former leader of the Black Shirt militia, and by his young mistress, Clara Petacci, Mussolini tried to reach Switzerland, but the Swiss government refused to admit the fugitives. The party was seized by Italian partisans, summarily sentenced, and shot. Their bodies were carried to Milan on April 28 and hung by their heels in Piazza Loretto.

On April 30, General Mark Clark was able to announce: "Troops of the Fifteenth Army Group have so smashed the German armies in Italy that they have been virtually eliminated as a fighting force. The military power of Germany in Italy has practically ceased."

In a broadcast directed to Germans and Republican Fascists alike, Italian Marshal Rodolfo Graziani, who backed Mussolini after his downfall in 1943, urged surrender. At the time the broadcast was made, the surrender was already under way. The subsequent count of prisoners revealed that the Fifteenth Army Group had been faced by no less than 1,000,000 enemy soldiers at the end.

Allied troops had conquered the Italian peninsula from the south. They had reached European soil when German strength was still near its peak, and some of their formations had come

all the way from the western desert. Unfortunately, the remarkable achievements and heavy sacrifices of the Allied forces in Italy were not fully appreciated by the public, since the Italian victory was overshadowed by events in Germany.

Forced marches carried Fifth Army units through the towering mountains of the Southern Tyrol to a junction with Seventh Army forces. Other Fifth Army troops reached the French-Italian border from the Riviera to Switzerland. The Eighth Army, meeting no resistance beyond the Po plain, established contact with Yugoslav partisans and marched into the Austrian provinces of Carinthia and Styria.

The Last Soviet Assault.—Premier Stalin appointed Marshal Zhukov as field commander on the eastern front. Despite the promotion, Zhukov also retained specific command of the First White Russian Army. By April 10, the crucial sector of the eastern front ran almost straight north and south from the Baltic near Stettin to the Czechoslovak-German border in the region of the Neisse River. The Second White Russian Army then held the right wing, the Third, on its left, ranged to the north of Küstrin, the First continued beyond Frankfurt on the Oder, and Konev's First Ukrainian Army was facing Saxony and the northwestern border region of Czechoslovakia. These four groups numbered about 2,000,000 fighting men.

The German government harangued its soldiers and citizens, urging them to repel the Russian onslaught at all costs and to defend Berlin to the last. Outnumbered, outgeneraled, and outmatched in equipment and morale, the Germans were beaten before the final Russian assault opened.

After a stunning barrage, Konev's First Ukrainian Army crossed the Neisse River on April 14, 1945. The initial push carried Konev westward in the direction of Dresden and Leipzig. Field Marshal General Schoerner made an attempt to rally a few divisions to hold the Russians——advancing at a speed increasing from 6 to 18 miles a day—east of these cities. Konev suddenly switched his main forces northward toward the Spree River. Masses of German armor and infantry were assembled to strike a surprise blow at Zhukov's left flank if the White Russians invested Berlin from the east. Konev broke into these German reserves from the south and routed them.

On April 16, Zhukov's army, supported by the bulk of the Soviet Air Force and 4,000 tanks, broke loose, followed immediately by Vassilevski and Rokossovski. The latter's forces were assigned to occupy northernmost Germany to the "boundary" with the western Allies. Zhukov faced stronger opposition than Konev, but the previously established bridgehead of Küstrin proved highly advantageous. On April 18, outflanked from Küstrin, the German central Oder positions crumbled. Red tanks poured into the gaps, and the lines collapsed. Russian columns reached the eastern outskirts of Berlin about 48 hours later. Throwing pincers around the city, Zhukov's forces sped to Oranienburg, north of the capital, and Konev's men to Bohnsdorf, south of Berlin. Converging patrols of both armies met west of the capital on April 24. On the following day, the encirclement of the city was complete. No attempt was made to break the Russian siege lines from outside the capital.

Red forces north of Berlin took Königswusterhausen, site of the big radio transmitter *Deutschlandsender*. Other troops of Konev's army reached Senftenberg, 14 miles from Dresden. Malinovski's Second Ukrainians hammered away at Wehrmacht divisions inside eastern Bohemia. Stettin, Rostock, and Warnemünde were captured on April 27. The Germans who remained in Latvia were annihilated. Berlin remained the crucial point.

Tempelhof airdrome fell on April 26. On April 27, the industrial suburb of Siemensstadt was in Russian hands, and the attackers penetrated the innermost section of Berlin, Unter den Linden, and the Tiergarten. Endless Russian columns poured into the bomb-scarred city, colorful, strangely spectacular, and intoxicated with victory. Some German units still fought block-by-block in subway shelters and makeshift forts. The last days of Berlin were a holocaust of destruction. On May 1, the Russian victory flag was raised over the Reichstag building. The next day, Artillery General Weidling surrendered all sections of Berlin still held by the Germans. Approximately 135,000 prisoners were taken—all that remained of a defense force of 500,000 men.

On May 6, Swinemünde on the Baltic fell to the Russians. The last pockets in the rear of the Soviet Army were cleared. Breslau was taken, and Malinovski completed the conquest of Moravia. The very last German stand was made south of Olomouc, in Moravia. It lasted for one day.

Germany's Unconditional Surrender.—A German communiqué of May 1, 1945, reported that the führer, Adolf Hitler, had died in action at 3:30 P.M. This claim was immediately revised to state that he had committed suicide. The magnitude of events minimized the stature of the man who had been visualized, for more than 12 years, as the sinister demon of the world. During the months preceding Germany's ultimate débacle, Hitler was hardly more than a fading symbol of a terrific evil that befell the post-World War I generation: that of self-abandonment to the spirit of a new tyranny and terrorism, generated by mass propaganda and maintained by mass persecution. This evil found its most violent expression in traditionally aggressive Germany. News of Hitler's death was far less electrifying than it might have been earlier in the war or even prior to its outbreak. His orders were invoked as an excuse by men who claimed to have acted upon his commands when committing their untold crimes, and by countless German fellow travellers who insisted they had been duped. In reality, all these men had acted according to their true instincts. No final evidence of Hitler's death, or the circumstances under which it occurred, was ever presented, nor was the evil eradicated by his disappearance. The communiqué issued on May 1 was the preface to complete German surrender.

Grand Admiral Karl Doenitz broadcast on May 1 from his headquarters at Flensburg, close to the Danish border, announcing that he had formed a new government whose first duty was "to save Germany from destruction by the advancing Bolsheviks," adding that "as far and as long as the achievement of this aim is impeded by the British and Americans, we [the German government] shall be forced to carry out our defensive fight against them." Doenitz and his Cabinet—men with aggressive pan-German rec-

ords—neither could be nor were considered to be the legally established government of the Reich and, for the time being, there was no Allied intention of allowing any such government to exist. To bring about organized surrender, however, the Allies chose to deal with whatever agency presented itself in Germany. Piecemeal surrenders had already begun.

On April 26, SS General Wolff again offered capitulation of the German forces in Italy, including Italian Republican Fascists. On April 29, his representatives signed the terms of surrender by which all hostilities in Italy were to cease on May 2. At that time, General Wolff inquired with whom the capitulation of the German North Alpine troops could be negotiated. He was told to apply to General Devers but was warned that only unconditional surrender would be acceptable. On behalf of the North Alpine German Army Group G (First and Nineteenth Armies), their commander, General Schulz, signed the surrender terms at Haar, Bavaria, to take effect at noon on May 6. In mid-April, Field Marshal General Busch had expressed his willingness to capitulate in the Hamburg area as soon as the western Allies reached the Baltic. General Lindemann, German commander in Denmark, was ready to yield at the same time as Busch. On April 30, a German emissary, arriving at Stockholm, confirmed these offers, but insisted that the two commanders would not surrender to the Soviet Army under any circumstances.

The western Allies did not want a surrender which did not include the forces facing east. On May 3, Admiral von Friedeburg, Doenitz' successor in command of the German Navy, appeared at Field Marshal Montgomery's headquarters and asked to be allowed to surrender the German Third Panzer Army, and the Twelfth and Twenty-first Armies, which had been fighting the Russians. Montgomery refused to discuss any terms which avoided the necessity for surrender to the Soviet Army but informed them that individual soldiers who surrendered would be treated as prisoners of war. The German representatives returned to Field Marshal Keitel, chief of the German High Command, for further instructions. On May 4, Admiral Friedeburg announced that he had permission from his superiors to offer unconditional surrender of all German armed forces, land, sea, and air, in northwest Germany, including the Frisian Islands, Helgoland and all other islands, Holland, Schleswig-Holstein, and Denmark. This capitulation was regarded as a tactical matter, and it was arranged that a Russian officer should be present on behalf of the Soviet High Command when it was accepted. This part of the German surrender was signed on May 4 and became effective on May 5 at 8 A.M.

Also May 4 it was learned that a representative of Admiral Doenitz would arrive at General Eisenhower's headquarters the following day and that all German U-boats had been ordered to return to port. The Soviet High Command was immediately informed and agreed with General Eisenhower's suggestion that a Soviet officer should be present in order that a simultaneous capitulation on all fronts could be arranged. This assignment was given to Maj. Gen. Ivan Suslaparov.

At a modest brick building—an industrial school at Reims, France, which was the site of Supreme Headquarters Allied Expeditionary Force—Admiral Friedeburg arrived on the evening of May 5, 1945 and was informed that only unconditional surrender would be considered. He said that he did not have the power to sign a document of capitulation. When he was shown the hopelessness of the Reich's position, Friedeburg communicated with Doenitz and learned that Col. Gen. Alfred Jodl would be sent for the negotiations.

General Eisenhower in his report states:

> Jodl arrived on the evening of May 6. It was at once obvious that the Germans were merely playing for time so that meanwhile they could evacuate the largest possible number of soldiers and civilians from the Russian front to behind our lines. They persisted even now in attempting to surrender the Western Front separately, going so far as to say that, whatever my answer might be, they intended to order their armies to cease firing upon the Anglo-Americans. They asked for an adjournment for 48 hours before signing the final surrender, allegedly to enable them to get the necessary orders to their outlying units, but actually, it was clear, only to gain further respite for the purpose above mentioned.
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> They were informed that unless they agreed to my terms forthwith, I would break off all negotiations and seal my front, preventing, by force if necessary, any further westward movement of German soldiers and civilians. They then drafted a cable to Doenitz, asking for authority to make full surrender, but specifying that actual fighting would cease 48 hours after signing. Since this solution obviously placed the decision as to when fighting should cease in the hands of the Germans, I refused to accept it, and finally told them that unless all hostilities should terminate on both fronts within 48 hours of midnight that night, my threat to seal the western front would be carried out.
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> This declaration at last had the desired effect. Doenitz gave his approval for the acceptance of my terms, and at 0241 hours [2:41 A.M.] on 7 May the act of surrender was signed by Jodl on behalf of the German High Command. My Chief of Staff [Lt. Gen. Walter Bedell Smith] signed for me, and General Suslaparov signed for the Soviet High Command. General Savez of the French Army, Deputy Chief of Staff for National Defense, signed as witness. The terms were to become effective at midnight, 8–9 May.
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> In addition to the act of military surrender, Jodl signed an undertaking that the Chief of the German High Command, with the Commanders-in-Chief of the Army, Navy, and Air Force, would appear at a time and place to be designated by the Soviet High Command and myself for the purpose of executing formal ratification of the unconditional surrender on behalf of the German High Command. This meeting was held in Berlin on the night of 9 May, when Air Chief Marshal Tedder signed on my behalf, and Marshal Zhukov for the Soviet High Command. General Spaatz of the United States Air Forces and General de Lattre de Tassigny (representing the French government) were present as witnesses.

Field Marshal General von Keitel signed as chief of the German High Command and for the Wehrmacht Heer, Admiral Friedeburg for the Wehrmacht Marine, and Col. Gen. Paul Stumpff for the Wehrmacht Luftwaffe.

General Eisenhower reported:

> With this final capitulation by the German leaders, the mission of the Allied Expeditionary Force placed under my supreme command on 14 February 1944 was accomplished.

Norway's liberation was achieved by Germany's surrender. Victory in Europe came five years, eight months, and nine days after the attack on Poland. The magnitude of the German military defeat was unparalleled in history. Once again a great coalition, partly forged by the Reich's aggressiveness, prevented Germany from subjugating most of the world. Statesmen in Allied countries pledged themselves to prevent the revival of German aggressive power. To fulfill this pledge, unity in peace was needed, as well as a coordinated policy to eliminate sinister elements of tyranny. Disunity, expansionist aims, and short-sighted egoism in peace would pro-

mote resurrection of German militarism. It was equally important that the true facts of German outrages should not only be known but well remembered in all Allied countries. Ignorance and forgetfulness would help the Germans to try again what they narrowly failed to accomplish in World War II. The ink was hardly dry on the instrument of surrender when a propaganda of sympathy developed in the United States and Great Britain to create pity for the Germans and to minimize their misdeeds. Disagreements between the former Allies obscured the German threat, warded off but not permanently eliminated by victory.

CONTINUED VICTORIES IN THE PACIFIC

(The following account of the conclusion of the war in the Pacific is based primarily upon Gen. George C. Marshall's report to the Secretary of War, *The Winning of the War in Europe and the Pacific,* and Fleet Admiral Ernest J. King's final official report to the Secretary of the Navy, *United States Navy at War.*)

Events in Europe gradually freed Allied forces for service in the Far East, but transportation was the serious problem. Consequently, the full superiority of the western Allies could be made effective only by slow degrees. The Soviet Far Eastern armies were very formidable. Once they entered the war, it was expected that the Japanese would soon be driven from Manchuria, southern Sakhalin, and even Korea, but it was plain that a Russian campaign beyond these areas would have to surmount major obstacles. The air assault on Japan continued, but in the spring of 1945 it was still doubtful if the enemy could be decisively defeated in this manner and, if so, how long it would take. When Germany surrendered, United States and British official sources rightly emphasized that the war was far from won.

The arrival of substantial British naval forces in the Asiatic theater of war was greeted by Fleet Admiral Ernest J. King in his *Second Official Report* as follows:

> Recently we have had the pleasure of welcoming the arrival in the Pacific of a strong task force of the Royal Navy, commanded by Admiral Sir Bruce A. Fraser, G.C.B., K.B.E. This potent addition to the Allied naval power in the Far East has been placed under the operational control of the Commander in Chief, United States Fleet, and will work side by side with our armed forces in the common effort against the Japanese. . . . Australian cruisers, destroyers and attack transports . . . have continued to operate as an integral part of our naval task forces, as they have in previous years.

The United States Pacific Fleet and Seventh Fleet submarines had an important share in Pacific offensive operations. Their patrols, according to Admiral King, "carried them to the interior lines of Japanese sea communication, where they have littered the bottom of the ocean with the sunken wrecks of a large part of

Japan's once great merchant fleet, as well as many naval vessels." Submarines rendered invaluable service on reconnaissance missions and accounted for the rescue of many Allied aviators shot down during raids upon various Japanese bases.

Carrier aircraft of the Fifth Fleet attacked Tokyo for the first time on Feb. 16, 1945. After this date, attacks by naval aircraft spread all over the Japanese home islands.

Other United States naval forces kept Japanese positions in the Kuril Islands under attack from bases in the Aleutians. As early as June 13, 1944, a task force of cruisers and destroyers, under the command of Rear Admiral Ernest G. Small, shelled Matsuwa Island in the Kurils and followed this up, on June 26, with an assault on the air base of Kurabu Zaki on Paramoshiri. Matsuwa was again attacked on Nov. 21, 1944, and Paramoshiri on Jan. 5 and Feb. 19, 1945, both by a United States task force commanded by Rear Admiral John L. McCrea.

To enable medium land-based bombers to join the air bombardment of Japan by Superfortresses based on the Marianas and to open the assault on the inner defenses of the empire, the central Pacific advance had to be carried to the Volcano Islands. Iwo Jima in the Volcanos, only 750 miles from Tokyo, afforded three sites for airfields which could be used by bombers as well as escorting fighter planes.

Capture of Iwo Jima.—The island of Iwo Jima, 5 miles long and less than 2 miles wide (8 square miles), was heavily fortified. Admiral King wrote in his Final Official Report:

The defensive organization of Iwo Jima was the most complete and effective yet encountered. The beaches were flanked by high terrain favorable to the defenders. Artillery, mortars, and rocket launchers were well concealed, yet could register . . . on any point of the island. Observation was possible, both from Mount Suribachi at the south end and from a number of commanding hills rising above the northern plateau. The rugged volcanic crags, severe escarpments, and steep defiles sloping to the sea from all sides of the central Motoyama tableland afforded excellent natural cover and concealment, and lent themselves readily to the construction of subterranean positions to which the Japanese are addicted.

Knowing the superiority of the firepower that would be brought against them by air, sea, and land, they had gone underground most effectively, while remaining ready to man their positions with mortars, machine guns, and other portable weapons the instant our troops started to attack. The defenders were dedicated to expending themselves—but expending skillfully and protractedly in order to exact the uttermost toll from the attackers. Small wonder then that every step had to be won slowly by men inching forward with hand weapons, and at heavy cost. There was no other way of doing it.

Of the performance of the United States Marines who conquered Iwo Jima, Admiral King had this to say:

American history offers no finer example of courage, ardor and efficiency.

This praise was not exaggerated, for the United States Marines were undoubtedly one of the most gallant and successful fighting organizations of all the armed services engaged in World War II.

Iwo Jima was subjected to air and naval attack for seven months before the invasion. During the last two months, the attacks were intensified. Planes from the fast carrier task force struck the island on June 15, 16, and 24, July 4, Aug. 4-5 and 31, and Sept. 2, 1944. Surface ships shelled installations on July 4 and September 2. Rear Admiral Allan E. Smith's cruisers and destroyers pounded Japanese shore batteries on November 11-12. Early in December, bombers of the Seventh Air Force, aided by marine corps bomber squadrons based in the Marianas, opened daily assaults on the island. On December 8, 24, and 27, Rear Admiral Smith's surface forces resumed action, suffering slight damage and some casualties by shore-battery fire and by a hit from a Japanese destroyer escort which was later sunk. Heavy naval units joined the assault on Jan. 24, 1945. A battleship-cruiser-destroyer force, commanded by Rear Admiral Oscar C. Badger, attacked Japanese installations and shipping in coordinated action with strategic air force bombers and B-29's of the 21st Bomber Command.

D-day was set for Feb. 19, 1945. Almost 60,000 marines were put ashore by a naval force of more than 800 vessels, manned by approximately 220,000 naval personnel. Operations were under the command of Admiral Raymond A. Spruance, commander of the Fifth Fleet. Vice Admiral Richmond K. Turner was in over-all command of the amphibious forces. Expeditionary forces were commanded by Lt. Gen. Holland M. Smith, United States Marine Corps. Maj. Gen. Harry Schmidt was in charge of the Fifth Amphibious Corps, Maj. Gen. Clifton B. Cates of the 4th Marine Division, Maj. Gen. Keller E. Rockey of the 5th Marine Division, and Maj. Gen. Graves B. Erskine of the 3d Marine Division. Vice Admiral Marc A. Mitscher's fast carrier task force supported the assault. The number of the Japanese defenders was correctly estimated at 20,000.

After three days of intensive bombing by navy carrier planes and army shore-based planes, the

4th and 5th Marine Divisions went ashore at 9 A.M. on February 19 and encountered heavy artillery, mortar, and rocket fire. The Japanese used some of the most modern weapons yet encountered. The marines assaulted interlocking caves, pillboxes, and blockhouses, suffering very heavy casualties. Japanese guns, emplaced on 546-foot Mount Suribachi and in northern high ground, commanded the American beaches. By the end of the day, Mount Suribachi was almost isolated. On February 20, after repulsing a Japanese counterattack, the marines captured Motoyama Airfield No. 1. On the third day, the 3d Marine Division moved into the line between the other two divisions. Again the Japanese counterattacked in vain, and the marines captured the southern part of Motoyama Airfield No. 2 on February 23. On that day, at 10:35 A.M., men of the 28th Marine Regiment hoisted the Stars and Stripes on the top of Mount Suribachi. By February 25, with the assistance of tanks, about half of the island had been taken. Admiral King reported:

> The advance was made against fanatical resistance from rockets, bazooka-type guns, pillboxes and interlocking underground strongholds. On one flank alone, 100 caves, 30 to 40 feet deep, had to be knocked out one by one.

On March 2, Motoyama Airfield No. 3 and the village of Motoyama were in the hands of the marines, inching forward with the 4th Division on the right, the 5th on the left, and the 3d in the center. The Japanese retained a horseshoe-shaped area at the northeastern end of Iwo Jima.

On March 6, land-based fighter planes relieved carrier-based aircraft to support ground operations. Airfield No. 2 was fully operational on March 16. Organized resistance was declared at an end as of 6 P.M. on that day. Japanese remnants, isolated in a pocket near Kitano Point, were mopped up.

The island was captured in 26 days of actual combat. United States casualties ashore, as reported on March 17, were 20,196, of whom 4,305 were killed. The navy also suffered casualties, although no naval action took place, and no major fleet units were put out of action. Japanese coastal guns, PT boats, and Kamikazes accounted for most of the naval losses. Japanese forces were wiped out. An advance of 725 miles —almost half of the remaining distance—was gained toward the heart of Japan.

Invasion of Okinawa.—The Ryukyu (Nansei Shoto) Island chain extends in a shallow loop from Kyushu, southernmost Japanese home island, to Formosa. Okinawa, the largest and most densely populated island of the group, is only 350 miles from Kyushu. From airfields on Okinawa—for which numerous excellent sites were available—Japanese sea communications to Korea, to Indo-China, to the Chinese mainland, and to Singapore could be raided by bombers with fighter escorts, tightening the blockade of the Japanese on the Asiatic mainland. Okinawa was one of the final and most vital stepping stones to an invasion of Japan, for which plans had been completed when the Okinawa campaign began. The defenders of Okinawa numbered about 120,000, including native Okinawans drafted into service.

Most of the intelligence information required for the attack on Okinawa was obtained from photographic coverage. The island is 67 miles long and 3 to 10 miles wide, divided by an isthmus into almost equal northern and southern parts. The northern area is wooded, rugged, and mountainous, the southern area generally rolling but frequently broken by steep slopes and ravines. The capital city of Naha (Nawa) and the five Japanese airfields were in the southern part of the island.

The final plan of attack called for extensive air and naval preparations to eliminate air and naval strength available for the defense, and to soften up Japanese ground installations. After this was done, the main attack was to be launched by four divisions on a six-mile beach on the southwest coast, bordering the Yontan and Kadena airfields. The two center divisions were to drive across the island to the east, while the flank divisions were to pivot north and south respectively. Japanese forces on the southern part of Okinawa—where the bulk of the defenders was expected to concentrate—were to be overcome by attack from the north. Coincident with the landings, a demonstration was planned for the southeast coast. The islands of the Kerama Retto group, 20 miles from Okinawa's southwestern shore, and the small island of Keise Shima, 20,000 yards from the landing beaches, were to be seized in preliminary amphibious operations. Supply depots and naval and seaplane bases were to be established in the Kerama Retto group. From Keise Shima, long-range army artillery could command the lower end of Okinawa, including the city of Naha, only 11,000 yards away.

After completion of operations supporting the Iwo Jima campaign, Vice Admiral Mitscher's fast carrier task force turned toward the Ryukyu chain. On March 1 and 2, his cruisers shelled the Okino-Daito-Shima area. On March 18-19, from a position 100 miles off Kyushu, air attacks were launched against airfields on that island. The United States carrier *Franklin* suffered two bomb hits, which severely damaged the ship and resulted in 772 dead and missing. Lesser units also suffered damage and casualties. Operations continued while the fleet moved slowly southward. During a four-day period, the United States task force destroyed 528 Japanese planes, damaged 16 hostile surface craft, and hit numerous hangars, factories, and warehouses, with a loss of 116 American planes. These costly operations prevented the Japanese from launching a strong air attack against the United States forces engaged in the Okinawa campaign until a week after the initial landings. On March 24, battleships of Mitscher's task force, under the command of Vice Admiral Willis A. Lee, Jr., shelled the southeastern coast of Okinawa as a part of the diversionary move.

Two days later, the 77th Division of Lt. Gen. Simon Bolivar Buckner's Tenth Army landed on Kerama Retto. In three days of moderately heavy fighting, the division secured all islands of the chain and placed its long range artillery opposite Okinawa. On March 24, minesweeping operations on the approaches to the beachhead began to clear the path for the main invasion armada.

Operations for the capture of Okinawa were under the command of Admiral Spruance, commander of the Fifth Fleet. The major forces participating under his command were: the joint expeditionary force (all elements engaged directly in the landings) under Vice Admiral Turner; the Expeditionary Troops (all ground forces engaged) under Lieutenant General Buckner; the fast carrier force (Vice Admiral Mitscher), including battleships and other supporting vessels under Vice Admiral Lee; the British Carrier Force (Vice Admiral Henry B. Rawlings); the Logistic Supply Group (tankers and cargo vessels which serviced the fleet while it was operating close to the combat areas) under Rear Admiral Donald B. Beary; Service Squadron Ten (repair, supply, and service vessels of all kinds based on Leyte Gulf, the Marianas, etc.) under Commodore Worrall R. Carter; the Amphibious Support Force (escort carriers, minesweepers, underwater demolition teams, gunboats, and gunnery ships assigned to bombardment missions) under Rear Admiral William H. P. Blandy; and the Gunfire and Covering Force (battleships and other gunnery vessels not with the fast carriers) under Rear Admiral Morton L. Deyo. In the operation, 318 combat vessels, 1,139 auxiliary craft, and about 548,000 men of the United States and British navies, the United States Army, and the United States Marines took part. Troops and cargo were loaded and embarked on the United States west coast, in Hawaii, in the southwestern Pacific, the Marshalls, the Carolines, and Leyte. Movements of all forces to the objective were carried out without enemy interference.

Anchorages at Kerama Retto were protected by nets and seaplane bases. Tankers, ammunition ships, and repair vessels were brought directly to these anchorages, which soon assumed an important role as a haven for ships damaged by kamikaze planes.

For seven days preceding the invasion, Okinawa was hit by intermittent gunfire and bombing. On April 1, the 24th Army Corps and the 3d Marine Corps hit the Hagushi beaches at 8:30 A.M. Four hours later, Yontan and Kadena airfields were captured with light losses. By nightfall, the Tenth Army had 50,000 men ashore, established in a beachhead 4,000 to 5,000 yards deep. The feint against the southeastern coast of the island was carried out realistically. The drive across the island met little resistance. Driving north thereafter, the marines encountered light to moderate opposition. The 24th Army Corps, pushing toward Naha to the south, met the main Japanese forces. The Japanese commander had shrewdly decided not to expose his men on the beaches, where overwhelming firepower could be brought to bear against them, but to concentrate in a terrain farther inland which was admirably suited for defense and delaying tactics. Protected by blockhouses, pillboxes, and caves, and surrounded by double apron barbed wire and minefields, the Japanese, using their artillery skillfully, displayed what was called "artful and fantastic" tactics. General Hodge, commander of the 24th Army Corps, wrote at the end of the first week of fighting:

> There are 65,000 to 70,000 fighting Japanese holed up in the south end of the island, and I see no way to get them out except to blast them out yard by yard . . .
>
> The Japs have tremendous amounts of artillery and have used it far more intelligently than I have ever seen them use it to date. With best estimate, it shows around 500 or more individual weapons of 75-mm or better, including some 169-175 of caliber 105 or better. The most powerful weapon of long-range we have encountered to date is the 150 rifle with range of 27,000 yards which fires occasionally upon the two airfields from the vicinity of Shuri. They are using quite a few of the Spigot mortars (320-mm), 250-mm mortars, and aerial bombs up to 250 kilograms fitted as rockets. They are also using large sized rockets somewhere in the 5-, 6-, to 8-inch class.

After mopping up the northern part of the island, the marines joined the drive toward Naha. In a fight which matched in ferocity the most protracted previous Pacific island battles, the Tenth Army and the Japanese wrestled yard by yard along an 8-mile front. Advances of half a mile a day, as scored on April 19, were considered major gains. On April 21, the United States 27th and 96th Divisions, after a violent artillery barrage, gained ground toward Hill 178, a strong Japanese bulwark. On April 22, the Japanese held only one fourth of the island's area, but this was the most vital part of it.

On April 27, the 7th Division closed in on Shuri, second largest city in Okinawa. By May 5, "Banzai" counterattacks, usually carried out when Japanese defensive strength was nearly exhausted, were begun. On May 13, the suburbs of Naha were invested. Sugar Loaf Hill, a key position, was taken and lost five times before it was firmly held by United States troops. By May 18, United States casualties on Okinawa were reported as 30,526, of which 3,958 were suffered by the navy. Three United States divisions had advanced 15,000 yards in 44 days of fighting. Heavy rains, setting in on May 25, further impeded the American offensive. The count of Japanese dead passed 60,000 on May 31. On June 2, Naha airfield was invested, and Shuri was taken. The fleet supported the land drive with everything it had. Japanese resistance con-

tinued fanatical. As General Marshall stated: "Each successive strong point was cleared only by heroic efforts of our soldiers and marines."

By June 7, pincers had squeezed the remaining Japanese forces into two pockets which were incessantly hammered from land, sea, and air. On June 16, the three strongest remaining hill positions were cleared, and 97 per cent of Okinawa was won. On June 18, Lieutenant General Buckner was killed by Japanese artillery fire while observing the final drive of his assault infantry. This gallant leader was replaced by Gen. Joseph W. Stilwell, whose previous command was assumed by Gen. Jacob L. Devers of AEF fame. Three days later, after 82 days of fighting, Okinawa was declared won, with some mopping up operations still in progress.

United States casualties in the Okinawa campaign amounted to 79,507, including killed, missing, wounded in action, and non-battle casualties. Battle casualties were 21,342 for the army, 16,313 marines, and 9,721 for the navy. Non-battle casualties (largely battle fatigue) amounted to 21,592 for the army and 10,881 for the marines. Enemy casualties were estimated at 120,000.

Okinawa was not only the last major ground battle of the war but the costliest single engagement in the Pacific.

Naval Operations at Okinawa.—After the first week of Japanese inactivity in the air, Kamikaze flyers, attacked the invasion fleet in large numbers. Japanese bombers and fighters joined in action over the beaches and over the battlefields. By mid-June, the Japanese had lost 20 per cent of their total combat air strength in the battle for Okinawa. Over 3,400 Japanese planes were destroyed in the air and 800 on the ground. United States losses totaled more than 1,000 aircraft.

The Allied fleets off shore suffered considerable losses from air attacks. Admiral King explained in the *Final Official Report* the extent of ship losses as follows:

> By its very nature an amphibious invasion implies advancing a huge number of vessels, both combatant and noncombatant, from a zone dominated by one's own land-based air forces into one hitherto dominated by the enemy's. Our vessels are localized by the landings so that the enemy has not the problem of finding them, but only of hitting them. Thus exposed, their protection depends wholly on their own anti-aircraft fire, smoke, and on cover from our own carrier-based air forces, which are to that extent diverted from offensive missions. . . . The longer the Navy must remain in support of assault troop operations, the more vulnerable it is to attack, and the higher is the proportion of personnel and ship casualties. Slow progress on the ground is directly reflected, therefore, in naval losses.
>
> The first enemy air attack at Okinawa occurred on 24 March . . . the first damage was done on 26 March; and by 21 June . . . about 250 vessels of all classes, from battleships and carriers down to destroyers and landing ships, had been hit by air attack, by far the greatest proportion of them in suicide crashes. Some 34 destroyers or smaller craft were sunk. Early warning of impending attacks proved to be the best countermeasure and for this purpose destroyers and other small vessels were stationed as pickets at appropriate distances from the concentration of heavier shipping. These pickets took the heaviest losses themselves, but in so doing they undoubtedly saved many bigger and more valuable vessels during a critical three months.

No United States or British vessel larger than a destroyer was sunk off Okinawa.

During the fight for the island, Allied naval forces continued operations close to and inside Japanese home waters. On April 7, Admiral Mitscher's carrier task force attacked strong Japanese fleet units in the East China Sea off Kyushu. United States airmen sank the battleship *Yamato,* the cruiser *Yahagi,* and four destroyers and started fires on two other destroyers. Of the entire Japanese force, only three destroyers escaped undamaged. Japanese aircraft attacked the United States task force. The carrier *Hancock* was severely damaged by a suicide flyer. On April 11, Japanese Kamikazes resumed their dives on Mitscher's vessels. No direct hits were scored, but 8 near misses accounted for some damage. Four days later, the task force effectively raided southern Kyushu airfields.

As Japanese planes continued to plague the invasion fleet off Okinawa, Mitscher concentrated on its defense. On April 16, 210 Japanese planes were shot down, but the United States carrier *Intrepid* was severely damaged by a kamikaze. On April 19, Vice Admiral Lee's fast battleships bombarded the southeastern coast of Okinawa. On May 4, a large-scale Japanese air raid was aimed at Allied land and amphibious forces. The task force assisted in smashing the raid and intervened one week later in another air battle when the carrier *Bunker Hill* was hit by a kamikaze. In addition to considerable material damage, 373 men were killed, and 19 were missing. The fast carriers again attacked Kyushu fields on May 13 and 14. Few planes were encountered, but one of them damaged the carrier *Enterprise.* The attack on Kyushu airfields was renewed on May 24 and again on June 2 and 3.

On June 4, a typhoon damaged two carriers, three cruisers, and one destroyer in the task force. This prevented the fleet both from raiding Kyushu again on June 8, and from assisting the ground fighting on Okinawa immediately thereafter. The fast carriers and their escorts arrived at Leyte Gulf for supplies and repairs on June 13. The British carrier task force neutralized Japanese air installations on Sakishima Gunto, southwest of Okinawa, in operations between March 26 and April 20 and again from May 4 to 25.

Reconquest of Borneo.—The recovery of Borneo not only meant access to valuable sources of raw materials but also a better approach by sea and air to the Asiatic mainland, in the path of Admiral Mountbatten's drive from India through Burma toward Malaya. The Borneo campaign also was the first step toward the recapture of the Dutch East Indies.

Allied seizure of Puerto Princesa on the east coast of Palawan on Feb. 28, 1945, threatened northern Borneo. Admiral Thomas C. Kinkaid's Seventh Fleet carried operations through the Sulu Sea, the Sulu Archipelago, and the Celebes Sea, between the main Philippine Islands and Borneo. In order to gain control of the passage from the Sulu to the Celebes Sea and to provide another stepping stone toward Borneo, an attack group of light cruisers and destroyers under Rear Admiral Forrest Royal bombarded Japanese positions on Zamboanga, on the southwest tip of Mindanao, from March 8 to 10, 1945. The United States 41st Division, put ashore on March 10, seized the city and two adjoining airfields and drove the Japanese back into the hills. Basilan Island was taken on March 16. The 41st Division then extended its hold on the Sulu Archipelago, landing at Sanga Sanga in the Tawi Tawi group on April 2 and on Jolo on April 8.

The next move to regain Borneo was directed against the island of Tarakan off the northeast-

ern coast of Dutch Borneo, 185 miles southwest of Tawi Tawi. Vice Admiral Daniel E. Barbey commanded the attack force. After preliminary shelling and minesweeping, an attack group under Rear Admiral Royal landed units of the Australian 26th Brigade on May 1 against insignificant opposition. By May 8, the Australians controlled the town of Tarakan and its air base. On May 20, the defenders, initially about 3,000 strong, were split and subsequently mopped up.

In the following Borneo operation, the reinforced Australian Division was transported from Morotai to the Brunei Bay area of northern Borneo. Air support was provided by the United States Thirteenth Air Force and the Australian 1st Tactical Air Force. Cruisers and destroyers under Rear Admiral Russell S. Berkey assisted the invasion. Rear Admiral Royal again commanded the attack group. Three separate landings were carried out on June 10, 1945, at Labuan Island, and on the mainland at Bintang and Cape Polompong. There was little resistance. The location of the beachheads, 700 miles from Indo-China and 800 from Singapore, constituted another bombing threat to these precarious Japanese conquests.

On June 16, the Australians had progressed four miles toward Brunei. Their drive had no objective beyond the nearby oil fields. The size and topography of Borneo gave Japanese diehards an opportunity to hold out indefinitely in the wilderness. There was no point in carrying the pursuit into such areas.

Further operations aimed at Balikpapan were set for July 1, 1945. The attack force consisted of the largest number of ships used in the Southwest Pacific area since the Lingayen landings in the Philippines. In the cover and carrier groups were six United States, two Australian, and one Dutch cruisers, three United States escort carriers, and destroyer escorts. In preparation for the attack, United States Army and Navy and Australian air forces struck at Balikpapan with 100 sorties a day. Sixteen days before the landings, minesweeping and underwater demolitions began under cover of naval artillery. On June 24, United States destroyers succeeded in smothering the Japanese coastal guns. Exactly on schedule, 17 assault waves hit the beaches without casualties. The Australians bore the brunt of the fight which stiffened as the attackers moved inland. An escort carrier group under Rear Admiral William D. Sample provided day and night air cover. Another landing was made unopposed at Cape Penajam on July 5. Balikpapan harbor was captured on July 8. One week later it was open to Allied shipping, and a 14-mile advance secured a valuable seaplane base. The defenders were driven into the wilderness.

Finale in the Philippines.—American victories in the battles for Leyte and Luzon broke the Japanese domination of the Philippines but did not completely liberate the archipelago. The Philippine campaign thereafter was resolved into a large number of isolated actions.

After the capture of Palawan provided an effective barrier on the west and gave United States forces a base for naval and air operations which controlled the Balabac Strait entrance from the South China Sea to the Sulu Sea, an amphibious assault on Lubang Island secured the most direct sea lane to Manila. The islands of Burias and Ticao were seized on March 4, 1945; Romblon and Simara, on March 12. Campaigns for the capture of coastal cities and other strongly held Japanese positions led to a number of landings in March 1945 by the forces of the United States Seventh Fleet.

On March 18, troops of the 40th Division from Lingayen Gulf landed at Iloilo, on the island of Panay, to establish radar and air facilities and PT boat bases. The assault group, under the command of Rear Admiral Arthur D. Struble, secured Iloilo City on March 20 and virtually completed the occupation of Panay and smaller neighboring islands by the end of the month. A successful landing on Cebu was effected on March 26. The attack group was supported by cruisers and destroyers under the command of Rear Admiral Berkey. The city of Cebu fell the next day, but extensive ground operations were required to clear the interior of the island.

On April 17, the United States 10th Corps landed at Malabang on Mindanao and moved across land toward Davao Gulf with little opposition. Rear Admiral Albert G. Noble commanded the participating naval task group; Rear Admiral R. S. Riggs, the covering cruiser force. For the first time there was a successful use of light landing craft on the rivers leading inland. The invading forces captured the city of Davao on May 4. Five days later a United States regimental combat team landed at Macajalar on the island's north coast. A junction of the two forces was established on May 23, and the Japanese garrison was sealed in the interior. Minor landings were effected on northern Negros Island on March 29, at Masbate on April 3, on Busuanga on April 9, and on Bohol Island on April 11.

General Krueger opened the final operations on Luzon in June 1945, the United States 37th Division driving northward from Balete Pass into Cagayan Valley. Japanese troops offered stiff resistance north of Baguio. Filipino guerrillas, assisted by rangers of the United States Sixth Army, cleared areas of northwest Luzon and captured Aparri on June 21. By June 23, a paratroop force of the 11th Airborne Division dropped just south of Aparri and drove 25 miles southward during the next three days to establish contact with the 37th Division.

After the seizure of Cagayan Valley, only pockets of desperate Japanese remained. In the Philippine campaign, the Pacific armies had killed 317,000 Japanese and captured 7,236. American casualties amounted to 60,628 killed, wounded, and missing. Large movements of men and supplies poured into the Philippines, and extensive redeployments were carried out in that area in preparation for projected landings on the Japanese home islands.

Japan Besieged by Sea and Air.—Ever since the establishment of air bases in the Marianas, the Japanese home islands had come within B-29 range. The hammering of Japanese cities from the air was intensified. The degree of destruction achieved in Japan by air bombardment was higher than in the most devastated cities of Germany.

Airfields in the Marianas were built up to accommodate greater numbers of B-29's. After Iwo Jima became available for emergency landings, greater bomb loads were carried, and constant fighter support was provided. Strategic bombing of vital Japanese industries and cities by army planes was coordinated with the activities of naval planes. Many thousands of mines were dropped in Japan's harbors and sea lanes.

KOMANDORSKIE
ISLANDS
KAMCHATKA
PETROPAVLOVSK
OKHOTSK
Aldan
UNION OF
SOVIET
SOCIALIST REPUBLICS
River
SEA OF OKHOTSK
PARAMOSHIRI
KURIL ISLANDS
SAKHALIN ISLAND
Amur River
HOKKAIDO
MANCHURIA
HARBIN
VLADIVOSTOK
KIRIN
HSINKING
SEA
OF
JAPAN
HONSHU
MUKDEN
TOKYO
YOKOHAMA
KOREA
KYONGSONG
DAIREN
PEIPING
TIENTSIN
HIROSHIMA
KYUSHU
PACIFIC
OCEAN
YELLOW
SEA
KOREA STRAIT
NAGASAKI

Among the most spectacular air raids on Japan was a blow by 200 Superfortresses against Tokyo in February 1945, when 650 acres of the city were engulfed in flames. The first, 1,000-ton raid by 300 B-29's was on March 9, when the use of incendiaries on an unprecedented scale laid waste 15 square miles of the capital and made 1,000,000 people homeless. Other devastating B-29 raids hit Nagoya (March 12), Osaka (March 14), and Kobe (March 17). After the capture of Okinawa, bases were built for Superfortresses on that island. The Eighth Air Force, operating from Okinawa, flew its first and only B-29 offensive mission (the target was Kumagaya on northern Honshu) during the last night of the war. Earlier missions by lighter aircraft hit Japanese positions on the Asiatic mainland and the remnants of shipping in coastal waters.

On July 10, the Joint Chiefs of Staff ordered a revision of the Pacific command. The formerly China-based 20th and 21st Bomber Commands were deactivated. The 21st became the Twentieth Air Force, and the personnel of the 20th Bomber Command was transferred to the Eighth Air Force which had been redeployed from Europe. Lt. Gen. Nathan F. Twining assumed command of the Twentieth Air Force. The Eighth and Twentieth Air Forces, containing the mightiest fleet of Superfortresses ever assembled, were combined into the United States Strategic Air Force. General Spaatz retained command of the strategic air forces in the Pacific. Lt. Gen. Barney M. Giles became his deputy and Maj. Gen. Curtis E. LeMay, his chief of staff. Strategic control of the Superfortress fleet remained with the Joint Chiefs of Staff, with General Arnold as their agent. During July 1945 the Mariana-based B-29's averaged 1,200 sorties a week.

After taking on supplies in Leyte Gulf, the fast carrier forces of Admiral Halsey's Third Fleet, comprising the greatest concentration of sea power ever assembled, started toward Japan on July 1 to complete the destruction of the Japanese Fleet, to conduct a pre-invasion campaign against Japanese war industries, and to keep maximum pressure on the Japanese to lower their morale. On July 10, the force launched planes 170 miles southeast of Tokyo, hitting the capital area. Moving north, it attacked northern Honshu and southern Hokkaido on July 14 and 15. On July 17, Halsey's ships were joined by units of the British Pacific Fleet (Vice Admiral Rawlings), and the first combined British-American bombardment hit the Japanese home islands. Some Japanese fleet units were concealed at Yokosuka naval base in Tokyo Bay. British and American carrier-based planes attacked the enemy vessels on July 18, badly damaging the *Nagato,* one of the two remaining Japanese battleships, and scoring numerous hits on shore installations and transport facilities.

On July 24 and 25, the combined fleets, steaming through Japanese home waters at will, launched extensive air attacks against targets in the Inland Sea area, sinking or putting out of action 22 Japanese naval units totaling 258,000 tons. The Japanese fought back as best they could, losing 113 planes compared with 12 British and American. Another carrier-based plane attack on July 28 added to the destruction and accounted for a score of 144 Japanese against 36 Allied planes. Aircraft from fast carriers, hitting the Tokyo area on July 30, destroyed 121 Japanese planes and caused severe damage on lighter Japanese fleet units. At the same time, the fast battleships spread havoc in the area of Hamamatsu, on the east coast of central Honshu. During the first week of August, Admiral Halsey's fleet was stalled by a heavy typhoon. On August 9, the offensive was resumed. In two days 397 Japanese planes were destroyed and another 320 damaged. The Allies lost 34 planes. At the same time as the air raids, battleships from the Third Fleet bombarded steel mills and other installations at Kamaishi. Admiral Halsey's last blow against Tokyo was on August 13. The next action, scheduled for August 15, was called off when Admiral Nimitz' "cease fire" order was received.

Since July 10, the naval forces of Admiral Halsey had destroyed or damaged 2,804 planes, sunk or damaged 148 warships, sunk or damaged 1,598 merchant ships, destroyed 195 locomotives and damaged 109 more. Powerful blows had been struck at industrial targets, and Japanese sea traffic was virtually wiped out. Land communications in the home islands were hit to an extent which seriously hampered the movement of vital supplies. An army defending the islands against the Allied invasion would have been unable to carry out operations which required even a moderate volume of transportation. Civilian mass starvation seemed inevitable, as even the fishing fleet upon which the Japanese largely depend could not function.

After the loss of Okinawa, the Japanese concentrated most of their remaining submarines for anti-invasion action. A number of German U-boats, not heeding the Wehrmacht's surrender order, operated in Far Eastern waters out of Penang. "Human torpedoes" joined the Japanese submarine effort, which was rapidly descending to the suicide level. Antisubmarine measures were carried out by Allied screening vessels, land- and carrier-based planes, and "hunter-killer" groups. The only important Allied loss due to Japanese submarines in this phase of the war was the sinking of the United States heavy cruiser *Indianapolis* on July 30, 1945.

Tide Turns in China.—Late in 1944, there was a possibility that China might not be able to continue fighting. According to the *History of World War II,* by Francis Trevelyan Miller (The John C. Winston Company, Philadelphia, 1945), the Chungking government asked for Allied landings on the China coast to loosen the Japanese grip on the war-torn country. Admiral Nimitz replied to the effect that the China coast was his objective. This objective, however, was uncomfortably remote before the firm establishment of United States control of the Philippines and before the Volcano and Ryukyu campaigns. Strategic bombing of the coastal area by long-range planes could not compensate for the handicap imposed upon the operations of the Fourteenth Air Force by the loss of seven of its major bases and a large number of its minor bases.

The Fourteenth Air Force and the "Chinese-American Composite Wing" improvised operations as a self-contained task force. General Chennault was able to report that, during December 1944, its planes destroyed 241 Japanese aircraft and sank 73,950 tons of shipping with practically no loss to themselves. The critical situation was slightly improved after a Chinese counterattack, under the command of General

Chen Cheng, drove the invaders back 65 miles in Kweichow Province in December 1944.

In January 1945, the Japanese resumed an offensive in China against American airbases, railroads, and remaining coastal areas not under their control. Suichwan airbase was lost on January 22 and Kukong on the Canton-Hankow railroad on January 28; also, the Chinese positions on the coast west of Hong Kong were pierced. In January, the Allies succeeded in flying 46,000 tons of goods over the hump into China, and the Stilwell (Ledo-Burma) Road was opened to traffic. The building of that road was termed a Herculean job by General Marshall, and its completion was effected under actual battle conditions. While General Stilwell's forces and British and Indian troops drove back the Japanese 15th, 31st, and 33d Divisions, United States engineers, commanded by Brig. Gen. Lewis A. Pick, built the road behind them, frequently operating their bulldozers under fire. On Jan. 28, 1945, a convoy of American trucks and matériel from India crossed the Burma-China frontier, and supplies reached China by land for the first time in almost three years. Increased supplies permitted progress in the reorganization of the Chinese forces. General Stilwell had been able to provide rough training and basic equipment for 35 Chinese divisions in his training centers in Yunnan Province. Maj. Gen. Albert C. Wedemeyer, in accord with Generalissimo Chiang Kai-shek, carried on his mission vigorously. More plentiful supplies also assisted the operations of the Fourteenth Air Force and made it possible to continue sorties by Superfortresses based in China.

A Chinese drive directed by Gen. Ho Ying Chin, newly appointed commander in chief of all Chinese ground forces, attempted to regain control of the Canton-Hankow railway but was repulsed by mid-February 1945. Another offensive, however, gave control of Suichwan to the Chinese on March 11.

Reduction of Japanese shipping by Allied sea and air attack and the extension of Allied control into Chinese coastal and Japanese home waters increasingly isolated Japanese invasion armies from their homeland. Had it not been for war industries in Manchuria and conquered parts of China, the Japanese supply situation might have been hopeless by the early spring of 1945. Communications between Manchuria and the combat area were under Allied air attack. The output of the Japanese war plants on the Asiatic mainland could retard but not prevent the breakdown of the Japanese supply system. A Soviet declaration that the Russo-Japanese Neutrality Pact of 1941 would not be renewed almost amounted to a declaration of war.

The Japanese made another effort to inflict defeat upon the Chinese. On March 22, they struck at southern Honan Province from bases at Yencheng, Chumatien, Kwangshui, and Loyang. Another Fourteenth Air Force base was lost, but the drive achieved no important tactical victories. Japanese offensives subsequently centered on western Hunan Province to eliminate more United States airbases and Chinese training centers.

By the spring of 1945, the impact of the smashing Allied attack across the Pacific islands had made itself felt in Asia. American officers were helping to speed the retraining and reequipping of Chinese soldiers. Brig. Gen. Lucian K. Truscott, Jr. and Lt. Gen. William H. Simpson, released from duty in Europe, were assisting Major General Wedemeyer, and the air forces in China were increased and reorganized. Maj. Gen. Claire L. Chennault was relieved of the command of the Fourteenth Air Force, at his own request, and was replaced by Maj. Gen. Charles B. Stone. Chiefly by the United States Air Transport Command, the American trained and equipped Chinese Sixth Army was moved into the area under Japanese attack. On May 1, its intervention halted the Japanese, and the attackers fell back ten days later.

The idea of continuing an isolated war in China became unpopular among the members of the Imperial General Staff. Japanese forces withdrew from south and central China. Behind them, Chinese troops were applying every possible pressure.

In southern Kwangsi, Nanning was recaptured on May 27, 1945. Japanese communications between Indo-China and central China were threatened. On May 10, the Chinese began operations to recover the city of Foochow which was considered a potential disembarkation port for Allied seaborne forces. Foochow was captured on May 19. Wenchow, another port city farther north, fell to the Chinese on June 18. The former United States airbase of Liuchow was regained on June 14, and another base, Kanhsien, was reoccupied on July 15. From Kanhsien, United States air forces raided coastal installations held by the Japanese.

During July, Chinese forces moved to the borders of Thailand and Indo-China. No large-scale advance into these territories followed. As the war drew to its close, the Chinese were pushing toward Canton. An Allied amphibious attack on the Asiatic mainland was scheduled for August 18, 1945. The target was Hong Kong, but the Japanese surrender cancelled the operation.

Reconquest of Burma.—The Southeast Asia Command under Admiral Lord Louis Mountbatten had approximately 575,000 ground troops at its disposal early in 1945, of which one third were American. Land forces under the command of Lt. Gen. Sir Oliver W. H. Leese were divided into three sections: (1) the Northern Combat Area, under Lt. Gen. Daniel I. Sultan, composed of a United States army including two to four American-trained Chinese divisions, the British 36th Division, and the American Mars Force (a brigade of two regiments); (2) the Fourteenth British Imperial Army (4th and 33d Corps) under Gen. Sir William J. Slim; and (3) the 15th Corps, under Lt. Gen. Sir Philip Christison. The Allied air commander in chief was Air Marshal Sir Keith R. Park, who had 47 American and British squadrons at his disposal. The East Indies Fleet, composed of British units, was assigned to the Southeast Asia Command under the command of Admiral Sir Arthur J. Power. It included four large aircraft carriers, among them the *Indefatigable,* biggest and most modern vessel of that type in the British Navy, the battleship *King George V,* a number of fast cruisers, and many lesser vessels.

The Burma campaign continued with intensity even during the monsoon season of 1944. Air supply played a very important role. British and American carrier squadrons, commanded by Brig. Gen. William D. Old under the direction of Major General Stratemeyer's Eastern Air Command, flew C-46's and C-47's night and day. They

shuttled from numerous bases and air strips in the Brahmaputra Valley in India to points of rendezvous with Allied ground columns in the Burma jungle. Each trip had to be flown over one or more of the steep spines of the Himalayas along the India-Burma border. The troop carrier squadrons averaged monthly 230 hours of flying time for each serviceable plane (normal flying time was 120 hours).

The drive against the most advanced Japanese air and naval base of Akyab came to a successful conclusion on Jan. 4, 1945, when seaborne British and Indian troops drove the defenders from the city and its installations. The Japanese retreat from Akyab was hampered by British and Indian landings on Myebon Peninsula. The next amphibious operation seized Ram Ree Island, 50 miles south of Akyab, on January 25. On January 26, seaborne troops established themselves on the mainland near Kangaw (35 miles from Akyab). Two weeks later, the 23d Indian Division landed at Ru Ywa, and, on March 13, the 26th Indian Division went ashore at Detpan. The East Indies Fleet, after covering amphibious operations, raided Japanese-occupied Sumatra, including the oilwells and refineries of Palembang.

The Fourteenth Army, the strongest Allied force engaged in the Burma operation, assisted by Lieutenant General Sultan's group, drove to recover Mandalay. At the close of the monsoon season, Sultan advanced southward astride the Irrawaddy and by December 1944 had cleared the projected route of the supply road to Bhamo. Meanwhile, the Fourteenth, in western Burma, broke south through Tiddim across the Chindwin River. Japanese rearguards sacrificed themselves to enable the bulk of their forces to rally for the defense of Mandalay. British and Indian troops, smashing the rearguards and overcoming major transportation troubles, moved toward the lower course of the Irrawaddy River and crossed it after capturing Pagan. By mid-February 1945, three bridgeheads were established, the largest of which was in the Singu area. In northeast Burma, Chinese troops advanced toward Lashio. On their right, other forces of Lieutenant General Sultan's group were south of the Shewhi River. The Japanese command considered communications south of Mandalay to be safe, but the troops of the 4th Corps of the Fourteenth Army staged a masterful lightning stroke against these communications.

The 225th Tank Brigade and the 17th Infantry Division, covering 85 miles in 11 days through very difficult terrain, on March 3 reached Meiktila where the command of the Japanese Fifteenth Army, holding Mandalay, had its headquarters. Mandalay was isolated by this maneuver. An attempt by 30,000 Japanese to break the trap failed. Punjabi troops of the 19th Indian Division under Maj. Gen. Wynford Rees entered Mandalay from the northwest on March 8, 1945. The garrison made a 12-day last stand inside old Fort Dufferin. Also on March 8, Chinese troops under Lieutenant General Sultan captured Lashio.

A special communiqué issued by the Southeast Asia Command on April 7 reported that the Japanese Fifteenth Army, pocketed between Mandalay and Meiktila, had been decisively defeated and was no longer an effective force.

Another operation was the recapture of Rangoon. The Fourteenth Army raced on toward Pegu north of Rangoon. Railroads had been captured, but no engines were available, so that transport planes carried small locomotives to the advancing army. The Japanese fled in disorder. On May 1, British paratroopers dropped on both sides of the mouth of the Rangoon River, 20 miles south of the city. Amphibious landings followed. Rangoon was occupied by the British on May 3 with its port still in good condition. Two days later, Admiral Mountbatten announced that between Feb. 1, 1944 and April 30, 1945, the Japanese Fifteenth, Twenty-eighth, and Thirty-third armies had been annihilated and that Japanese losses amounted to 347,000, of whom 97,000 were dead.

The number of Allied troops killed during that period was a little more than 10 per cent of the Japanese death figure, but 250,000 American, British, and Chinese soldiers were temporarily stricken with illnesses. The remnants of the Japanese forces in Burma started on a long and tortuous flight toward Siam. The Battle of Burma was officially declared at an end on July 28, 1945, with the Japanese Twenty-first Army added to the list of major Japanese fighting forces wiped out in the campaign. The way to Siam and Malaya was open.

THE END OF WORLD WAR II

By order of the Joint Chiefs of Staff, Gen. Douglas MacArthur assumed command of all United States Army forces in the Pacific on April 6, 1945. MacArthur and Admiral Nimitz, commander of the naval forces in the Pacific, were directed to prepare for the final operations against Japan. General MacArthur created a new command under Lt. Gen. Wilhelm D. Styer, known as the United States Army Forces in the Western Pacific, to replace the old Southwest Pacific Area. Lt. Gen. Robert C. Richardson, Jr. was appointed commander of the United States Army Forces of the Middle Pacific.

Grand Strategy for the Invasion of Japan. The Japanese had massed an army of 2,000,000 for the defense of the homeland, and the country was honeycombed with pillboxes. After learning from experience that Allied air and naval power made it futile to attempt to crush an invasion on the beaches, the Japanese planned an inland defense utilizing every natural barrier and built-up area to check the Allied forces and inflict disastrous casualties upon them.

General MacArthur and Admiral Nimitz agreed to launch two seaborne operations: the first, known as "Operation Olympic," provided for a three-pronged assault on southern Kyushu in the fall of 1945 by the United States Sixth Army (1st and 11th Army corps and 5th Marine Amphibious Corps). These groups were to land in the order named at Miyazaki, at Ariaka Wan, and on the beaches west of Kagoshima, in order to isolate the southernmost Japanese island and destroy the defending forces there. Preliminary operations in Koshiki Retto and a diversionary feint off Shikoku by the 9th Corps were to precede the main assault.

The second phase of the Japanese invasion, code-named Coronet, was to be carried out in the early spring of 1946. The Eighth and Tenth Armies—9 infantry divisions, 2 armored divisions, and 3 marine divisions—were to assault the Kanto or Toyko plain of eastern Honshu. These two veteran Pacific armies were to be followed ashore by the First Army (10 infantry divisions), redeployed from Europe. The three armies were to destroy the Japanese Army on the main home-island and to occupy the Tokyo-Yokohama area.

The Atomic Bomb.—Many improvements in existing weapons were made by all the major nations participating in the war. The United States, Great Britain, and Canada, however, were the only belligerents to develop an entirely new and revolutionary weapon: the atomic bomb.

Experiments in the use of atomic power were carried out in the United States, the British Commonwealth, Germany, Russia, and—crudely and on a small scale—in Japan. The wealthiest countries, with the best-trained scientists, won the race to use atomic energy for the construction of the most destructive weapon yet known. In December 1941, the United States Office of Scientific Research and Development was created to work on the atomic project. American, British, and Canadian scientists worked in three great plants on United States territory. The development of the bomb required four years and cost approximately $2,000,000,000.

On July 16, 1945, while President Harry Truman, Prime Minister Churchill, and Marshal Stalin were meeting in Potsdam, Germany, a test bomb was detonated in the New Mexico desert. The experiment was shrouded in extreme secrecy, but President Truman was informed of the results. General Spaatz received orders from Potsdam to drop the atomic bomb on one of four selected Japanese cities—to be chosen according to weather conditions—any time after Aug. 3, 1945.

On August 6, at 10:20 A.M. President Truman announced that an American B-29 had dropped one atomic bomb on the Japanese city of Hiroshima 16 hours before. According to the presidential statement, the bomb was equal in explosive force to 20,000 tons of TNT. On August 9, a second atomic bomb was dropped on Nagasaki; smoke rose 50,000 feet into the air and was visible for more than 175 miles.

The number of victims killed by the blast and its after effects was greater in Hiroshima. A report from the Supreme Allied Headquarters in Tokyo announced in February 1946 that casualties from the Hiroshima bomb totalled 306,545. This included 78,150 dead; 13,983 missing; 9,428 with serious injuries; 27,997 with minor injuries; and 176,987 sufferers because of sickness or lack of homes, food, and clothing.

Russian Intervention in the Far East. The USSR, as agreed at Yalta, joined the war against Japan within three months after the German surrender. The Japanese fully realized the strength of Russian forces between Irkutsk and Vladivostok. Two border incidents which amounted to major battles—near Changkufeng in 1938, and near Nomahan (Bar Nor) in 1939—ended in defeats for the forces of the Japanese Kwantung armies. Only limited reinforcements were subsequently drawn from the Kwantung armies to participate in the Chinese campaign. Large-scale deployment of the Kwantung armies in China might have forced the collapse of Chi-

nese resistance before British and American forces could help China materially.

After the conclusion of the Russo-Japanese pact of 1941, mutual watchfulness in the Far East continued. A great Japanese army, bolstered by all the forces the Manchurian puppet government could muster, remained in Manchuria. For their part, the Russians, even during the most critical stages of the war in Europe, did not transfer any substantial portion of their Independent Red Banner armies—as the Far Eastern forces were called—to Europe.

After the expiration of the Russo-Japanese Neutrality Pact on April 25, 1945, the Japanese made several futile attempts to negotiate with the USSR and to obtain Russian mediation for peace with the western Allies. Failure to achieve an understanding with Russia darkened the prospects for Japan. Russia's entry into the war unquestionably helped to influence the Japanese decision to surrender.

The fighting contribution of the Russians to Japan's collapse was not very great. Few if any Japanese accounts are available on events in Manchuria and Korea after the Soviet declaration of war on Aug. 8, 1945, and no neutral or allied observers were given an adequate opportunity to watch the campaign. Three Independent Red Banner armies under Marshal Alexander M. Vassilevski swept across the Manchurian, Korean, and Sakhalin borders. Japanese forces had neither the will nor the strength to offer determined opposition. The Russians advanced as much as 65 miles a day. The mechanized Soviet forces used wood gas combustion engines, as liquid fuel was scarce, and means of transporting it, even scarcer. Wood gas was inferior to gasoline, but it kept tanks and trucks moving.

The First Independent Red Banner Army, under Marshal Kyril A. Meretskov, advanced from the region west of Vladivostok in a twin drive to the Manchurian communications center of Harbin and toward Najin (Rashin) and Chongjin (Seishin) in Korea. A separate group of Meretskov's forces, including Russian marines, invaded the southern part of Sakhalin, near Karafuto, while army forces crossed the border in the center of the island. The Second Independent Red Banner Army under Gen. M. A. Purkayev, starting from Khabarovsk, pushed toward Harbin through the Sungari River valley, and continued to Mukden Port Arthur, and Dairen. The Third (Transbaikal) Army under Marshal Rodion J. Malinovski drove south and west from Russian-controlled Outer Mongolia, completing the occupation of Manchuria and cutting off the northern divisions of the Kwantung Army and its Manchurian auxiliaries.

Japan's surrender did not stop the Russian advance or the capture of Japanese force On September 10, a Soviet communiqué summed up the campaign by stating that 80,000 Japanese had been killed and 594,000 captured. Japanese naval losses were reported as 2 destroyers, 28 transports, 3 tankers, 5 motor launches, and 12 barges and schooners sunk. Russian casualties were claimed to be 8,219 killed and 22,264 wounded.

Japan's Surrender.—The Potsdam Conference issued another stern warning to the Japanese to surrender unconditionally. This was in part a reply to Japan's desperate attempt to avoid such surrender. Naotake Sato, Japanese ambassador to Moscow, met with Soviet Foreign Minister Vyacheslav M. Molotov before the latter's departure for Potsdam. The Japanese ambassador again suggested that Russia should mediate to bring an end to the war. On Aug. 9, 1945, at 3:00 A.M., the first word of the Russian declaration of war was picked up by Japanese monitors. A few minutes later the Kwantung Army reported that Soviet forces were on the move.

At sunrise on August 9, Foreign Minister Shigenori Togo, according to Ralph Chapman's dispatches to the New York *Herald Tribune,* reported the latest events to Emperor Hirohito. At 10 A.M., the Japanese Supreme War Council met for a gloomy three-hour session, in which Prime Minister Kantaro Suzuki expressed the opinion that there was no alternative to acceptance of the Potsdam declaration. War Minister Korechik Anami, abandoning an army plan for the mobilization of the entire Japanese people as a nation of suicide fighters, did not disagree but urged insistence upon four conditions: (1) Hirohito to be maintained as emperor; (2) the Allies would not occupy the Japanese home islands; (3) punishment of war criminals would be left to the Japanese; and (4) withdrawal and disarming of Japanese troops would be carried out according to Japanese plans. The foreign minister contended that such conditions would be tantamount to rejection of the Potsdam declaration. No agreement was reached at the time.

News arrived of the dropping of the second atomic bomb. The emperor summoned the War Council to meet again. More officials were inclined to accept the views of the foreign minister, but Anami remained adamant. The minister of war considered a possible coup d'état by the army but abandoned the idea for fear of going down in history as a disloyal subject of the emperor. The emperor ruled in favor of a suggestion by the foreign minister that the Potsdam declaration should be accepted with the interpretation that it permitted the emperor to retain his prerogatives.

Messages were drafted to Seimasa Okamoto, Japanese minister at Stockholm, Sweden, and Shunichi Kasei, minister at Bern, Switzerland, at 10 A.M., August 10, asking for the mediation of the governments to which they were accredited to transfer the Japanese peace plea to the Allied governments. *Domei,* the official Japanese news agency, broadcast their text for foreign consumption, in order that the Allied governments might learn of the plea without delay and no more atomic bombs would be dropped.

On August 11, it was learned unofficially that the Allies, including the Soviet Union, would not object to the emperor's retention of the throne provided he took orders from the Supreme Allied Command. This did not mean that the Allies guaranteed the emperor's future status.

The official text of the Allied reply reached Tokyo at 8 A.M. on Aug. 13, 1945. Anami demanded that a further inquiry be sent to the Allies regarding the status of the emperor with reference to the Allied supreme commander. Foreign Minister Togo replied that such an inquiry would accomplish nothing and that the Allied reply was the last word. A cabinet meeting came to the conclusion that there were three possible alternatives: acceptance of the Allied terms, resignation of the Suzuki Cabinet, or dispatch of a further note to the Allies to ask them to clarify ambiguities. In the meantime, *Domei* monitors reported indications of Allied impatience.

At 7 P.M., Premier Suzuki suggested to the emperor that the Supreme War Council should convene and reach a final decision before more atomic bombs were dropped. The meeting began a few hours later in the air raid shelter under the palace. The minister of war and the chief of the Navy General Staff, Admiral Soemu Toyoda, expressed fears that restrictions placed upon the emperor by Allied conditions would cause widespread confusion throughout the nation.

The emperor informed the council that he considered the Allied reply satisfactory, although he fully understood the awkward position of the high command since the word "surrender" was "unknown" to the fighting forces. This meant acceptance of Allied terms. An imperial rescript was drafted by Chief Cabinet Secretary Hisatsune Sekomizu, and was signed at 11 P.M. on August 14. Cables of acceptance of Allied terms were transmitted through the Swiss and Swedish governments. At midnight, the emperor made a recording of the rescript. A group of irresponsible younger officers plotted a coup d'état, but it did not take place, and the leaders committed suicide. War Minister Anami also killed himself.

The Japanese people, still not informed about the true situation, learned that the emperor would be heard over the radio on August 15 for the first time in history. Many believed that Hirohito would command them to battle to the last man. Such a command would have been accepted as a divine ordinance. Listeners were stunned when the recording of the imperial rescript ordered the immediate cessation of hostilities. The next reaction was weeping on a national scale and mass hara-kiri (suicide) before the palace.

The Potsdam proclamation called for the complete disarmament and surrender of all Japanese military forces and equipment. Japanese representatives, summoned to present themselves at Manila, received the instrument of surrender from General MacArthur on Aug. 19, 1945. It was provided that the commander in chief of the army forces, Pacific area, should receive the surrender of the Imperial General Headquarters, its senior commanders, and all ground, sea, air, and auxiliary forces in the main islands of Japan, minor islands adjacent thereto, Korea south of 38° north latitude, and the Philippines, whereas the commander in chief of the United States Pacific Fleet was designated to receive the surrender of the senior Japanese commanders of all ground, sea, air, and auxiliary forces in the Japanese mandated islands, the Ryukyus, the Bonins, and other Pacific islands.

The United States Eighth Army was assigned to an occupation zone north and east of a line crossing Honshu west of Yokohama and Tokyo. Naval responsibility for that zone was allotted to the Third Fleet. The Sixth Army and the Fifth Fleet shared in the control of the rest of the Japanese home islands. South Korea was assigned to the 14th Corps and the Seventh Fleet. On August 15, orders were issued to cease offensive operations against the Japanese. Apprehension that Japanese hotheads might not comply with imperial orders was not borne out by events. The emperor's prestige proved stronger than militarist resentment.

On August 28, a small force of United States Army Air Forces technicians landed at Atsugi airfield, 14 miles southwest of Tokyo, to prepare for a subsequent large-scale airborne landing and for the landing of marine and navy units at the Yokosuka naval base. The beginning of the occupation was delayed 48 hours by a typhoon, which also postponed the formal signing of the surrender from August 31 to September 2. On August 27, an advanced unit of the Third Fleet, guided by a group of Japanese naval officers, harbor pilots, and interpreters, moved into Sagami Bay, southwest of Tokyo Bay.

Admiral King's *Final Official Report* gives the following description of the Japanese surrender:

> On 29 August, Fleet Admiral Nimitz arrived from Guam to break his flag in the battleship *South Dakota*. Aboard the *Missouri*, Admiral Halsey, Commander Third Fleet, entered Tokyo Bay and anchored off Yokosuka naval base. The following day General of the Army MacArthur arrived at Atsugi Airfield to set up General Headquarters at Yokohama. With him came an aerial armada of troop-carrying planes. At the same time about 10,000 Marines and naval personnel landed and took possession of the Yokosuka base and neighboring fortress islands. . . . The last day of August many American prisoners of war were freed and the area of occupation was expanded; new forces came ashore from transports, some groups reaching the outskirts of Tokyo.
>
> The Japanese naval base of Tateyama, across the bay from Yokosuka, was occupied by Marines on 1 September, as American control spread smoothly and swiftly throughout the whole area south of the capital.
>
> The formal surrender of the Japanese Imperial Government, the Japanese Imperial General Headquarters, and all Japanese and Japanese-controlled armed forces wherever located, was signed on board the battleship *Missouri* in Tokyo Bay at 0908 [9:08 A.M.] on 2 September 1945. General of the Army MacArthur signed as Supreme Commander for the Allied Powers, and Fleet Admiral Nimitz signed as representative for the United States. . . .

The surrender of Japanese forces widely scattered in bypassed and still not attacked areas was swiftly completed. It included substantial troops, such as 105,000 men in the Ryukyus and 49,000 men on Truk.

> Five days after the formal Japanese surrender, General of the Army MacArthur entered Tokyo, and his troops raised the United States flag over the American Embassy. It was the same flag which had flown over Washington, D. C., on 7 December 1941; which had been hoisted over Rome and Berlin; and which had been flown on the battleship *Missouri* while the Japanese signed the surrender there.

Thus ended the military phase of the most stupendous and the most destructive war the world has known thus far, 3 years, 8 months, and 26 days after the Japanese attacked the United States at Pearl Harbor.

A SUMMING UP

Statistics which have grown out of the war provide some startling information. While mere figures do not tell a complete story and are continually being revised, many mobilization and casualty estimates are available.

World Mobilization.—Peak mobilization in the United States was 14,000,000. The British Empire mobilized 12,000,000, and China, 6,000,000. Figures from the USSR run as high as 22,000,000, including militarized workers of both sexes. Counting Allied nations knocked out of the war and those whose territory was completely occupied by the enemy, total Allied mobilization amounted to more than 62 000,000.

The Germans mobilized 17,000,000 (13 000,000 before September 1944). Total mobilization of Axis and associated powers reached a peak of slightly more than 30,000,000.

The ratio of opposing land forces was not as favorable to the Allies as these figures indicate. In the decisive phases of the war, neither France

nor the smaller Allied nations had a large proportion of this mobilized strength in battle.

The United States, waging war 3,000 to 9,000 miles from its shores, needed very large forces to operate and safeguard communication lines. Great Britain was forced to keep strong garrisons in distant regions of her empire. Chinese official mobilization figures give an exaggerated picture of China's fighting strength. Both the United States and Britain diverted a large part of their manpower to their navies, while the German Navy was relatively small, and the minor Axis satellites had practically no naval forces. On the Axis side, only Japan and Italy had substantial navies. The western Allies also successfully diverted larger percentages of manpower to their air forces than did their opponents.

The following was the estimated number of divisions:

USSR	550	Great Britain (including Dominions)	50
Germany	313	Hungary	23
Japan	120	Bulgaria	18
United States	89	Rumania	17
Italy	70	Finland	13

The figure for China is given at 300 divisions, but the strength of a Chinese division did not exceed that of one United States infantry regiment.

As divisional strength differed widely among countries and as most divisions were frequently reorganized, these figures are not a final clue to the ratio of opposing forces.

Germany had a clear numerical advantage early in the war, diminishing during the winter of 1939–1940 but rising during the period between the collapse of France and the attack on Russia. The odds later turned against the Wehrmacht, which was outnumbered at the time of its defeat.

Japan began the war with superior numbers but was outnumbered during the Allied Pacific Island invasion.

Strength of United States Forces.—On Jan. 8, 1946, President Truman made a statement that the United States Army on V-E Day had its peak strength of 8,300,000. At maximum strength, the United States Navy had 3,500,000; the Marine Corps, 486,000; and the Coast Guard, 180,000.

This made a total maximum strength of 12,466,000 for all United States forces. (General Marshall stated that peak mobilization was 14,000,000.)

On Feb. 13, 1946, the War Department announced that 10,033,640 men and women entered the United States Army between Nov. 1, 1940 and June 30, 1945.

Casualties of United States Forces.—The United States Army and Navy suffered more than 1,000,000 casualties in World War II, including a death and missing toll of 396,637 (as of June 1946).

In June 1946, the War Department published the first complete list of the army dead and missing for World War II. The report provided the following figures:

Killed in action	176,432
Died of wounds	25,493
Died of injuries	929
Died non-battle causes	85,219
Deaths found under Public Law 490, 77th Congress	19,481
Missing	1,424
Total Army dead and missing	308,978
Total Navy, Marine, and Coast Guard dead and missing (as of June 1, 1946)	87,659
Death total for United States Armed Forces	396,637

Infantry Losses for United States.—During World War II, the United States Ground Forces had a total of 4,194,000 enlisted men and 230,000 officers on 10 major battlefronts.

In April 1946, the commanding general of the army ground forces announced that the infantry, which comprised only 20.5 per cent of the total United States overseas strength, took 70 per cent of the casualties.

Total casualties for all branches of the army amounted to 945,904 men; of these, 731,814 were from the ground forces.

The United States had 89 trained divisions: 5 airborne, 16 armored, 1 cavalry, 1 mountain, and 66 infantry. All of them went overseas, and all but one infantry division saw battle action.

The three divisions which suffered the most casualties were the 3d, 45th, and 36th Divisions. All of them fought in North Africa, Italy, France, and Germany, spearheading the invasion of southern France.

The 3d Division, a Regular Army unit, had 33,547 casualties, including 6,571 killed. The 45th Division, a National Guard unit, suffered 27,207 casualties, including 4,030 killed. The 36th Division, another National Guard unit, had 26,718 casualties, including 4,265 killed.

Three other divisions with heavy losses were: 29th Division with 4,612 killed; 4th Division, 4,581 killed; and the 9th Division, 4,474 killed.

Air Forces Losses for United States.—General Marshall states in his report (dated Sept. 1, 1945) that at peak strength the United States Army Air Forces had 273 combat air groups. The air forces suffered nearly 120,000 casualties, including 36,698 dead.

United States Losses from War Crimes.—On July 28, 1946, the assistant secretary of war announced that a total of 142,076 United States and Filipino armed forces and civilians had died from enemy war crimes. These deaths were results of murder, cruelty and torture, starvation and neglect, and other assaults and mistreatments. They were not battle casualties. Of these victims, 131,028 were in the Pacific, a ratio of 13 in the Pacific for 1 from all other theaters of war.

United States Loss of Generals.—In September 1946, the War Department announced that 26 United States generals were killed in action, and 85 others became casualties during the war.

Casualties of Great Britain.—On June 6, 1946, Prime Minister Atlee informed Parliament that 357,116 Britons were killed in the war, including 154,079 for the army; 69,606 for the RAF; and 50,758 for the navy. More than 60,000 civilians were killed, including 30,248 of the merchant navy and fishing fleets; 1,206 of the Home Guard; and 624 from the women's auxiliary services.

Casualties for the British Empire, including dead, missing, and wounded, were over 1,200,000. This included casualties for India of 177,315 (23,295 killed); casualties for Australia of 92,211 (21,415 killed); and for Canada of 101,008 (36,018 killed).

Soviet Losses.—The USSR gave no precise account of its casualties. It was estimated that almost 15,000,000 Russians perished, a large part of them civilians, victims of German deportation and persecution.

China's Losses.—Including a period of more than 4 years prior to Dec. 7, 1941, China's losses

were reported by Gen. Ho Ying-chin to total 3,500,000, almost half of whom were killed.

France's Losses.—France lost 1,925,000 men prior to the armistice in 1940, of which 125,000 were killed and 1,500,000 were captured. Casualties suffered in operations in which French forces later participated were reported to number 150,000, one third of them during the period from August 1944 through the end of the war. Most of the rest were recorded during the Tunisian campaign.

On Aug. 27, 1945, French Minister of Justice Pierre Teitgen said that the war cost France 4,897,000,000,000 francs ($97,940,000,000) or 45 per cent of its national wealth. The major part of this amount was collected by the Germans as "occupation costs."

Other Allied Losses.—Greek casualties were reported at 147,600, with 77,600 killed. One Yugoslav account told of 1,810,000 casualties, of which 125,000 were prisoners of war. Belgium reported 80,000 casualties; the Netherlands, 6,344; Norway, 10,000; and Denmark, 7,000. Polish military losses were figured at 1,045,000. Polish sources also revealed that 5,000,000 Polish civilians (including 3,000,000 Jews) were murdered by German occupation forces.

Axis Losses.—Reports of enemy losses are variable. According to records discovered in Berlin official archives after the downfall of the Reich, Germany had lost a total of 3,875,000 men by September 1944 (85,000 by May 31, 1940; 185,000 by May 31, 1941; 800,000 by May 1942; 1,680,000 by May 1943; and 3,285,000 by May 1944) not including wounded returned to service.

On May 18, 1946, the United States Allied Military Government officially disclosed that of 17,000,000 listed in the Wehrmacht, 2,250,000 were killed and 1,500,000 missing. United States troops had captured more than 8,000,000 Germans; the British took 2,663,000 as prisoners; and the French took 35,000.

General Marshall gives the following breakdown of German and Italian losses against American, British, and French forces, after the landings in North Africa:

	Battle dead	*Permanently disabled*	*Captured*	*Total*
Tunisia	19,600	19,000	130,000	168,600
Sicily	5,000	2,000	7,100	14,100
Italy	86,000	15,000	357,089	458,089
Western Front	263,000	49,000	7,614,794[1]	7,926,794
Total	373,600	85,000	8,108,983[1]	8,567,583

[1]Includes 3,404,949 disarmed enemy forces.

Japan's military casualties, exclusive of the Chinese theater of war, were reported by Japanese sources as follows: army, 310,000 killed, 146,000 wounded; navy, 157,365 killed, 1,483 missing. A total of 4,470,000 army men were listed as ill, 40,000 of whom died. Navy personnel dead from illness were reported to total 1,430.

This report was exposed as unreliable by General Marshall. He listed Japanese losses on Eastern battlefronts, including China, since Dec. 7, 1941, as follows:

	Battle dead	*Permanently disabled*	*Captured*	*Total*
Southern Pacific	684,000	69,000	19,806	772,806
Central Pacific	273,000	6,000	17,472	296,472
India-Burma	128,000	38,000	3,097	169,097
China	126,000	126,000	1,059	253,059
Aleutians	8,000	1,000	30	9,030
Total	1,219,000	240,000	41,464	1,500,464

Italy lost 60,000 killed, 200,000 wounded and 500,000 prisoners as Germany's partner, and claimed to have suffered 44,494 casualties (including 17,494 killed) while fighting for the Allies.

Of the Axis satellite nations, Rumania lost 694,000, most of whom were prisoners. Finland, exclusive of the 1939–1940 war against the USSR, lost 52,609. Hungarian casualties were not reliably reported after the war. Bulgarian losses were small.

Civilian Losses from Air Raids.—In July 1946, the Metropolitan Life Insurance Company announced that a survey showed at least 1,200,000 and possibly 1,500,000 civilians were killed in air raids during World War II. Germany suffered heaviest with almost 500,000 deaths, and Japan second with 360,000.

Naval and Shipping Losses.—Results of the U-boat war in the Atlantic as compared to Allied construction are listed in Admiral King's report:

Year	*German Subs. Sunk*	*Allied Shipping Sunk*	*New Construction U.S.*	*British*	*Total*	*Allied Gains or Losses*
	(Number)		*(In thousands of tons)*			
1939 (4 mos.)	9	810	101	231	332	—478
1940	22	4,407	439	780	1,219	—3,188
1941	35	4,398	1,169	815	1,984	—2,414
1942	85	8,245	5,339	1,843	7,182	—1,063
1943	237	3,611	12,384	2,201	14,585	+10,974
1944	241	1,422	11,639	1,710	13,349	+11,927
1945 (4 mos.)	153	458	3,551	283	3,834	+3,376
Totals	782	23,351	34,622	7,863	42,485	+19,134

United States naval losses were as follows: 2 battleships, 5 aircraft carriers, 6 escort carriers, 7 heavy cruisers, 3 light cruisers, 71 destroyers, 11 destroyer escorts, 52 submarines, 3 minelayers, 24 minesweepers, 18 submarine chasers, 12 gunboats, 15 coast guard vessels, 3 seaplane tenders, 69 motor torpedo boats, 40 tank landing ships, 9 medium landing ships, 67 tank landing craft, 22 infantry landing craft, 6 support landing craft, 10 tugs, 6 tankers, 21 troop transports, 36 district patrol craft, 152 miscellaneous district craft, 4 cargo vessels, and 22 miscellaneous auxiliaries.

Combatant ships added to the United States Navy between Dec. 7, 1941, and Oct. 1, 1945, were as follows: 8 battleships, 13 heavy cruisers, 2 large cruisers, 33 light cruisers, 17 aircraft carriers, 1 large aircraft carrier, 9 light aircraft carriers, 110 escort carriers (33 of which were lend-leased), 352 destroyers, 12 mine layers, 498 destroyer escorts (86 of which were leased), 55 high speed transports, 203 submarines, and numerous lesser craft.

British naval losses as of May 31, 1945, were reported as follows: 5 capital ships (battleships and battle-cruisers), 8 aircraft carriers, 26 cruisers, 128 destroyers, 77 submarines, 16 armed merchant cruisers, 41 large escort vessels, 51 minesweepers, 240 trawelers, 48 drifters, 6 minelayers, 10 yachts, 7 gunboats, 3 cutters, 1 monitor, 63 small craft and auxiliary vessels. The British dominions lost 3 cruisers, 10 destroyers, 14 large escorts, 10 minesweepers, 2 trawelers, and 7 miscellaneous small vessels.

Japan, in addition to losing 6,130,000 tons of merchant shipping, suffered the following losses: 11 battleships (only one survived in damaged condition), 15 aircraft carriers (6 left, none in fighting condition), 5 escort aircraft carriers (none left), 16 heavy cruisers (2 left),

both out of action), 20 light cruisers (2 left, one of which was damaged), 2 training cruisers (1 left), and 135 destroyers (39 left).

On Feb. 2, 1946, the United States Navy announced that during the war United States submarines sank 1,944 major Japanese vessels, including 194 warships, killing 276,000 Japanese. The first American submarine victory of World War II was the sinking of the 8,663 ton *Atsutaan Maru* off Hainan Island by the *Sword-fish,* on Dec. 15, 1941. The last official victory was the *Torsky's* sinking of two destroyer-escorts on Aug. 14, 1945.

Japan had 51 submarines at the end of the war. The United States had 240 submarines on V-J Day, having lost 52 in the war. Of these losses, 7 are known to have resulted from operational causes.

A total of 3,505 United States officers and enlisted men were lost in submarine warfare.

Neutral shipping losses (almost exclusively merchant vessels) amounted to 1,420,000 tons, 930,000 of which were sunk by submarine action and 270,000 tons by mines.

Lend-Lease Summary.—The twenty-second report on lend-lease to Congress disclosed that aid to all countries from March 11, 1941 through Dec. 31, 1945, amounted to $49,096,000,000. More than 60 per cent of that sum, $30,753,304,000 went to the British Empire. Russia was second with $11,141,470,000, and France and her possessions were third with $2,377,072,000. China was fourth with $1,335,632,000; Brazil, fifth with $319,494,000. Other American republics received a total of $114,646,000; the Netherlands, $178,064,000; Belgium, $82,884,000; Greece, $76,838,000; Norway, $37,708,000; and all other countries, $100,186,000.

Reverse lend-lease from other countries to the United States amounted to $7,345,747,000 through Sept. 2, 1945. The British Empire supplied $6,306,149,000 of this total.

Cost of World War II.—In December 1945, James H. Brady and the American University estimated that the total cost of World War II was $1,154,000,000,000 and property damage amounting to $230,900,000,000, excluding China. The United States spent $317,600,000,000 for materials; Russia $192,000,000,000; United Kingdom, $120,000,000,000; Germany, $272,900,000,000; Italy, $94,000,000,000; and Japan, $56,000,000,000.

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*WORLD WAR II: NAVAL STRATEGY.

Naval strategy in World War II must be discussed in terms of geography, because it was localized. Until the final stages of the war, contending parties proceeded as though they assumed the classic strategic principle of Admiral Alfred Thayer Mahan (q.v.)—that of obtaining command of the sea and then employing it for any desirable purpose—was inapplicable in any but local terms. At the beginning, British strategy was the same as England always consciously or unconsciously used in a Continental war: to deny the waters of Europe to her enemies and to use the sea as a means of liaison with areas of raw materials and as an avenue for the transmission of land forces to support Continental Allies.

Germany had foreseen that England would attempt this classic application of sea power. There is evidence that German naval commanders designed a struggle for control of the seas on classic lines and were shocked when Adolf Hitler launched the conflict before they were prepared. Actually, the Nazi führer had perceived the futility of the struggle that his admirals proposed, involving naval building in competition with a nation of vastly greater industrial resources; however, from her encircled position, Germany could bring her resources up to the British level only by conquests that would ultimately precipitate a British war.

German Naval Strategy.—Hitler sought escape by a new system of sea strategy which probably can be attributed to Dr. Karl Haushofer, the German geopolitician. Although the military philosopher's ideas had a tinge of irrational mysticism, the new sea strategy was developed with a reasonable amount of logic from the concept that modern war is total, engaging all human and material resources of every nation, once it has begun. If this were true, the key lines of communication were not those in battle areas but the lines between sources of raw materials and factories where they were transformed into weapons.

In the historic past, communication by sea had always been cheaper, easier, and more rapid than by land. In Napoleon's day, for example, Toulon was nearer to Plymouth, England, in elapsed travelling time than to Paris. In the efficiency of water transport lay the source of the greatness of England. The new Nazi strategy proposed to make England's dependence on marine commerce her downfall, for, the Germans insisted, transportation had been radically changed by the invention of the internal combustion engine. In its adaptation to the automobile, it had made land transportation as cheap and efficient as that by sea. By adapting it for the submarine and airplane, they could take control of the surface of the sea by denying its use to enemies.

The special theory of war which developed was that Germany could obtain access to all needed raw materials by a career of conquest on land. The lines of communication between sources of raw materials and factories could not be cut by England, because materials would travel in vehicles of small unit value, invulnerable to almost any form of attack except actual occupation of territory. Water transportation is efficient in proportion to the size of the transporting unit. British communications were carried in high-unit value vehicles, which could be attacked by means of small, cheap, rapidly produced military craft, such as submarines and airplanes. Given the respective times for construction, crews involved, and overall value, if Germany could sink two English merchant ships, complete with cargo, for every submarine she lost, she would be the gainer.

This was the mathematical theory of naval strategy with which the Nazis entered the war, supported by facts from less theoretical regions. One was that the British placed great reliance in their sonic and supersonic methods of submarine detection. The Nazis realized that these devices were quite as useful to a submarine in enabling it to escape pursuers as to the hunter in finding the submarine. The Germans proposed to cancel other British advantages by tactical and technical methods. The new U-boats were built with hulls capable of withstanding a considerable amount of depth charging and were able to go to depths

* See page 560i for bibliography.

where detection devices and depth charges alike were relatively ineffective. Submarines of the new attack on England were to operate in groups, several attacking a single convoy, and even if one or two might be lost, the remainder would uninterruptedly sink the convoy.

It did not matter to the Nazis that a large proportion of British overseas trade was carried in neutral ships, because their total-war theory declared that there were no neutrals, only allies and enemies. The fact that Germany lacked raw materials and coastal bases to carry on a successful war with England required her either to conquer or to convert those who might have been neutrals in such a conflict. All neutral ships approaching England were fair game, even those bound from one neutral to another.

From a combination of Nazi totalitarianism and Nazi immorality, a new sea strategy was born, expressed by Hitler: "Everything that comes before our torpedo tubes will be sunk." Its leading feature was the complete release of the German submarine captain or aviator from responsibility: he was to sink anything he saw. It was not a war of ships alone upon which the Nazis counted. They placed surprisingly great reliance upon two new types of mine, the magnetic and the series-switch, both of which could be sowed by airplanes. Hitler ecstatically proclaimed that in these mines he had weapons for which no defense or retaliation was possible. As early as November 1939, a large-scale aerial mining offensive was launched in the English Channel. The rapid discovery by British scientists of effective defenses against the magnetic mine was the first German defeat of the war. This should not conceal the fact that the essential idea behind German naval strategy was not the classic concept of winning control of the sea and and using it for their own purposes, but making it impossible for any ships of any nation to sail the sea in areas Germany could reach.

The small German surface navy thus became an auxiliary. It was perfectly proper in the terms of their strategy to expend the large part of that navy in the capture of Norway, or the remainder of it in commerce-raiding in support of the submarines. Both of these steps were bitterly regretted by many German strategists when England refused to negotiate after the fall of France, and the ships lost in the first year of war would have been very useful in attempting a passage of the Channel.

Italy's Mediterranean Strategy.—Meanwhile, Italy entered the war, and another system of local strategy had come into operation in the Mediterranean. Italy possessed a submarine fleet, but the main force of her navy lay in its surface vessels, all extremely fast and heavily armed, but with exiguous armor and a fuel capacity which limited them to the inland sea. Among the five great naval powers, she alone had no aircraft carriers. The Italians did not doubt the value of the airplane in naval war; in fact, no nation gave more encouragement to the doctrine that the plane had become a dominant force at sea. Italian ships were supposed to operate under cover of planes from shore bases and, with their help, to be able to close the Mediterranean to any ship movement, naval or commercial. This was a localized form of the Nazi strategy which did not aim at seizing sea power but at preventing the enemy from using it. In the Mediterranean Sea this strategy was carried through with success, although not until German airplanes from Italy and Greece accomplished what Italian fleets could not. The Italians had forgotten that ships which have been ordered not to give battle in ordinary circumstances are not able to when the special condition arises, requiring them to fight or to abandon the field.

On Dec. 7, 1941, when the Japanese attacked Pearl Harbor, a wholly new set of ideas began. The contest between the British doctrine of control of the sea and the Nazi doctrine of making the sea unsafe for anybody was still undecided. The Mediterranean was unsafe for either party, as were the Black and the Baltic seas. In the Atlantic, the Germans were gaining slowly; they were getting as many as four or five cargo carriers for every submarine lost, more than their theory required. On the other hand, American productive capacity had been linked to England's and was providing replacements at a more rapid rate than anticipated.

United States and Japanese Pacific Strategy.—United States strategy in the Pacific was based on the classic doctrine of Mahan. The backbone of the American Fleet was its line of battleships, slower than those of any other navy but also more heavily gunned and less vulnerable to every form of attack. The assumption was that battleships could go wherever they pleased; sooner or later an opponent would have to yield an essential objective without a fight or attempt to combat these monsters with his own inferior ships. This concept was as well known in Japan as the English system was in Germany, and, like the European member of the Axis, the Asiatic had conceived a strategy which looked less toward gaining control of the sea than of rendering Allied control valueless within a specific region of action.

Japanese strategy was based on the use of aircraft. It did not contemplate the immediate destruction of either American or British fleets but planned their elimination for a period adequate to the accomplishment of their purposes. The most prominent of the Japanese admirals, Tatsuo Yamamoto, stated that if the United States battle fleet were destroyed in the first rush, an entirely new one could be built in two years' time, an estimate which proved to be remarkable accurate. The ulterior purpose was the seizure of the enormous empire of the Indies with its resources which would make Japan and her colonies capable of sustaining a war of any duration, just as the Germans contemplated erecting a similar unit with their satellite states in Continental Europe. The only difference between the two objectives was the dependence of the German Empire upon land transportation, while the Japanese expected to transport their goods by sea, along protected routes. Japan could obtain this protection on the ocean flank by possession of the great chain of islands sweeping from the Kurils to New Caledonia and back again to Singapore, embracing more than a sixth of the earth's surface.

The Japanese expected to erect airfields and establish squadrons of aircraft. The island screen could be approached only by sea. As soon as an enemy fleet came near, the approaching ships would be attacked by planes based on these fields, while reserves were drawn in from further islands, each of which was within effective supporting distance of the next member in the chain. The Japanese Fleet would lie at the center of the web, ready to strike at the crippled attacker if he persisted after receiving aerial attack from the

islands. The plan was based on the universally admitted superiority of the land plane to that carried on shipboard. Like the German scheme, it was essentially a method for overcoming large, slowly constructed, and expensive warships by means of small, cheap, easily constructed instruments.

Errors in the Japanese Plan.—The first steps were carried through with brilliant success. Within three days, Japanese planes sank four American and two British battleships and obtained not merely the local superiority necessary to carry out the imperial plan (which was executed within three months) but an overall superiority throughout the Pacific. A classic naval strategy would have required Japan at this point to seek out and destroy the remnants of the now inferior American Fleet, but the Japanese clung faithfully to their original plan and in so doing perhaps lost a war. The concept contained at least four fundamental errors, two of them technical, two of appreciation.

The first error was the idea that United States strategy had become so wedded to the thought of the battleline of great gunnery ships that it had no escape and that a Japanese Fleet built around carriers (some of which they had constructed in defiance of their treaties) would possess a permanent superiority. The Japanese overlooked the fact that while battleline thought was dominant in the prewar United States Navy, there was a strong group of officers who regarded the carrier as the true ship of the line and the battleship as its auxiliary. It was from the Americans that the Japanese had taken the idea of a combination of dive-bombing and torpedo plane attack which was the most successful tactical device of aero-naval war, a tactic unknown in Europe. The error the Japanese had made in underestimating American carrier ability was hinted at in the Battle of the Coral Sea, May 5–6, 1942, when American carriers protected only by cruisers engaged Japanese carriers covered by battleships; the Japanese battleships dared not close in after their carriers had their flight decks damaged and their planes shot down.

Coral Sea had been fought when Japan attempted to round out her empire by an extension to the southeast, bringing within it the only area from which the island chain could be approached without a long voyage across water. Yamamoto and his associates misread the import of this setback by thinking that the southeastward extension of the empire could not be carried forward until the United States base at Pearl Harbor was neutralized. Japan sent her fleet to secure a base from which the bombing of Pearl Harbor could be indefinitely repeated, and in the Battle of Midway, a month after Coral Sea, the lesson was thunderingly reinforced.

It was too late for Japan to profit from the truth. She had lost her six months' command of the Pacific and the power of the offensive. In the succeeding phase, the long struggle for the Solomons, a second Japanese error became apparent: the assumption that surface ships were relatively helpless under well-directed air attack. The origins of this date back to the early part of the European phase of the war and to an Allied misconception. In the evacuations of Norway and Dunkerque, German shore-based dive bombers had inflicted destructive losses on Allied light craft, but these were regarded as atypical cases, since the ships were forced to work close to enemy shore bases, without protective air cover of their own. The record of planes against more stoutly built ships was distinctly bad. In the first two years of the war, that is until Pearl Harbor, only three armored ships had been sunk from the air. All three were at anchor in harbor when hit: two had already been seriously damaged by submarine torpedoes, and the third was one of the lightly built Italian battleships, caught at a time when she did not have her guns manned or steam up. The British carrier *Illustrious* had even survived an all-day pounding by German dive bombers in the Strait of Sicily.

The prospect of air attack on heavy ships was regarded without any particular apprehension, except by the Japanese. It was elsewhere considered that the armament of major ships was adequate, the armament being designed to beat off high-level bombing attacks, not the close-in duel form of dive-bomb and torpedo attack which Japanese and Americans shared.

The sinking of two British battleships off Malaya by unsupported planes surprised everyone but the Japanese, who saw in it the justification of their theories of investing a high proportion of their strategic power in outlying island bases. (At about the same time, German submarines attained their maximum effect, and the criticism of the classic theory of sea power appeared to be supported by the event.) The vulnerability shown by carriers at Coral Sea and Midway to the torpedo-dive-bomber system of attack, tended to confirm the Japanese viewpoint that aerial defense by means of their island chain could not be broken. In the meanwhile, research on weapons against close-in air attack had progressed rapidly. At Santa Cruz in October 1942, the first new United States battleship armed with such weapons appeared in action. The ship shot down not only all the planes which broke through the aerial patrols to attack her but also all those that made attempts on the carrier she was covering. After that date, no vessel under battleship protection was sunk by planes.

It is obvious how grave an error this introduced into Japanese calculations for winning the war cheaply and the attitude this error inspired in the Japanese command throughout the Solomons campaign. During those operations, Japan continued to treat naval strategy as ancillary to attaining a result ashore rather than as something which would make all results ashore attainable if carried to a successful conclusion. Consequently, Japanese warships were sent into the Solomons piecemeal and according to the immediate necessities of the Japanese Army, while Japanese aircraft were committed before their pilots were fully trained. In the sanguinary series of battles that continued for nearly a year, Japanese losses were not much heavier than the American except in the air. What was irreparably lost was time, the two years during which the United States built an entirely new navy, as Yamamoto predicted, while Japan's own replacement capacity did not even keep pace with her losses.

The second major error in appreciation concerned United States submarines. From the first day of the war, American submarines completely escaped control, and as construction in the United States brought its full weight to the submarine service, the effects reached into every region of Japanese strategy. The German submarines in

their best days were sinking no more than four or five ships for every submarine launched, but the United States sent down 20 Japanese ships for every loss she sustained.

By the summer of 1943, a third of the Japanese merchant marine had been destroyed, and because many of the necessary items for construction could be obtained only from the empire to the south and by sea, the capacity for replacement went with the ships. The demand for escorts against submarines came into sharp competition with ships and men to implement the nation's major sea strategy at the same moment that the American attack on the Gilberts revealed the fourth of Japan's major errors.

A gigantic program of building destroyers and other escort vessels was undertaken in the United States from the earliest days of the war, but it became evident that convoy by surface vessels alone was inadequate against the new German submarine tactics. A group of submarines could scatter across a wide area, sometimes with planes coming out from the coast to scout for them. As soon as a convoy was reported, they would run on the surface and well beyond sight of the ships to assemble across their path. On the surface the submarine is faster than any convoy, and the attackers had plenty of time to submerge for an approach by night, coming up again for a close-in attack after dark when the submarine's low silhouette and high speed gave it every advantage. Airplanes could force the submarine to remain submerged during the day and could even find them under water by means of magnetic detectors, but the range of planes from shore was relatively limited. There were far too few carriers to spare them for the immense number of convoys necessary to sustain the war. In July 1942, nearly every ship of a large convoy for Russia was sunk.

At this juncture the escort carriers appeared, rapidly converted from merchant hulls. They were slow but fast enough to accompany the convoys; they carried few airplanes in comparison with the usual carriers but enough to keep submarines at such a distance that their ordinary tactics failed. Their planes were equipped with radar which enabled them to discover submarines by day or night far beyond the limit of visibility. The escort carriers were normally accompanied by groups of destroyers or similar ships which followed the bombing attacks of planes with close-in attacks of their own.

Under the counterattack of the escort carriers and of long-ranged, shore-based planes, German submarine losses mounted. By the fall of 1943, the monthly number of U-boats sent down was exceeding that of merchant ships, and the shadow of failure hung over the whole German strategy. The Nazi system required the production of submarines and their crews in enormous numbers, and, as with Japanese aviation production, mechanical output was far greater than the ability to provide trained and skillful operators. The Germans attempted to overcome this defect by making their more skillful leaders squadron commanders whose orders were scrupulously obeyed by the unit commanders, and even by directing individual attacks from Berlin via radio. The first of these devices only caused the better leaders to be the first to lose their lives, since they pressed home their attacks more boldly. The second made it easier for the Allies to locate submarines by means of radio-direction finders and the interception of code messages. German overall strategy was fundamentally faulty, because it required of the Western Allies no division of effort between meeting the attacks of commerce raiders and those of combat fleets. By the close of 1943, it was possible to spare American escort carriers for operations in the Pacific; the total Allied shipping tonnage in service was showing progressive monthly gains, and Admiral Ernest J. King of the United States Navy was able to announce that submarine warfare was no longer a menace but merely a problem.

The aerial losses of Japan in the Solomons campaign had been so serious that the defenses of the outer island chain were weakened at the moment when the United States Fleet and landing forces moved to the attack. The defect that developed in the Japanese system was not the product of this attrition. Even if every airfield in the Gilberts had been manned by a full quota of planes, and these planes had had the best pilots in the world, they would still have been outnumbered in meeting the attacks of the United States air groups: 11 carriers and 4 new escort carriers. The Japanese planes were shot down with insignificant loss to the Americans, and as the reinforcement squadrons poured in from adjacent islands, they were destroyed in great numbers. Japan had been so positive of the tactical mobility of the airplane that she forgot its strategic immobility. Also, a carrier fleet of the size which approached these outer islands represented a far larger concentration of airpower than any system of land bases could give to a small area. Their correct strategic answer would have been to use their own mobile forces in support of the outlying bases, but as in the case of their failure to appreciate the strength of American seaborne airpower, the lesson came too late to be of any value to them.

The Japanese admiral moved his fleet from the central base at Truk to Eniwetok when the Americans attacked the Gilberts under a plan that had been prepared for a counterattack. One element of this plan was that the Japanese counterattack should be delivered while United States forces were still astride the landing beaches with not all their troops and supplies unloaded. The United States Fleet had arrived so rapidly, coming without warning from the ocean under cover of its carrier air patrols, that the conquest of the Gilberts was complete before the Japanese Fleet reached Eniwetok, still several hundred miles from the scene of action. Another element in the counterattack plan was that the planes from land bases should have damaged many vessels in the United States Fleet; yet all those planes were lost with no appreciable damage to the American ships. The counterattack plan provided that its first blows should be delivered by carrier air groups, but there were neither planes nor pilots for the Japanese carriers. Japan was forced to abandon the whole scheme, and the Gilberts went by default.

The campaign there, although only the beginning of the American drive across the Pacific, was strategically decisive. The differences between it and the campaigns that followed until the fall of Japan were tactical or concerned with operations ashore. In the course of those operations, two new features appeared, both in the domain where something that has begun as a tactical technique is extended until it affects the broader problems of strategy.

Development of Amphibious Operations.—Before World War II, it was generally held that landing on a hostile and defended shore could not be effective without prohibitive loss of lives and, even when achieved, seldom led to any results of strategic importance. Cases in point were the utter failure of the Franco-British expedition to the Dardanelles in 1915 and the very qualified success and high casualties of the German expedition against Riga in 1917. After the German airborne attack on Crete in 1941 and the savage fighting on the beach at Tarawa in the Gilberts, it seemed that the point about dangerously high casualties might still hold true. As the Pacific campaign progressed, however, it became clear that Tarawa had been experimental. Through the refinements of its technique and its equipment, the United States Navy and the Marine Corps were able to make landings which not only resulted in the establishment of the troops ashore but also inflicted upon the defense casualties higher than those suffered by the attacker. The application of similar methods on the Normandy beachheads produced similar results. The amphibious operation, whose possibilities must always be taken into account by future strategists, had made a new dimension to naval war: it is not impossible for a fleet to lose one of its major bases to a *coup de main* while the fleet itself is elsewhere.

This is substantially what happened when the United States attacked Saipan in the summer of 1944, and from that date the Japanese were left without a strategy. They sought refuge in the council of desperation which culminated in the individual suicide attacks of the Kamikaze flyers (of which it is worth observing that in a strategic sense this was one more effort to destroy large and expensive units by means of small and cheap ones), and the mass suicide attack of the Japanese Navy in the Battle for Leyte Gulf. Even the attack on Saipan would have been impossible without the other major strategic innovation which, in its inception, was no more than a technique.

Forward Bases.—In the classic days of seapower under sail, bases were of comparatively slight importance. Some of Nelson's ships, for example, remained at sea for as long as three years with no more base facilities than those furnished by a few days' layover in a cove. This was radically changed by the appearance of the mechanical warships, which required constant replenishments of fuel and equally constant repairs, not of battle damage alone but also to intricate machinery. These repairs could be accomplished only in the security of a dock and with the assistance of facilities which a dock implies. The extent of the necessity for bases is reflected in the fact that at the Washington Conference of 1922 Japan was willing to accept a ratio of 3 ships to the American 5 to provide Japan with adequate security in the Western Pacific, with the understanding that the United States build no more bases. Japan thought that 5 United States ships in the Eastern Pacific or at Pearl Harbor would be worth 3 or less off the coast of Japan because so many of the "5-fleet" would be under repair at a distance or in transit to the repair shops.

By the production of new types of floating equipment, the United States Navy rendered the concept completely falacious. In the fall of 1944, the American Fleet occupied the atoll of Ulithi in the Southwest Pacific. Within less than a week it had become a major United States base, capable of repairing any type of battle or operational damage to ships, adequately stocked with supplies to support the campaign of the largest group of ships the world had seen. The overall result was that fleets were set free from the limitations that engineering had imposed upon them.

The effect of World War II on strategy was not to change but to confirm; not to impose new limits but to erase those limits that had appeared to exist; to dispose of localizations; and to assert once more that the proper objective of strategy is control of the surface of the sea. The weapons by which such a result is attained may be employed above, below, or upon that surface, but that is a matter of tactics. Above all, the effect of the war was to demonstrate that, although the enemy's lines of communication and supply carriers may be the ultimate objective in sea warfare, the first objective must be, and always is, the elimination of the fighting forces contesting control of the sea. See also AMPHIBIOUS WARFARE, UNITED STATES—*Navy of the United States.*

FLETCHER PRATT,
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WORLD WAR II PEACE CONFERENCE. The full conference of the 21 Allied nations which participated in the defeat of the Axis powers convened at the Luxembourg Palace (q.v.) in Paris on July 29, 1946, to draft treaties of peace, based on earlier drafts made by the Council of Foreign Ministers, with the following enemy nations: Italy, Rumania, Hungary, Bulgaria, and Finland. (See also PACTS AND CONFERENCES—*Council of Foreign Ministers.*) The nations represented in the conference and their leading delegates were as follows:

France: Georges Bidault, Premier and Foreign Minister; Pierre Schneiter, Undersecretary for Foreign Affairs; René Massigli, Ambassador in London; Henri Bonnet, Ambassador in Washington; Gen. Georges Catroux, Ambassador in Moscow; Couve de Murville and Hervé Alphand, of the Quai d'Orsay.

United States: James F. Byrnes, Secretary of State; James Dunn and William L. Clayton, Assistant Secretaries of State; Benjamin V. Cohen and H. Freeman Matthews, of the State Department.

Great Britain: Clement R. Attlee, Prime Minister; A. V. Alexander, First Lord of the Admiralty; Hector McNeil, Under-Secretary for Foreign Affairs; Glenvil Hall, Financial Secretary to the Treasury.

Soviet Union: Vyacheslav Molotov, Foreign Minister; Andrei Vyshinsky, Deputy Foreign Minister; M. Gusev, Ambassador in London; M. Novikov, Ambassador in Washington; M. Bogomolov, Ambassador in Paris. The Soviet delegation also included the foreign ministers of the Lithuanian, Latvian, and Estonian Soviet republics, respectively MM. Rotomskis, Kruss, and Valeskalm.

Australia: Dr. Herbert V. Evatt, Minister for External Affairs; James Beasley, Minister Resident in London.

Belgium: Paul-Henri Spaak, Foreign Minister; F. van Langenhove, Secretary-General of the Belgian Foreign Office.

Brazil: João Neves de Fontoura, Foreign Minister; Luis de Souza Dantas, formerly Foreign Minister.

Belorussia: A Kisseley, Foreign Minister.

Canada: Mackenzie King, Prime Minister and Minister for External Affairs; Brooke Claxton, Minister of Health and Welfare.

China: Dr. Wang Shih-chieh, Foreign Minister; Pao Yi.

Czechoslovakia: Dr. Jan Masaryk, Foreign Minister; Dr. Vladimir Clementis, Under-Secretary for Foreign Affairs.

Ethiopia: Ato Aklilou Abte-Wold, Vice-Minister for Foreign Affairs; Blatta Ephrem Tewolde Medhen, Minister in London.

Greece: Constantin Tsaldaris, Premier and Foreign

Minister; Philip Dragoumis, Under-Secretary for Foreign Affairs.

India: Sir Samuel Runganadhan, High Commissioner in London; Sir Joseph Bhore, formerly of the Viceroy's Executive Council.

Netherlands: Baron van Boetzelaar van Oosterhout, Foreign Minister; Tjarda van Starkenborgh Stachouwer, Ambassador in Paris.

Norway: Halvard Lange, Foreign Minister; Ludwig Aubert, Ambassador in Paris; Judge Terje Wold, of the Supreme Court; Carl Hambro, former president of the *Storting*.

New Zealand: H. G. R. Mason, Attorney-General; W. J. Jordan, High Commissioner in London.

Poland: Wincenty Rzymowski, Foreign Minister; Zygmunt Modzelewski, Deputy Foreign Minister; M. Skrzeszewski, Ambassador in Paris.

South Africa: Major-Gen. Frank Theron, Minister to Italy; Leif Egeland, Minister to Belgium and the Netherlands. Field Marshal Smuts was expected to arrive in Paris later.

Ukraine: Dmitri Manuilsky, Foreign Minister.

Yugoslavia: Edvard Kardelj, Deputy Premier; Stanoje Simitch, Foreign Minister.

It was announced that the official languages of the conference would be English, French and Russian. By prior agreement of the Council of Foreign Ministers, Norway alone of the 21 nations was excluded from signing any of the five treaties, and France would sign only the treaty with Italy. The United States would be a signatory of all the treaties except that with Finland. Of the Big Five powers only Great Britain and the USSR would sign all five treaties. The principle upon which these exclusions of signatories was based was that only those governments which had declared war against the Axis satellites should be privileged to sign the relative peace treaties. Thus, the United States, not having declared war against Finland, was denied the right to sign the Finnish treaty, which was limited to 10 signatories. The Italian treaty, it was agreed, would be signed by 20 of the 21 nations, only Norway abstaining. The signatories of the other four treaties would be as follows:

Hungary
1. United States
2. Great Britain
3. USSR
4. Australia
5. White Russia
6. Canada
7. Czechoslovakia
8. India
9. New Zealand
10. South Africa
11. Yugoslavia
12. Ukraine

Rumania
1. United States
2. Great Britain
3. USSR
4. Australia
5. White Russia
6. Canada
7. Czechoslovakia
8. India
9. New Zealand
10. South Africa
11. Ukraine

Bulgaria
1. United States
2. Great Britain
3. USSR
4. Australia
5. White Russia
6. Czechoslovakia
7. Greece
8. India
9. New Zealand
10. South Africa
11. Yugoslavia
12. Ukraine

Finland
1. Great Britain
2. USSR
3. Australia
4. White Russia
5. Canada
6. Czechoslovakia
7. India
8. New Zealand
9. South Africa
10. Ukraine

Premier and Foreign Minister of France Georges Bidault formally opened the conference with a speech of welcome to the delegates in which he declared:

> For the second time in less than 30 years France is the seat of the international convocation where the nations that have emerged victorious from terrible wars are striving to establish peace. The conference which met after the war of 1914–18 laid before the world solutions which did not prevent the outbreak, less than 25 years afterwards, of a new, longer, and more terrible war. It is only too easy to call to account the men or the policies which were responsible for these solutions. The right of passing judgment belongs to history. But whatever the mistakes and weaknesses of the time, the underlying cause of failure lay in the fact that two great powers whose arms had been brought to bear with decisive weight in the struggle had no part in the peace settlement.

The next day United States Secretary of State James F. Byrnes addressing the conference acknowledged the validity of Premier Bidault's assertion that the failure to preserve peace after World War I had been due to nonparticipation of the United States and Russia in 1919 peace settlements. He declared that the United States would not again commit the mistake of returning to a policy of isolationism. He also defended the course of the Council of Foreign Ministers in preparing preliminary draft treaties, while conceding that they were not such as the United States would have advocated had it been the sole arbiter. One of the most significant points in his speech was a declaration that the conference was free to adopt its own rules of procedure, ignoring the recommendations of the Council of Foreign Ministers. His address included the following remarks:

> After World War I, differences among the Allies were allowed to weaken and destroy their will to cooperate in the maintenance of peace. The United States unwisely decided to return to a policy of isolation rather than to cooperate and to improve a peace which fell short of its expectation. Other governments also drifted into a policy of isolation or appeasement. That must not happen again. However difficult may be the paths of international cooperation, the United States is determined not to return to a policy of isolation.
>
> We must try to understand one another even when we cannot agree with one another. We must never accept any disagreement as final. We must work together until we can find solutions which, while not perfect, are solutions which can be defended . . .

Prime Minister of Great Britain Clement R. Attlee addressed the conference after Mr. Byrnes, saying, among other things:

> The greater part of the drafts before you have been agreed by the four powers. They are put forward as embodying the greatest measures of agreement. Having agreed to them ourselves we shall naturally support them at the conference, but we are anxious to hear the opinions of the 17 other states to whose judgment they are now submitted. Criticisms, suggestions, and recommendations made here must be given full consideration when the final drafts are framed. The remaining articles which have not been agreed will come before you, and I have no doubt that the discussions here will be powerful factors in resolving difficulties and promoting agreement. The four powers should not, and indeed cannot, be unresponsive to the desire of the wider community of nations, and equally to those nations who have made such significant contributions to victory . . .

Foreign Minister of China Dr. Wang Shih-chieh spoke after Mr. Attlee, pleading for "a peace of the common people and not merely a peace of government delegates." He gave special emphasis in his speech to two points: (1) that the victors should abide by the principles and pledges proclaimed during the war; (2) that care should be taken not to impose peace terms on the defeated countries that would favor the resurgence of "reactionary elements" and prevent the emergence of democratic forces.

On July 31, Soviet Foreign Minister Vyacheslav Molotov addressed the conference, his speech including the following observations:

> It is justly said that big states should not impose their will upon small countries. The Council of Foreign Ministers was set up just so that question might be settled not by imposing upon some states the will of others, but by arriving at joint decisions and arrangements. The example of the drafting of the treaties proved to us that positive results have been achieved by the Council of For-

eign Ministers. We can claim this, though we by no means feel that the just aspirations of the Allied peoples have found an adequate reflection in those drafts. But we cannot overlook the fact that at present the decisions of the Council of Foreign Ministers are assailed by all sorts of reactionary elements, who are stuffed with absurd anti-Soviet prejudices and who base their calculations on the frustration of the cooperation among the great powers.

On July 28, the day before the conference opened, Gen. Charles de Gaulle, while on a visit in Lorraine, made a speech at Bar-le-Duc, near Verdun, which was regarded as epitomizing the French point of view on the treaties. Germany's position in postwar Europe was his first concern. He stated the historical reasons "why France must oppose a unified and centralized Germany, a Reich such as that used as an instrument by Bismarck, Wilhelm II, and Hitler." France's solution, he said, was the simple one of allowing the diverse and traditional German entities—Prussia, Bavaria, Saxony, Wurttemberg, Baden, Hesse, the Palatinate, the Rhine Province—to administer themselves.

General de Gaulle recalled the great changes that had supervened in the recent past. "A third of a century ago we lived in a world containing 6 or 8 Great Powers, with which were associated less powerful states and creating a sort of equilibrium . . . In view of the collapse of Germany and Japan and the weakening of Europe, only the United States and Soviet Russia now hold front-rank positions." Quoting the prophetic comparison between Russia and the United States enunciated by de Tocqueville in 1835, de Gaulle said that the destinies of all other countries depended on the future relations of these two, implying that there was small likelihood of such relations becoming amicable. "Who, then," he asked, "can restore the balance between these two new worlds? Only the old world of Europe, which is alone able to provide the necessary element of balance and understanding in a world which is tending to split in two." In order to preserve the balance between the "two new masses" he considered it essential to establish "in the first place an entente between London and Paris." The speech was received with enthusiasm in England where de Gaulle's treaty with Soviet Russia and coolness toward the proposal of a permanent alliance with Great Britain, due to his anger over British intrigues against France in Syria, had caused considerable anxiety.

WORLD WAR II, WAR CRIMES TRIALS.—Trial and punishment of war criminals has been customary during and after wars. The instructions for the government of the armies issued by the United States War Department in 1863 recognized that war crimes could be punished only after trial, and distinguished the jurisdiction of courts martial over statutory offenses from that of military commissions over offenses, under the common law of war. There were a number of war crimes trials during and after the Civil War including that of Capt. Henry Wirz, the Confederate commander of the prison camp at Andersonville, Ga. War crimes have been defined by customary international law, and more precisely in national instructions such as the United States War Department instructions referred to, and in, the Hague Conventions of 1899 and 1907 based upon them and ratified by most countries.

Especial interest has attached to war crime trials of World War I and II. The Treaty of Versailles provided for the trial of Kaiser Wilhelm II "for a supreme offense against international morality and the sanctity of treaties" by a special tribunal composed of judges of the five principal Allied and associated powers (Art. 227). Because of the refusal of the Netherlands (to which he had fled) to surrender him, this trial was never held. Germany also agreed in the Versailles Treaty to the trial of "persons accused of having committed acts in violation of the laws and customs of war," such trials to be before military tribunals of one or more of the Allied and associated powers whose nationals had been injured (Arts. 228–230). Germany declined to surrender the 900 persons accused by the Allies, and agreement was reached for Germany to try them. The tribunal set up at Leipzig for this purpose tried 12 of the 45 initially indicted and convicted 6 mainly for brutality in prison camps and illegal submarine warfare. In the case of Dithmar and Boldt, officers on a German submarine which had sunk a British hospital ship and some of the lifeboats occupied by survivors, the Leipzig tribunal found that certain brutal acts were offenses against the law of nations and that individuals who participated were criminally liable in spite of superior orders, if they knew the order was in violation of law. This opinion established an important precedent, but because of the failure of the tribunal to convict in most of the cases and the short sentences meted out in the few convictions, the Allies declined to indict further persons before this body.

The memory of these inadequate trials influenced public opinion in the Allied countries during World War II to insist that war criminals be tried under Allied auspices. This determination was also motivated by the widespread feeling that Axis aggressions were illegal and that the behavior of the Nazis toward minorities in occupied territories and the Nazi conduct of hostilities on land and sea was not only illegal but atrocious. This opinion, expressed in public by President Franklin D. Roosevelt and Prime Minister Winston Churchill in the autumn of 1941, was also manifested in the declaration of 9 governments in exile in London on Jan. 13, 1942 who "placed amongst their principal war aims the punishment, through the channel of organized justice, of those guilty and responsible for these crimes, whether they have ordered them, perpetrated them or in any way participated in them."

The Moscow Declaration of German atrocities, signed Nov. 1, 1943 by Roosevelt, Churchill, and Stalin, declared that "those German officers and members of the Nazi Party who have been responsible for, or have taken a consenting part in" the described "atrocities, massacres, and executions" will be sent back for trial "in the countries where their abominable deeds were done" without prejudice to the case of the major criminals, whose offenses have no particular geographical localization and who will be punished by the joint decision of the governments of the Allies.

In accordance with the Moscow Declaration and with customary international law, each of the Allied powers has tried many enemy persons accused of crimes against their nationals or armed forces in military commissions or other tribunals. Thus a United States military commission found eight German soldiers, who had landed in the United States during the war and abandoned their uniforms, guilty of attempted

sabotage contrary to the customary law of war. This proceeding was sustained by the United States Supreme Court (Ex parte Quirin, 1942, 317 U.S. 1), and the death sentences were carried out. The Supreme Court also sustained the sentencing by a military commission of Gen. Tomoyuki Yamashita for failure to prevent atrocities by forces under his command during Japanese occupation of the Philippines (In re: Yamashita, 1946, 66 Sup. Ct. 340). After the occupation of Germany, national military commissions sentenced many persons for wholesale murder and other acts in concentration camps such as Büchenwald and Dachau, for killing Allied airmen who had landed in Germany, and for other offenses.

Most interest, however, has been attracted by the trials of major war criminals whose offenses had no particular geographic localization. The procedure for these trials resulted from the report on June 7, 1945, by Supreme Court Justice Robert H. Jackson, who had been appointed chief of counsel for the United States in prosecuting the principal Axis war criminals. Following this report, Justice Jackson was authorized to negotiate with the other principal powers, with the result that the London Agreement for the establishment of an International Military Tribunal was signed by him in behalf of the United States, and by representatives of the USSR, Great Britain, and France on Aug. 8, 1945. The other United Nations were invited to adhere, and 19 did so.

Attached to this agreement was the charter of the International Military Tribunal. This document provided for a tribunal composed of one judge and two alternates from each of the four powers; for a procedure designed to assure the defendants a fair trial and adequate opportunity for defense; for jurisdiction "to try and punish persons who, acting in the interests of the European Axis countries, whether as individuals or as members of organizations," committed any of the crimes defined in the charter. The charter authorized a committee consisting of the chief prosecutors of each country to prepare the indictment and present the evidence on the basis of the law set forth in the charter as follows:

Article 6.—The following acts, or any of them, are crimes coming within the jurisdiction of the Tribunal for which there shall be individual responsibility:

(a) Crimes against peace: Namely, planning, preparation, initiation or waging of a war of aggression, or a war in violation of international treaties, agreements or assurances, or participation in a common plan or conspiracy for the accomplishment of any of the foregoing:

(b) War Crimes: Namely, violations of the laws or customs of war. Such violations shall include, but not be limited to, murder, ill-treatment or deportation to slave labor or for any other purpose of civilian population of or in occupied territory, murder or ill-treatment of prisoners of war or persons on the seas, killing of hostages, plunder of public or private property, wanton destruction of cities, towns or villages, or devastation not justified by military necessity;

(c) Crimes against humanity: Namely, murder, extermination, enslavement, deportation, and other inhumane acts committed against any civilian population, before or during the war, or persecutions on political, racial or religious grounds in execution of or in connection with any crime within the jurisdiction of the Tribunal, whether or not in violation of the domestic law of the country where perpetrated.

Leaders, organizers, instigators and accomplices participating in the formulation or execution of a common plan or conspiracy to commit any of the foregoing crimes are responsible for all acts performed by any persons in execution of such plan.

Article 7.—The official position of defendants, whether as heads of state or responsible officials in government departments, shall not be considered as freeing them from responsibility or mitigating punishment.

Article 8.—The fact that the defendant acted pursuant to order of his government or of a superior shall not free him from responsibility, but may be considered in mitigation of punishment if the Tribunal determines that justice so requires.

Article 9.—At the trial of any individual member of any group or organization the Tribunal may declare (in connection with any act of which the individual may be convicted) that the group or organization of which the individual was a member was a criminal organization. . . .

Article 10.—In cases where a group or organization is declared criminal by the Tribunal, the competent national authority of any signatory shall have the right to bring individuals to trial for membership therein before national, military or occupation courts. In any such case the criminal nature of the group or organization is considered proved and shall not be questioned.

Article 11.—Any person convicted by the Tribunal may be charged before a national, military or occupation court, referred to in article 10 of this Charter, with a crime other than of membership in a criminal group or organization and such court may, after convicting him, impose upon him punishment independent of and additional to the punishment imposed by the Tribunal for participation in the criminal activities of such group or organization.

The tribunal was promptly established with Lord Justice Geoffrey Lawrence of the British Court of Appeals as president; and Francis Biddle, former attorney general of the United States; Maj. Gen. I. T. Nikitchenko, vice chairman of the Soviet Supreme Court; and Donnedieu de Vabres, professor of law at the University of Paris, as judges. The alternates were Sir Norman Birkett, judge of the High Court of England; John J. Parker, judge of the United States Circuit Court of Appeals; Major A. F. Volchkov, judge of the Moscow District Court; and Robert Falco, judge of the Court of Cassation of France. The tribunal held its first public meeting in Berlin on Oct. 18, 1945, and received the indictment from the Committee of the Chief Prosecutors consisting of Justice Robert H. Jackson for the United States, Sir Hartley Shawcross and Sir David Maxwell Fyfe for Great Britain, François de Menthon for France, and General R. A. Rudenko for the Soviet Union.

The indictment, comprising approximately 25,000 words, outlined four counts and three annexes concerning the responsibility of individual defendants and organizations, and the state's violation of international agreements. The four counts, on two or more of which each of 24 Nazi leaders was indicted, were as follows:

(1) "the common plan," or conspiracy to commit war crimes;
(2) crimes against peace—the planning, preparing, initiating, or waging of aggressive war;
(3) war crimes—violation of the laws and customs of war; and
(4) crimes against humanity.

The tribunal established itself in the Palace of Justice at Nürnberg where it decided upon its rules and assisted the defendants to find the counsel of their choice and to obtain the witnesses necessary for their defense. It also decided that Gustav Krupp von Bohlen, who had been indicted, was too sick to be tried and that Martin Bormann, who had not been found, should be tried in absentia. It also found that Rudolf Hess, who was alleged to be suffering from loss of memory, was not in such a condition as to prevent his trial. One defendant, Robert Ley, committed suicide while in custody. Thus only 21 defendants were present in person during the trial.

The trial, begun on Nov. 20, 1945, and continued until Oct. 1, 1946, was conducted in four languages, facilitated by a simultaneous interpretation device. The case of the prosecution was opened by the Americans who dealt with the first count, on which all had been indicted. The British prosecution followed with the second count, on which 16 had been indicted. The French prosecution then dealt with counts three and four, as applied to the west, and the Soviet prosecution followed with the same counts in the east. Nineteen were indicted under each of these counts. The prosecution's case consumed three months, that of the defense—represented by able German lawyers and having many witnesses—five months. In August 1946, the prosecution summed up its case, and each of the defendants made a final statement. After a few weeks' adjournment, the court read its opinion on September 30 and sentenced the defendants the following day. Three of the defendants (Hjalmar Schacht, Franz von Papen, and Hans Fritzsche) were found not guilty on any counts. Seven (Rudolf Hess, Walther Funk, Karl Doenitz, Erich Raeder, Baldur von Schirach, Albert Speer, and Konstantin von Neurath) were sentenced to prison terms varying from 10 years to life. The remaining 12 (Hermann Göring, Joachim von Ribbentrop, Wilhelm Keitel, Ernst Kaltenbrunner, Alfred Rosenberg, Hans Frank, Wilhelm Frick, Julius Streicher, Fritz Sauckel, Alfred Jodl, Martin Bormann, and Artur von Seyss-Inquart) were sentenced to hang.

The Allied Control Council for Germany considered applications for clemency as provided in the charter but did not grant them and carried out the executions of those sentenced to death on October 16, with the exception of Bormann who had not been found and Göring who succeeded in committing suicide a few hours before.

Of the 76 counts on the indictment against the 22 defendants, the court sustained 52. All those sentenced to hang were found guilty of crimes against humanity and in most cases of other crimes also. Four defendants, Funk, Neurath, Schirach, and Speer, though found guilty of crimes against humanity, were given prison sentences because of extenuating circumstances. Defendants found guilty of aggressive war or conspiracy were given life sentences (Hess, Raeder, and Funk) unless there were extenuating circumstances as in the case of Neurath and Doenitz. The Soviet judge dissented from that part of the verdict acquitting three of the defendants.

The tribunal also declared that three of the six accused organizations, the SS (Black Shirts) and its subsidiary the SD, the Gestapo, and the Leadership Corps of the Nazi Party were criminal. The SA (Brown Shirts), the Reich Cabinet, and the General Staff were acquitted without prejudice to the individual liability of members.

In its opinion, the tribunal recognized that it was bound to apply the law provided by the charter, but it considered this law declaratory of customary and conventional international law in existence at the time the offenses were committed. The summary of the opinion contained the following points.

It was said by defendants' lawyers that to punish defendants for the crime of aggressive war was to indulge in ex post facto legislation abhorrent to the law of all civilized nations. In the judgment of the tribunal these contentions ignore the true nature of international law which is continually developing, adapting itself to the needs of a changing world as the wisdom and experience of the succeeding generations dictate. The General Treaty for the Renunciation of War of Aug. 27, 1928, generally known as the Pact of Paris or the Kellogg-Briand Pact, was binding upon 63 nations, including Germany, Italy, and Japan. After 1928, war was an illegal thing. The solemn renunciation of war as an instrument of national policy necessarily involves the proposition that such a war is illegal in international law and that those who plan and wage such a war, with its inevitable and terrible consequences, are committing a crime in so doing.

The contention was made that the official position of defendants as heads of state should free them from responsibility and that international law did not apply to individuals. The tribunal declared that the doctrine of the immunity of heads of state had no application where a state had violated international law and that for many years past military tribunals had tried and punished individuals guilty of violating the rules of land warfare laid down by the Hague conventions. The defense of "superior orders" has never been recognized as a defense to a crime but is considered in mitigation as the charter here provides.

In spite of this opinion, the tribunal was criticized on the ground that it was constituted from one side in the war, that it had jurisdiction only over enemy persons, and that it applied a principle of collective criminal responsibility. In respect to one-sidedness, the tribunal was no different from all military commissions of the past. This was not a trial of Germany but of individual offenders, and it is recognized that international law permits states to assume jurisdiction over offenses against the law of nations, endangering their security, committed by individuals outside their territory. While the tribunal had jurisdiction only over Nazi offenders, the principles of law it applied, as Justice Jackson pointed out, "impose liability upon war-making statesmen of all countries alike."

The ex post facto criticism has been applied particularly to the crime of "aggressive war." Its cogency depends upon the precision with which it is thought crime and penalty must be defined by law before the act. The prosecution pointed out that acts of warlike character not under lawful state authority have long been considered offenses against the law of nations. Piracy and the setting on foot of military expeditions were defined by the United States Congress as such offenses in the 1790's, and a United States district court supported indictments under customary international law for the latter offense prior to any congressional enactment (Henfield's Case, 11 Fed. Cas. 1099). After aggressive war had been outlawed by treaties binding substantially all states, a person who committed warlike acts under the alleged authority of such a state could not claim to be acting in pursuance of a lawful act of state. Thus while there was no precise international legislation defining aggressive war as a crime and affixing a penalty, international practice and custom had established that crime and indicated penalties commensurate with its gravity long before the charter was made or the acts committed. The tribunal, therefore, considered that the Allied powers in making the charter had not made new law but had declared

with greater precision pre-existing rules of customary international law.

As to the question of collective criminal responsibility, the tribunal made it clear that an organization could be found criminal only if its membership constituted a conspiracy to commit crime, that is, if the organization had criminal purposes voluntarily supported by the members. "Persons who had no knowledge of the criminal purposes or acts of the organization and those who were drafted by the state for membership" could not be regarded as members. The presumed members of the organizations found to be criminal, of which there were several hundred thousand, were to have individual opportunity to prove before national military commissions that they were not members in the sense defined by the tribunal.

The trial gave publicity to thousands of documents discovered by the prosecution and to over 16,000 pages of evidence, of great historic and educational value in establishing the activities of the Nazis and the origin of the war. It manifested the practicability of a fair trial of war crimes in an international tribunal, and may encourage the establishment of a permanent tribunal with a wider jurisdiction for the trial of such crimes and other offenses against the law of nations not dealt with by national tribunals. It established important precedents for the development of international law, particularly the principal of responsibility of individuals for war crimes irrespective of official position or superior orders; the inclusion among such crimes of the planning, preparing, initiating, or waging of aggressive war, and the distinction between the aggressor and the defender in hostilities. These principles, if established, will add important sanctions to the numerous international agreements, including the Kellogg-Briand Pact and the charter of the United Nations, outlawing war as an instrument of national policy.

The trial of Japanese major war criminals proceeded along lines similar to the Nürnberg trial. Gen. Douglas MacArthur, supreme commander for the Allied Powers in Japan, proclaimed the charter for the International Military Tribunal for the Far East on Jan. 19, 1946. The charter provided for a tribunal of 6 to 11 judges appointed by the supreme commander on nominations by the signatories of the Japanese surrender instrument and for a chief of counsel designated by the supreme commander. Otherwise it closely resembled the charter under which the Nürnberg trial was held.

The Far Eastern trial began in Tokyo on April 29, 1946. Joseph B. Keenan, chief of counsel for the prosecution, presented a 55-count indictment against 28 defendants, including the major military, naval, and political officers of Japan at the time of the Pearl Harbor attack. The tribunal included judges from Australia (Sir William Webb, chief justice of the Supreme Court of Queensland, presiding), Canada, China, France, Great Britain, the Netherlands, New Zealand, USSR, and the United States.

The experience of the war crimes trials in World War II has contributed much to the definition of war crimes and to the development of procedures for punishing them.

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WORLD'S COLUMBIAN EXPOSITION, an international exposition held in Chicago, Ill., in 1893, to celebrate the 400th anniversary of the discovery of America by Christopher Columbus.

History.—The fitness of some special celebration of the discovery of America had been recognized and the question agitated several years before the bill providing for a Columbian Exposition was introduced in Congress in 1889. Several cities urged their claims for the site of the exposition; chief among them were New York, Chicago, Washington and St. Louis; Chicago was finally chosen as the site and the bill passed and approved April 25, 1890. The organization of the fair was placed under the charge of an Illinois corporation previously organized, and the World's Columbian Commission, a national commission consisting of delegates appointed two from each state and territory, two from the District of Columbia, and eight at large. The work of construction was placed under the charge of a bureau of construction, of which Daniel H. Burnham was chief; work was begun on the first building in July 1891. On Oct. 23, 1892, the buildings were formally dedicated by the vice-president of the United States; the dedication ceremony, which was attended by 130,000 people, was held in the Manufactures and Liberal Arts Building. The exposition was formally opened May 1, 1893 by President Cleveland; at the moment which he declared the fair open, the flags of the various nations were unfurled, the electric fountains turned on, and the statue of *The Republic* unveiled. The attendance at the fair was 27,539,041, of which 21,479,661 were paid admissions; the days showing the largest attendance were October 9, Chicago Day, and July 4, the United States' Independence Day; the average daily attendance was 172,712. The exposition was formally closed October 30.

Financial.—The bill providing for the exposition required the city of Chicago to raise

$10,000,000 toward the expenses; later, Congress provided for the gift of a special mintage of $2,500,000 in souvenir half dollars, the exposition authorities also issued $5,000,000 worth of debenture bonds; about $3,000,000 additional were received from other miscellaneous sources, so that about $20,000,000 was available before the opening. The total expenditures for the fair were over $31,000,000, and the profits, about $1,850,000. The United States government appropriated $2,250,000 to its exhibits, the states $6,060,350, the foreign governments $5,830,000, and over $350,000 was invested in the Midway Plaisance.

Buildings and Principal Exhibits.—The site chosen for the exposition was Jackson Park, a portion of the South Park system of Chicago; it covered 666 acres and extended about two miles along the shore of Lake Michigan. There were about 150 buildings erected; the more important were built of the material called "staff," a composition of plaster of paris and jute fiber, which produced the general effect of white marble, hence the exposition grounds became generally known as the White City. The Manufactures and Liberal Arts Building faced the lake near the eastern end of the basin; this was the largest building yet constructed for an exposition; it covered nearly 31 acres; the main roof was of iron and glass. At the head of the basin was the Administration Building, with its gilded dome; near this were the Agricultural Building, Machinery Hall, and the Electrical and Mining Building. On the west of the lagoon were the Transportation Building and Horticultural Hall, and on the east the Government Building, with a large dome 150 feet high; at the northwestern end of the lagoon was the Womans' Building, and at the northeastern end, the Fisheries Building. Still further to the north were the state buildings, many of the foreign nations' exhibits, and the Fine Arts Building. The Fine Arts Building was an example of purely classical architecture; it was entered by four richly ornamented portals. The state and foreign nations buildings were in many cases copies of some characteristic historic building or type; as, for example, Virginia's building was modeled on Washington's Mount Vernon home; Massachusetts' was a copy of John Hancock's house; England's represented a manor house of the time of Henry VIII, and Spain's, the Convent of La Rabida. In the southern part of the grounds was the Forestry Building, built in the rustic style, the columns supporting the roof being made of tree trunks furnished by the different nations and the states and territories of the United States. Near the Forestry Building were a number of the small exhibits, the Krupp exhibit, dairy, etc. The Manufactures and Liberal Arts Building included in its exhibits everything related to engineering, architecture, publishing, technical and domestic arts, together with education, the professions, music, and the drama. The fine arts exhibit included many masterpieces of painting and sculpture, the Womans' Building containing a collection representing womans' work in all lines of activity; the Transportation Building's collection represented all modes of transportation from the most primitive to the most complete, modern inventions of ocean steamers and locomotives; and the exhibits of the other special departments of human industry showed excellently the progress of the race in each special industry.

Special Features.—Among the special features of the exposition the Midway Plaisance was perhaps most interesting; on this were represented the villages of different nations and peoples, including the Irish village, the Javanese village, the Japanese bazaar, the Samoan and Dohomey villages, etc.; here also were the "Street of Cairo," and the various amusement features; and the Ferris wheel, 250 feet in diameter, carrying 36 coaches. Other special exhibitions of interest outside the main buildings were the reproduction of the cliff dwellers' buildings at Battle Rock Mountain, Colo.; the models of Columbus' three caravels, of the Viking ship, and of a modern United States battleship. Another interesting feature of the exposition was the numerous world's congresses held on the grounds under the auspices of the World's Congress Auxiliary. These congresses discussed the leading phases of professional, scientific, economic, educational and religious thought; the World's Parliament of Religions probably attracted the most general attention.

WORM, or **SCREW GEARING** are gears connecting shafts that are not parallel and do not meet, and the elements of whose teeth are helical or screw-like. The worm is a screw, sometimes termed an endless screw, made to mesh with the teeth of a wheel called the worm-wheel. The axis of the worm is usually at right angles to the axis of the worm-wheel. Worms are usually made for single curve gear-teeth, because the sides of involute rack teeth being straight, the tool for cutting worm-teeth is easily made. Special gear-cutting machines are used to cut worm-gears. See GEARS.

WORMS, vōrms, Hesse-Darmstadt, town on the Rhine, nine miles northwest of Mannheim. The town is irregularly built and has remains of its mediaeval walls and ramparts. Its principal building is the cathedral, completed and consecrated in 1101, a noble Romanesque structure with four elegant towers, two domes, a double choir and a flamboyant 15th century Gothic portal. The interior is 357 feet long, 87 feet wide, across the transepts 117 feet and is very imposing from its grand simplicity. On the north side of the cathedral is the site of the Bischofshof or episcopal palace, the seat of the celebrated Diet of Worms in April 1521. It was destroyed by the French in 1689, and again in 1794. On its massive red sandstone substructure the Heil'sche Haus has been erected in the rich Renaissance style. The restored church of Saint Martin, and the church of Saint Paul secularized as a museum, are also of notable ecclesiastical architecture. Outside the town stands the Liebfrauenkirche (dating from the 15th century), which gives its name to the Liebfrauenmilch, a much-esteemed wine grown in the vicinity. The finest monument in Worms is that to Luther, erected from Rietschel's designs in 1868 at a cost of $85,000. Worms is a considerable river port with a good harbor and an active shipping trade. The principal industries of Worms are the manufacture of patent leather, machinery, worsteds, chicory, slate, tobacco, beer, soap and amber wares. Worms is one of the most historical towns of Germany. It was known to the Romans as *Borbetomagus,* and later as *Augusta Vangionum*,

the capital of the Vangiones. It was destroyed by Attila and rebuilt by Chlodwig in 486. After the partition of the empire among the sons of Ludwig the Pious, Worms became a German free town under the protection of the Elector of the Palatinate. Already in 1255 it belonged to the Confederation of Rhenish towns, and it contained in the time of Frederick Barbarossa 70,000 inhabitants. It was the seat of many Imperial Diets, most famous that under Karl V, at which Luther made his defense. In 1632 the suburbs of the town were leveled by the Swedish Colonel Haubold, and in 1689 the town itself was ruthlessly destroyed by Melac and the young Duc de Créqui under the orders of Louis XIV. In September 1792 part of it was leveled by the French under Custine; at the peace of Lunéville in 1801 it was given to France. The peace of Paris in 1814 gave it back to Germany, and the Vienna Congress in 1815 to Hesse-Darmstadt. Pop. 47,015. Consult Fuchs, 'Geschichte der Stadt Worms' (Worms 1868); 'Beiträge zur Geschichte der Stadt Worms' (Worms 1896); Nover, 'Das alte und neue Worms' (Worms 1895).

WORMS, vorms, island in the Baltic, east of Dagö, belonging to Esthonia, about 36 square miles in area. It is flat and generally well wooded in the interior and throws out numerous steep promontories, round which strong currents run, so that, often for months together, it is cut off from all intercourse with the neighboring islands of Oesel, Dagö, Runö, etc., as well as with the mainland, and thus the inhabitants who are of Swedish origin have remained unmixed with foreign elements. A stranger is a surprising rarity on this island, and he, in turn, is not less surprised at the peculiar old Swedish dialect, the architecture and the manners and customs of this small, poor, but happy insular people.

WORMS, any of many elongated jointed animals; the term has no more definite signification or limits than has Vermes (q.v.). Examples of what may most properly be called worms are earthworms, leeches, marine annelids and the parasitic flatworms, roundworms, etc., especially such as infest the intestinal tract. These are described elsewhere, under their names. See also Parasites.

WORMWOOD, a perennial herb (*Artemisia absinthium*) of the composite family. It is a native of Europe and northern Asia, whence it has been introduced into other countries by way of gardens in which it was formerly cultivated for domestic medicine. The plant grows about three feet tall, is spreading, bears silky, pinnatifid leaves and yellow flowers in heads arranged in racemes. All parts of the plant are intensely bitter on which account they, the leaves especially, have been used for flavoring drinks. Wormwood is cultivated to some extent for the manufacture of absinthe (q.v.), of which it forms one of the most important ingredients and which is named from it. See Artemisia.

WORSHIP, the act of paying divine honors to the Supreme Being; or the reverence or homage paid to Him in religious exercises, consisting in adoration, confession, prayer, thanksgiving and the like. The Christian Church distinguishes between the worship due to God alone (*latria*), the respect paid to the saints (*dulia*) and the worship due to the Virgin Mother of Christ (*Hyperdulia*). The homage paid to idols or false gods by pagans is idolatry. "Worship" is also a title used in Great Britain and some British colonies in addressing certain magistrates. See Liturgy; Prayer; Religion; Ritual.

WORSHIP, Freedom of. (The word *worship* is derived from A. S. *weorthscipe* = *weorth,* worthy, + *scipe,* ship; it meant *worthiness* in O. E., and is now used to designate *reverence* for a person or a thing). Reverence is the honor due to another because of some excellence which he has and we have not. That excellence is either natural or supernatural. If we reverence another because of some natural excellence, which we have not, our worship is natural. By such natural reverence we honor our parents, because of a superior excellence in them. They gave us life itself. For that gift we can never sufficiently pay them back. By the excellence of parenthood they will ever be superior to us, and an object of natural reverence. Of natural worship and reverence this article does not treat.

1. Supernatural and External Worship.— If we reverence another because of some supernatural excellence, which we have not, our worship is supernatural. Now this supernatural excellence may be finite or infinite, created or uncreated. Supernatural reverence of another, because of infinite and uncreated excellence, is called *adoration.* Supernatural reverence of another, because of finite and created excellence, has among Catholics the technical, figurative name of *dulia* — from *δουλεία,* "slavery." Just as the subscription "Your obedient servant" means servitude only in a figurative sense, so the supernatural reverence of the saints is slavery only by a figure of speech. Moreover, among Catholics the reverence for the Blessed Virgin Mary is called *hyperdulia,* "more than *dulia,*" to indicate that the homage paid to her is in a class by itself. It is not adoration, because the motive, objectively considered, is not infinite and uncreated. It is *dulia;* because the motive is finite and created. It is "more than *dulia*"; because divine motherhood, the motive of our reverence for Mary, though a finite and created excellence, is unique and in a class by itself. There is only one mother of the divine Person, Jesus Christ. Supernatural reverence — be it *adoration, hyperdulia,* or *dulia* — is either internal or external worship. Quite naturally one is free from State interference with one's internal worship; the State is not concerned with the acts of reverence, which one in no wise expresses by outward signs. The subject of this article is freedom, not of internal, but of external, supernatural worship.

2. Obligatory Worship.— This freedom of worship does not preclude man's obligation to religion, which flows from natural law. External, supernatural worship is not a matter of choice to man. Apart from the duty of religion, consequent upon his knowledge of God's supernatural revelation of Himself to the human race, man is by the very law of nature obliged to both internal and external supernatural worship. For man was created to praise, reverence and serve God. But man is

made up of both body and soul. Hence the faculties of his animated body, as well as the powers of his spiritual soul, should join in this praise, reverence and service of the Creator. That is to say, there should be an external manifestation of the reverence, which the mind conceives and the will elicits. «Ever since the creation of the world, the unseen truths about God,— that is, His everlasting power and divinity,— are to be seen by being reasoned out by means of His works. So that men have no excuse.» (Romans i, 20). The religious freedom, whereof our article treats, is man's right to follow the dictate of his reason and the mandate of his will as to the manner of external worship. This right should be respected and protected by the State as it now is constituted. It is fundamental to our government. For the First Amendment to the Constitution ordains that «Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof.»

Freedom of external worship, guaranteed to the individual by the Constitution of the United States, does not preclude the duty of civil society as such to give reverence to God. For God is the author and stay of civil society. Without Him and His gifts there would be no social organism. Hence is society bound to acknowledge His dominion and beneficence. The State recognizes its indebtedness to particular persons and to other States. America is not unmindful of the services of Lafayette and Rochambeau, nor of France that sent them to our aid. Much less should our State be oblivious of the infinite Being, on whom we depend for our existence and well-being. Nor are the United States forgetful of God. Witness the appeal of the signers of the Declaration of Independence to «the laws of nature and of nature's God,» to the rights wherewith men «are endowed by their Creator,» and «to the Supreme Judge of the world, for the rectitude of their intentions,» when they pledged themselves to the support of the independence of the United States «with a firm reliance on the protection of divine Providence.» Witness likewise the annual proclamation of Thanksgiving Day by the President of the United States.

The Church, as established by Christ, is a true and perfect society; it has its own inalienable rights, which the State should protect. Such protection is quite feasible, when society is entirely Catholic; but in a State such as ours, would be fraught with many and varied difficulties. Hence Catholics of the United States have always stood for justice to the consciences of each and all. Their principle of action in matters religious has been: Live and let live. Whereas at times Protestants seem to have called upon civil authority to impose on others their own religious tenets. In colonial days, the only real freedom of worship to be found was that of Maryland during the brief control of the colony by Catholics, 1634–89. As Bancroft says, in his 'History of the United States,' the Maryland Act of Toleration, 1649, was «the first in the annals of mankind to make religious freedom the basis of the State.»

3. Free Worship.— In civil society constituted as is ours, the only feasible attitude of the State toward external worship is that of the First Amendment to the Constitution. Thereby is safeguarded by the United States the inalienable right, which her every citizen has to liberty of conscience. That right should be respected by civil authority. For authority, the unitive principle of the State, is from God. Therefore it may not validly impose an obligation to violate God's law. But to go against one's conscience is to violate God's law. For it is the function of conscience to dictate to us what is God's law in each particular case. Were the State so to legislate as to atrophy this function of conscience, it would seriously interfere with the observance of God's law. For it is the certain dictate of conscience that testifies just what particular form of worship is willed by God.

From this inalienable right, which each one has to worship God according to the certain dictate of conscience, we may conclude that, in a State such as ours, it would be ethically wrong to force one to practice even the true revealed religion. And this conclusion we draw, despite the fact that Christianity was established as a world-religion, which Jesus wished all to embrace. Just before the Ascension, He appeared to the eleven apostles in Galilee and said to them: «All power hath been given me in heaven and upon earth. Therefore go ye; make disciples of all nations; baptize them in the name of the Father and of the Son and of the Holy Ghost; teach them to observe all things whatsoever I have commanded you. And, lo, I am with you all days, even to the end of the world.» (Matthew xxviii, 18–20). And on the very point of ascending into heaven from Mount Olivet, Jesus once again gave this solemn message to the same body of teachers: «Go ye to all the world; preach the Gospel to all creation. He that believeth and is baptized, shall be saved. He that believeth not, shall be damned.» (Mark xvi, 15–16). The will of Jesus Christ, the divine Ambassador, is clear. He wishes all to belong to His Church. And yet no one is subject to the authority of the Church, unless he has entered it. And he enters the Church by faith; since faith is the root and foundation of justification. But true faith may not be forced. It must flow from the reason at the mandate of the unhampered, unshackled, free will.

Likewise, as our Constitution decrees, the State may not «prohibit the free exercise» of religion according to one's conscience; nor impose any obligation which runs counter to one's religious duty. It goes without saying that the rights of others must be protected. And the State may prevent such religious practices as interfere with these rights, and hinder the well-being of the community. This juridical status of the modern, constitutional State, as the protector of the religious rights of all, is the logical consequence of two fundamental facts in the science of sociology.

First, the State is not a divinely constituted depository of God's revelation to man. Hence it has neither the duty nor the right to dictate what its members shall believe, nor how they shall externally manifest their belief. Christ established a spiritual, and not a material society. He gave His doctrines to the Church, and not to the State, to hand down to men.

Pilate asked Him, «Art thou a king?» Jesus made reply: «My kingdom is not of this world.» (John xviii, 33–36).

Secondly, the social organism or State is from God. Because man is by nature a social being. It is by the law of nature that men form themselves into an organic social unit. But whatsoever is by the law of nature, is from God the Author of nature. Therefore the social organism is from God. Therefore the unifying and vitalizing principle of that social organism is from God. But authority is the principle which unifies and vitalizes society. Hence the authority of the State is from God. Therefore civil authority is bound to protect God's rights in society. And one of those divine rights is to the reasonable manifestation, by the members of society, of their relations to the Supreme Author of the social organism.

No State has the right to be so godless and atheistic as utterly to rule God out. To rule God out of society were to do away with the very Author of society; to substitute the authority of might for the might of authority; to destroy the vitalizing principle of the State, and to devitalize, disintegrate and destroy the social organism.

4. Freedom of Worship, Guaranteed by Treaties.— Since the State, as to-day constituted, has the right and the duty to guarantee to its subjects that freedom of worship which is dictated by the certain conscience of each individual and does not clash with the rights of others, this same freedom may be the legitimate content of international treaties. The exigencies of diplomatic, business or other relations may render it necessary that the subjects of one State reside in another. They still have the natural right to worship God according to the dictate of a certain conscience. And their own State may protect that right. The treaty, whereby a State protects the religious freedom of its subjects abroad, is an agreement between two sovereign States; and essentially differs from a concordat. A concordat is a treaty between the Apostolic See of Rome and a State in diplomatic relations therewith; it has to do with the relations of the Catholic Church to the State. Before the Protestant reformation there was only one ecclesiastical authority in Christendom; and the religious rights of subjects were amply protected by the canonical relations between that supreme papal power and Christian states. Now such protection can no longer be guaranteed. Hence the necessity of treaties between sovereign states, which have as their object the guarantee of a freedom of divine worship. We instance some such treaties between the United States and other countries, which were generally made for the protection of Protestant missionaries. By a treaty of 1805, with the sultan of Tripoli, the American consul, his family and household, were guaranteed freedom of worship in the consulate. By the Treaty of Guadalupe, 1848, Mexico permitted Americans to practise and spread their religion within that republic. In 1856, Siam signed a treaty with the United States, whereby Americans were allowed to build churches and practise their faith in that kingdom. China, by the treaties of 1858 and 1868, yielded to Americans the right to build churches, maintain cemeteries and practise their religion in those parts where foreigners were permitted to reside. In 1858, Japan ceded to Americans freedom of worship and the right to build churches; and the United States in turn assured Japan against molestation of her subjects in their worship. The year following, 1859, our government secured by treaty the religious freedom of Americans, residing in Paraguay. In Turkey, American missionaries have been active since 1818. At first they shared in the religious freedom, which the Edict of Toleration has allowed to all Christians in the Ottoman empire since the 15th century. The treaties of 1830 and 1874 guaranteed to Americans the right to build churches, conduct mission schools and spread their religion throughout the Turkish empire.

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WORSTEDS, wûst'ĕd or wûr'stĕd, are varieties of woolen yarn or thread, spun from long staple wool which has been combed, and which in the spinning is twisted harder than ordinary. It is knit or woven into stockings, carpets, etc. The name is derived from Worsted, a village in Norfolk, where it is supposed to have been first manufactured.

WORT, the saccharine liquid obtained by the action of malt on a mixture of water and crushed barley, corn or other grain, the whole being known as «mash.» The water extracts

the maltose and dextrine from the malt and allows the diastase to act on the starch of the grain, changing it also to maltose and dextrine. The pectase of the malt at the same time changes the grain proteids to soluble peptones. Care must be taken of the temperature and the dilution of the mash in order to obtain the best results. Worts are of various kinds, depending on the grain used and the temperature given it. Some are fermented to beer, ale, porter and like beverages, while other forms are fermented to a mash that is distilled for alcohol or whisky.

WORTH, wûrth, **William Jenkins,** American general: b. Hudson, Columbia County, N. Y., March 1, 1794; d. San Antonio, Tex., May 7, 1849. He received an ordinary education, and when the War of 1812 broke out enlisted as a private soldier, rising to the rank of captain in 1815. He was instructor of infantry tactics and commander of cadets at West Point 1820–1828 and in 1838 became colonel of the 8th Infantry.

In 1840 he was sent to serve in the war against the Florida Indians, and in 1841 took the chief command. He was successful in repeated and severe conflicts with the aborigines, whereby the war was brought to a close, and in August 1842 was brevetted a brigadier general for gallantry and distinguished services.

In the war with Mexico, at the Battle of Monterey, Sept. 23, 1846, he bore a very important part. As it was impossible to communicate with Zachary Taylor, Worth was obliged to act independently throughout the battle. He carried the forts commanding his line of approach, stormed the bishop's palace, and had fought his way through the streets nearly to the great plaza, when the town capitulated to Taylor, approaching from the other side. For these achievements Worth was brevetted a major general, and received a sword from Congress.

Later under Winfield Scott he further distinguished himself at Cerro Gordo, Puebla, Cherubusco, Molino del Rey, and at the storming of the city of Mexico, which surrendered to him. A monument was erected to his memory by the city of New York, at Broadway and 25th Street in 1858. Fort Worth, Texas, was named for him.

WORTH, William Scott, American general: b. Albany, N. Y., Jan. 6, 1840; d. Clifton, S. I., Oct. 16, 1904. Entering the Union army as 2d lieutenant in 1861, he became captain in 1866; lieutenant colonel of the 13th Infantry in 1894, and colonel in September 1898. He accompanied the army to Cuba, and during the assault on San Juan Hill, July 1, 1898, was severely wounded. He was promoted brigadier general, United States Army, in the following November, and was retired a week later.

WORTH, vûrt, village in Alsace, France, at the confluence of the Sauerbach and Sulzbach rivers, 10 miles southwest of Weissenburg. Here the French under Marshal MacMahon on Aug. 6, 1870 met their first great defeat in the Franco-German War. Pop. (1946) 1,165.

WORTHEN, wėr'thĕn, **William Ezra,** American civil engineer: b. Amesbury, Mass., March 14, 1819; d. New York, April 2, 1897. After graduation from Harvard in 1838, he began the practice of civil engineering, and until 1848 was employed chiefly with surveys connected with the Boston water supply, and in other hydraulic works. He became chief engineer of the New York and New Haven Railway, and in 1854 its vice president. After 1854 he was busily employed as a practising and consulting engineer, being frequently retained as an expert in matters relating to the planning, construction or improvement of sewage and water systems. He was chief engineer of the first rapid transit commission of New York, and in 1890–1891 chief engineer of the Chicago main drainage canal.

WORTHING, wėr'thĭng, borough, England, a watering place in Sussex, 47 miles south of London, with good streets, handsome terraces, crescents, and villas, splendid hotels, baths, smooth sands and a beautiful esplanade. Industries include metalworking and pharmaceutical products. Fruit and flower growing under glass is an important industry of the town. Pop. (1951) 69,375.

WORTHINGTON, wûr'thĭng-tŭn, **Henry Rossiter,** American inventor: b. New York, Dec. 17, 1817; d. Tarrytown, N. Y., Dec. 17, 1880. In 1840 he began a series of experiments with steam for the propulsion of canal boats, soon afterward devised a small steam pump to be used in the maintenance of the water supply in the engine boiler, and in 1841 patented an independent feed pump which developed into the direct-acting steam pump which he patented in 1849. Subsequently he built in Savannah, Ga., the first direct-acting compound-engine ever used in waterworks; invented the duplex steam feed pump, and devised various improvements in steam and hydraulic machinery.

WORTHINGTON, Thomas, American public official: b. Charleston, Va. (now W. Va.), July 16, 1773; d. New York, N. Y., June 20, 1827. A member of Ohio's territorial House (1799–1803) and the state's General Assembly (1803; 1807–1808), he was one of Ohio's first United States senators. Resigning his Senate seat in 1814, he assumed the governorship, and was re-elected in 1816. He was responsible for founding the state library, served two terms in Ohio's House of Representatives, and was a strong advocate of a state-supported school system.

WORTHINGTON, city, Minnesota, Nobles County seat; altitude 1,593 feet; 186 miles southwest of Minneapolis, on the Chicago, Rock Island and Pacific, and the Chicago and North Western railroads, and on two federal and one state highways. It has a public library, radio station, municipal hospital, airport and municipally owned electric and water utilities, and a mayor and council. Worthington Junior College is here. The city was established in 1871 as a prohibition colony and was first known as Okabena. Pop. (1950) 7,923.

WOTHERSPOON, William Wallace, American military officer: b. Washington, Nov. 16, 1850; d. there, Oct. 21, 1921. He was commissioned in the army in 1873, and saw campaign service in the Indian wars and the Philippine Insurrection. Returning to the United States in 1903, he was made assistant commandant of the service schools at Fort Leavenworth, Kansas. Appointed chief of staff of the army in April 1914, he retired with rank of major general in November 1914.

WOTTON, wŏt"n, Sir **Henry,** English diplomat and poet: b. Boughton Malherbe, Kent, March 30, 1568; d. Eton, December 1639. He was educated at Oxford, and having studied civil law under an eminent Italian professor, became proficient in the Italian language. He visited all the principal countries of the Continent 1589–1597, and on his return was secretary to the earl of Essex. On the fall of that nobleman he went to Florence, where he composed a treatise, printed after his death, entitled *The State of Christendom.* The grand duke of Tuscany having intercepted some letters disclosing a plot to take away the life of James, king of Scotland, engaged Wotton to carry secret intelligence of it to that prince. This service he ably performed in the character of an Italian, and when James came to the English crown he sent for Wotton, knighted him and in 1604 employed him as an ambassador to the Republic of Venice. As Wotton passed through Augsburg, being desired to write in an album, he wrote in Latin that "an ambassador is a good man, sent to lie abroad for the good of his country." This innocent sally was represented as a state maxim sanctioned by the religion of the king of England. James I, who thought nothing relative either to kingcraft or state-craft a subject for wit, was highly displeased; and on his return Wotton had to make humble apology. At length he recovered the royal favor, and was restored to his former post at Venice (1616–1619). Other missions followed, and in 1624 he was made provost of Eton College. The first fruits of his leisure were his *Elements of Architecture.* A collection of miscellanies was published after his death entitled *Reliquiae Wottonianae.* This collection includes several poems by Wotton, of which two, *The Character of a Happy Life* and *On His Mistress, the Queen of Bohemia,* are among the finest lyrics in the English language.

Consult *Lives* by Izaak Walton (1651) and A. W. Ward (1899), and More, P. E., *Shelburne Essays* (Fifth Series, New York 1908).

WOTTON, William, English scholar: b. Wrentham, Suffolk, Aug. 13, 1666; d. Buxted, Essex, Feb. 13, 1726. He had acquired a remarkable knowledge of Latin, Greek and Hebrew at the age of 10, was graduated at St. John's College, Cambridge, in 1679, and was elected a Fellow there. He was later ordained, held various livings, and was a prebend of Salisbury Cathedral from 1705 until his death. He was prominent in the controversy concerning the respective merits of ancient and modern languages, taking the side of the moderns. He ably defended his views in *Reflections Upon Ancient and Modern Learning* (1694, 1697), which was subjected to an attack by Swift in *The Battle of the Books.* He was also author of *History of Rome* (1701); *Traditions and Usages of the Scribes and Pharisees* (1718), and he left an unpublished translation from the Celtic of the laws of Hywel Dda (1730).

WOUND, a disruption of continuity of an external or internal surface of the body caused by an instrument. Wounds are classed as to character under many heads such as *cutting,* when due to a sharp instrument, *contused* when produced by a blunt one, *incised* when caused by a sharp pointed weapon, *penetrating* when due to the piercing of the wall of a cavity and entering an organ, *lacerated* when the tissues are torn. Other types have received their names from the weapons used such as *gunshot,* made by the projectile of any small arm (pistol or rifle), *shell wounds,* usually lacerated and the result of artillery fire. In general wounds fall into two main classes as to causation, those that are accidental, homicidal, or suicidal and resulting from violence, and those that are intentional and incident to surgical operative procedures.

Healing and Management of Wounds.—In practice every wound is regarded in the light of how best to effect its healing. Wound repair is dependent upon the activity of growth of living cells. When healing is complete cell growth ceases. The presence of necrotic tissue, debris, and foreign bodies retards healing. Likewise undue motion of the parts about a wound, especially joint motion, disturbs the young cells, inviting minute hemorrhages, this in turn rendering infection likely, with consequent death of immature cells. An adequate blood supply is essential for wound repair and an absolute requisite in wound closure following operative procedure. Continued bleeding in the depth of a wound may be disastrous for it separates tissue planes and increases the cellular repair necessary to bridge the gap. It also provides a medium of blood plasma and clot in which bacteria will multiply. All wounds require a certain amount of granulation tissue for healing. In a clean wound with well approximated edges the amount of granulation tissue necessary to cover the gap with epithelium will be small, while in one with widely separated edges it will be considerable (second intention). The greatest menace to wound healing is the presence of bacteria. All wounds, including many of those made by the surgeon under the best aseptic conditions, will harbor some bacteria on their surfaces and no wound can be guaranteed aseptic. The objection to using antiseptics in wounds is that such agents, if capable of killing bacteria, will also be certain to damage or destroy young tissue cells. The sulfonamides, penicillin, and other antibiotics are not regarded as antiseptics in the generally accepted sense. The extent to which they may be used locally as preventives of infection is often a matter of individual opinion, but their use systemically is not open to question. In a planned operative wound, closure should be made and a dressing applied when bacterial infection is at a minimum and bleeding is at a standstill. If the wound is traumatic and newly made, all devitalized tissue is removed together with surface bacteria. In a wound presumably infected care should be observed to avoid opening up channels to widespread infection through unnecessary cutting operations. In such a wound, drainage is often indicated and, if no more than a few hours have elapsed, healing without serious infection may be expected. After 12 hours all wounds are presumably infected and should be so treated. Large areas denuded of epithelium may be impossible to close and may require skin grafting later. In some cases, a skin graft may be avoided by secondary suture which cuts short an unnecessarily protracted period of healing.

Treatment of Specific Varieties of Wounds.—The ordinary wound, which on examination appears superficial and without any important blood vessel or nerve being severed, may be

sutured at once after surgical cleansing. If a large artery or vein has been cut it must be tied before closure and if the wound edges are damaged they will have to be trimmed. If a nerve trunk has been divided, as occurs fairly often in stab wounds, the original wound must be enlarged and the nerve ends sought for in order to suture them (nerve suture). The nerves most often involved are the cranial, brachial plexus, median, ulnar, sciatic, and peroneal. If a cut nerve is not sutured a permanent paralysis of the muscles supplied will result. A deep stab wound is not necessarily serious unless it involves a vital organ or one of the great blood vessels but any wound penetrating the abdominal cavity demands immediate exploration with repair of the damage done to intra-abdominal organs. Stab wounds of the chest may cause alarming hemorrhage from divided intercostal arteries. Wounds of the heart are not infrequent, both in civil and military practice; in a large percentage of these wounds suture is possible, with a surprising recovery rate, about half of those operated on. A contused wound may present a special problem. If the skin is viable it may be wise not to open the wound. If damage is so great that a slough is inevitable it is best to proceed as with any open lacerated wound, that is, the skin edges are excised along with any dead tissue and the wound washed with salt solution before closing. In all scalp wounds it is essential to save as much tissue as possible so as to permit closure without tension. In extensive lacerated wounds of the extremities, tendons are often severed which will require painstaking repair. Bullet wounds in civil practice are produced mostly from rifles, revolvers and shotguns. Wadding and pieces of clothing may be carried deep into the wound. Bullet wounds should not be probed. Where the abdominal cavity is involved immediate operation is mandatory. In most wounds antitetanus vaccine is advisable if the individual is unprotected. Antibiotics such as penicillin have a wide use in combating infection.

Battle Wounds.—These include almost every type of injury. Most have been already defined, being similar to those encountered in civilian life and differing only in distribution and causation. The causative agents are small arms, grenades, explosive shells, bayonets, and incendiary material. Their care and treatment involves no departure from accepted surgical methods and standards maintained in civil practice. Military surgery is the surgery of trauma encountered on the battlefield, in what might be called epidemic proportions. Battle statistics reveal that out of every 100 casualties about 15 are wounded men. See also SURGERY.

HAROLD WELLINGTON JONES, M.D.

WOUWERMAN, vou'vĕr-män, **Philips,** a Dutch painter: b. Haarlem, May 1620; d. there, May 19, 1668. He was instructed by his father, an indifferent artist and by Wynants of Haarlem, in which city his life was passed. According to the commonly received account, his reputation as a painter during his life was small. After his death his pictures rose immensely in value, and he is now one of the most esteemed painters of the Dutch school. In consequence, it is said, of the disgust with which this neglect inspired him, he destroyed before his death all the studies he had made during his life, from fear that his son might be induced by the possession of them to become a painter. His subjects consist for the most part of roadside scenes and hunting or battle pieces, and it is commonly believed that he never painted a picture without a white or gray horse as a conspicuous object. His technical qualities are of a high order and his skies, foregrounds and foliage are executed in the best style of his school. He left upward of 800 carefully finished pictures. Those offered for sale always bring high prices, and in 1892 his *Halt of a Sporting Party* was sold for $18,375. The best collection of his works is in the Royal Gallery of Dresden. There are also fine examples in the Louvre, and in Munich, Vienna, Petrograd, Amsterdam, The Hague, Rotterdam, etc.

Consult De Groot, C. Hofstede, *Catalogue Raisonné of the Works of the Most Eminent Dutch and Flemish Painters of the 17th Century* (new ed., 1909).

WOVEN FURNITURE. See WICKER WEAVING AND PRODUCTS.

WOVOKA, wō-vō'kà (English name, JACK WILSON), Piute Indian mystic: b. Mason Valley, Nev., about 1856; d. 1932. He was left an orphan at the age of 14, and became a member of the family of David Wilson, a white man, from whom he received his English name. In 1888 or 1889, while in delirium from an illness he had what he described as a revelation to the Indians from the Great Spirit. He established himself as a prophet, foretelling the time when the old Indian life would be restored as it had been before the coming of the whites. Among the principles he put forth in his preaching were the equality of women in ceremonial affairs, the abolition of tribal warfare and the war dance, property distribution, and undue grief at funerals. He became most widely known among the various tribes by the institution of the Ghost Dance which the Indians generally adopted. The dance reached its greatest popularity in about a year's time after which, largely because of the Sioux outbreak (1890–1891), and the action of the United States government, the excitement quickly subsided. Wovoka's influence waned to negligibility upon the failure of his prophecies.

WRANGEL or **WRANGELL,** vrän'gyĕl, Angl. răng'gĕl, BARON **Ferdinand Petrovich von,** Russian explorer: born St. Petersburg (now Leningrad), Russia, of Swedish parents; d. Dorpat, Estonia, June 6, 1870. He studied at the Naval Academy of St. Petersburg and in 1820–1824 directed a Polar expedition to explore eastern Siberia and the region north of Asiastic Russia. By sledge journeys undertaken in 1822 and 1823 he reached latitude 72° 2′ north, but he found no trace of the reported land for which he was searching after being first reported by native Siberians. This was discovered later by G. W. De Long in 1867, and is now known as Wrangel Island. In 1829–1834 Wrangel was governor general of Russian-America and in 1840–1849 director of the Russian-American Company. He attained vice admiral's rank in the navy. In 1855–1858 he was acting minister of marine, and subsequently a councillor of state. He opposed the sale of Russian-America to the United States. His account of his Polar expedition appeared in Russian in 1844. An account in German was prepared from Wrangel's journals (1839), and an English translation was made by Sabine,

'Wrangell's Expedition to the Polar Sea' (1840). Consult Von Engelhardt, 'Ferdinand von Wrangel und seine Reise' (1885) and Sabine (ed.) 'Narrative of an Expedition to the Polar Sea in 1820–23' (London 1840).

WRANGEL, Karl Gustaf von, Count, Swedish general: b. Skokloster, on Lake Maelar, 13 Dec. 1613; d. Isle of Rugen, 24 June 1676. He accompanied Gustavus Adolphus in his expedition to Germany, and at the battle of Lützen, in 1632, rendered great services after the fall of the king. In 1641 he was one of the major-generals who commanded the Swedish forces until the arrival of Torstenson, and under him participated in the campaign in Germany, and the famous march of Holstein. After the death of Flemming in 1644 he received the supreme command of the Swedish fleet, and obtained over the Danish fleet a great naval victory on 13 October, between the islands of Femern and Laaland. In 1646 he succeeded Torstenson as commander-in-chief of the Swedish army, effected a junction at Geissen with the French forces under Turenne, with whom he crossed the Main and besieged Augsburg, which, however, was relieved by the Austrian army. In 1648 the Swedes and French defeated the Austrians and Bavarians near Zusmarshen, but retired before the army of Piccolomini. Wrangel commanded under Charles X in the campaigns in Poland (1655) and Denmark (1657–59), and in 1674 led an army of 16,000 men into the electorate of Brandenburg. Ill health obliged him to relinquish this command before the conclusion of the campaign.

WRANGEL (răng'gĕl) **LAND,** or **NEW COLUMBIA,** an island in lat. 71° 32" N., and long. 178° W.; in the Arctic Ocean, about 100 miles off the coast of Siberia and 300 miles from the coast of Alaska. It is about 75 miles long and 20 miles wide. It consists chiefly of bare rocks which rise to a height of 2 000 feet. At the base and in places near the shore line there is some vegetation. The first mention of an island in this locality was made about 1810, and in 1821 Ferdinand, Baron Wrangell, the Russian explorer, commanded an expedition in search of this land. Long, the American explorer, sighted the island in 1867, and Hooper, also an American, visited it in 1881, and took possession of it for the United States. He named the island New Columbia. Consult Hooper, Rosse, Muir and Nelson, 'Cruise of the Corwin' (Washington 1893).

WRANGELL, Alaska, town, on Wrangell Island, near the mouth of the Stikine River, 160 miles south of Juneau. A Russian settlement here in 1833 was named for Baron Ferdinand von Wrangell, Arctic explorer. There is fine hunting and fishing for sport, but commercial fishing is more important, with a cold storage plant and canneries of salmon, shrimp, and crab. It has airplane and steamer transportation. There is mining and fur farming near by. Bishop Rowe Hospital and Wrangell Institute (U. S.) are here. Pop. (1930) 948; (1939) 1,162.

WRANGLER, Senior, a term applied previous to 1909 in the University of Cambridge, England, to the undergraduate who passed the best public mathematical examination for the bachelor's degree. The candidates for honors were arranged in order of merit in three lists or classes, of which the highest was called that of wranglers, the next that of senior optimés, and the lowest that of junior optimes — the whole constituting what was known as the mathematical tripos. Hence the senior wrangler or the highest in the list of wranglers was the most distinguished mathematician of the year. Since 1909 the results of the examination have been published with the names in alphabetical order.

WRASSE, a fish of the family *Labridæ* (q.v.), of which the best known representatives in America are cunners, doncellas, ladyfishes, tautogs, etc.

WRATTISLAW, răt'ĭs-lâ, **Arthur Henry,** English scholar: b. England, of Bohemian parentage, about 1822; d. 1892. He was graduated from Cambridge in 1844, was headmaster of Felstead Grammar School 1849–57, and of that at Bury Saint Edmonds 1857–79, and was vicar of Manorbier, Pembrokeshire, Wales, 1879–87. He was the leading Slavonic scholar of his day in England, and among his important publications are 'Lyro Czecho-Slavonska' (1849); 'The Queen's Court MSS. with Other Ancient Bohemian Poems' (1852); 'Life, Legend and Canonization of Saint John Nepomuk' (1873); 'Native Literature of Bohemia in the 14th Century' (1878); 'Sixty Folk Tales from Exclusively Slavonic Sources' (1889).

WRAXALL, răk'sąl, Sir **Nathaniel William,** English historian: b. Bristol, 8 April 1751; d. Dover, Kent, 7 Nov. 1831. He was in the East Indian Civil Service, 1769–72, and during the course of some seven years of foreign travel was a confidential agent of Queen Caroline Matilda of Denmark to her brother, George III (1774–75). He published 'Cursory Remarks Made in a Tour' (1775); 'Memoirs of the Valois Kings' (1777); 'History of France from Henry III to Louis XIV' (1795); 'Memoirs of the Courts of Berlin, Dresden, Warsaw, and Vienna' (1799), and the famous 'Historical Memoirs of My Own Time, from 1772 to 1784' (1815). For a libel in the last on Count Woronzov, Russian envoy to England, Wraxall was fined $2 500 and sentenced to six months' imprisonment. He is an amusing writer, but his veracity has been many times questioned. He sat in Parliament for 14 years from 1780 and was knighted in 1813. Consult his 'Posthumous Memoirs,' continued from 1784 to 1790 (1836).

WRAY, John. See Ray, John.

WRECK, that which is cast or driven ashore by the waves, the goods, broken timbers, plates, etc., cast ashore from a ship that has been broken up, destroyed or rendered helpless at sea, as by collision, tempest, etc. In maritime law the term means the goods cast ashore by the waves after shipwreck, and left there within the jurisdiction of some country, and subject to common law. A ship also is a wreck when she is rendered unable to pursue her voyages without repairs exceeding half her value. A sunken vessel is not a wreck, but a derelict. In the United States laws have been enacted by the several States bordering on the sea and on the Great Lakes for the safe-keep-

ing and proper disposition of wreck. Goods found at low-water mark, or between high- and low-water mark, whether resting or partly resting on the ground, are wrecks, and, if not reclaimed, belong to the owner of the shore. See SALVAGE; MARINE INSURANCE.

WRECKAGE, *in navigation,* is usually understood to mean any ship or goods driven ashore or found floating at sea in a deserted or unmanageable condition. *In law,* wreckage is defined as such articles of value as are cast upon land by the sea, and includes jetsam, flotsam, ligan and derelict. In most countries any person found stealing or destroying any wreck is chargeable with felony; and a person proved to be in possession of shipwrecked goods, or who offers such goods for sale, may be fined or imprisoned. See WRECK.

WREN, rĕn, SIR **Christopher,** English architect: b. East Knoyle, Wiltshire, 20 Oct. 1632; d. Hampton Court, Berkshire, 25 Feb. 1723. He entered as a student at Wadham College, Oxford, in 1646, having previously given proofs of genius by the invention of astronomical and pneumatic instruments. In 1647 he wrote a treatise on spherical trigonometry upon a new plan, and the following year composed an algebraical tract on the Julian period. He was one of the earliest members of the Philosophical Society at Oxford, which was the origin of the Royal Society, after the institution of which, in 1663, he was elected a Fellow and distinguished himself by his activity in promoting the objects of that institution. In 1657 he was appointed professor of astronomy at Gresham College, but, being nominated to the Savilian professorship of astronomy at Oxford, resigned the former office, and in 1661 returned to the university. He received a commission in 1663 to prepare designs for the restoration of Saint Paul's Cathedral, then the largest Gothic edifice in the kingdom. While his designs were under consideration the cathedral was destroyed by the fire of 1666, and Wren had now an opportunity for signalizing his talents by the erection of an entirely new structure. In 1668 he succeeded to the office of surveyor of works, resigned his Savilian professorship in 1673, in 1674 received the honor of knighthood; and in the following year the foundation of the new cathedral was laid. In 1680 he was chosen president of the Royal Society. In 1683 he was appointed architect and one of the commissioners of Chelsea College; and the following year controller of the works at Windsor Castle. He was elected member of Parliament for Plympton in 1685, and to his public trusts were added in 1698 that of commissioner for the repair of Westminster Abbey, and in 1699 that of architect of Greenwich Hospital. In 1700 he represented in Parliament the boroughs of Weymouth and Melcombe Regis. In 1708 he was made one of the commissioners for the erection of 50 new churches in and near the city of London. After having long been the highest ornament of his profession he was, in 1714, deprived of the surveyorship of the royal works from political motives. He was then in the 85th year of his life, the remainder of which was devoted to scientific pursuits and the study of the Scriptures. His remains were interred under the choir of Saint Paul's Cathedral, and over the choir entrance was placed the following inscription (since removed to another part of the church):

Subtus conditur
Hujus Ecclesiæ et Urbis Conditor,
Christ. Wren;
Qui vixit Annos ultra nonaginta,
Non sibi sed Bono publico.
Lector, si Monumentum quæris,
Circumspice.

(Beneath is laid the builder of the church and city, who lived above ninety years, not for himself but for the public good. Reader, if thou seekest his monument, look around).

The edifices constructed by Wren were principally public, including a royal hunting seat at Winchester and the modern part of the palace at Hampton Court. Some of the most remarkable of his buildings, besides Saint Paul's, are the monument on Fish Street Hill, the theatre at Oxford, the library at Trinity College, Cambridge; the hospitals of Chelsea and Greenwich; the church of Saint Stephen's, Walbrook; those of Saint Mary-le-Bow, Saint Michael, Cornhill and Saint Bridge, Fleet street; and the great campanile of Christ Church, Oxford. The Royal Exchange and Custom-house, since destroyed by fire and re-erected, were among his works. As an architect he possessed an inexhaustible fertility of invention combined with good natural taste and profound knowledge of the principles of his art. His talents were particularly adapted to ecclesiastical architecture but in his palaces and private houses he sometimes achieved monotonous results, as at Hampton Court. The interior of the church of Saint Stephen's, Walbrook, which has been considered as his *chefd'œuvre,* exhibits a deviation from common forms equally ingenious and beautiful, and Saint Paul's Cathedral may be fairly reckoned among the most magnificent productions of architectural genius. Yet the works of Wren have not passed without censure. Even in Saint Paul's, while the grandeur of the whole work is admitted, many faults, and especially waste of interior space, are charged against him. Consult 'Parentalia, or Memoirs of the Family of the Wrens' (1750); Elmes, 'Sir Christopher Wren and His Times' (London 1823); Clayton, 'Churches of Sir Christopher Wren' (London 1848); Milman, 'Annals of Saint Paul's Cathedral' (1868); 'Life,' by Phillimore (1883); Loftie, 'Inigo Jones and Wren' (New York 1893); Marshall, 'Under the Dome of Saint Paul's' (1899); Dimock, 'Handbook of Saint Paul's Cathedral' (1900).

WREN, a family (*Troglodytidæ*) of passerine birds, having a slender, slightly curved and pointed bill, with the exposed nostrils partly concealed by a scale, the wings very short and rounded, with nine well developed and the first short primaries, the tail short and often carried erect; the legs are robust and rather long. They are abundant in the neotropical region, less common in the nearctic, and only a few occur in the Old World in Europe, Asia and Sumatra, those of the latter region being more or less aberrant. The known species exceed 100 and are arranged in about 15 genera, several of which are confined to tropical America. North America has six genera and 14 species. Closely related to the wrens are the mocking thrushes, which some ornithologists place in the same family, and the creepers (*Certhiidæ*). The wrens are plain little birds

usually clothed in modest browns and seldom exhibiting bright colors of very conspicuous markings. They are insectivorous and mostly migratory, though particular species may inhabit either warm or cold regions. Their haunts are mostly brush piles, tangled roots, stone walls and similar places, where they pry into every nook and cranny; they enter holes and reappear in another place in very mouselike fashion; and are altogether very sprightly little creatures. Their songs are wonderfully loud and vehement for such small birds, but differ characteristically for each species. Although the nests vary greatly in their location, which is most often a hole of some sort, they are always more or less spherical in construction. Few passerine birds are more prolific, the eggs numbering from five to 10, and many of the species producing several broods.

Few birds are more familiar in the United States than the house-wren (*Troglodytes aëdon*). It is about five inches long. The color is very uniform, reddish brown above, barred with dusky, and pale fulvous white below. It often builds its nest near houses and in boxes prepared for it or in any convenient hole. The nests are made to fill the boxes; and to effect this a large mass of heterogeneous materials is sometimes collected. From six to eight eggs constitute a brood and two or three broods are produced in a summer. The eggs are so thickly spotted with brown that they appear to be almost uniformly colored. The song is extremely rapid and vivacious as though the performer were overflowing with good spirits. The male is a very bold, pugnacious bird, readily attacking birds far larger than itself, as the bluebird and swallows, and taking possession of the boxes which they have appropriated for their nests. It even attacks cats when they approach its nests and vigorously scolds all intruders.

The winter wren (*T. hiemalis*) is our smallest species of wren, only about four inches long, and the ridiculous little tail is usually cocked straight up into the air. Above, the color is a rich dark brown; below it is much lighter, both regions prettily barred. The typical form inhabits most of eastern North America, the Canadas, and northernmost United States during the summer and the rest during the winter.

Of the genus *Cistothorus,* or marsh-wrens, we have three species, of which one (*C. marianae*) is a Florida form. See MARSH-WREN.

Thryothorus comprises the mocking wrens, of which *T. ludovicianus,* the great Carolina wren, is the best known Eastern species and the largest of the wrens of this region. It is six inches long, of which the tail is two and one-third inches, about equaling the wings. It is nearly uniform bright reddish brown above with yellowish white under parts, a conspicuous white superciliary streak and the wings and tail cross-barred with black. Bewick's wren (*T. bewickii*) is a related species very abundant in the interior southward, while a number of other species and subspecies of the same genus are found in the West and Southwest. In the latter region also, as well as in Mexico, and southward, occur several large wrens which have broad spreading tails composed of somewhat cuneate feathers. Among these are the cactus wrens (q.v.), which build purse-shaped nests in bushes in the desert regions of Texas, California, etc., and the rock-wrens and cañon-wrens (qq.v.), which live and nest in rocky places. They have loud ringing songs. In Europe are several species of *Troglodytes,* of which the beloved common or jenny wren (*T. parvulus*) is found in all parts of Europe, and in Morocco and Algeria, and in Asia Minor and northern Persia. In central Asia it is represented by *T. pallidus,* in Iceland and the Faroes by *T. borealis* and in Norway by *T. bergensis.*

Consult Baird, Brewer and Ridgway, *Land Birds of North America* (Boston 1874); Sharpe, *Catalogue Birds of the British Museum* (Vol. VI, London 1881); Coues, Elliott, *Birds of the Colorado Valley* (Washington 1878); Forbush, E. H., *Useful Birds and their Protection* (Boston 1913); and *Bulletin 30, United States Biological Survey.*

WRESTLING. Greek legend ascribes the invention of wrestling to Theseus. Homer sang of it in the *Iliad,* and it has been estimated that ancient Egyptian monuments contain figures showing over 1,000 holds. About 708 B.C. wrestling was introduced into the Olympic Games as part of the pentathlon, the wrestler attempting to throw his opponent to the ground while remaining on his feet himself. The pancration, introduced in 648 B.C., was a rough and tumble fight with only biting forbidden and lasted until one contestant acknowledged defeat.

One of the earliest English sports records concerns matches held in 1222, but probably wrestling's pinnacle was reached in 1520, when King Henry VIII challenged Francis I of France to a bout and was thrown by him. The rules governing the original Loose style are obscure, but apparently it resembled the Cumberland and Westmoreland style, in which the hands were clasped around the body and a wrestler was defeated when any part of his body other than his feet touched the ground. Under the Devonshire and Cornwall rules contestants wore jackets on which holds were taken, the object being to throw an opponent to the ground so that he lit on two shoulders and a hip or both hips and a shoulder. The Lancashire style was the direct ancestor of the present catch-as-catch-can wrestling. This is by far the most popular in the United States and the British Commonwealth, the earlier forms now being of historic interest only.

Under Intercollegiate rules the objective is to gain a fall, and a fall is gained by pinning the opponent's shoulders to the mat for two seconds. When no fall is gained the wrestler showing the most aggressiveness and wrestling skill is awarded the decision. A bout lasts nine minutes, but in case of a draw two additional two-minute periods are wrestled. Strangling, butting, holds for punishment alone and grips considered dangerous to life and limb, such as the full nelson, toe hold, etc., are forbidden. It is illegal to slam an opponent to the mat unless the slammer has one knee on the mat. The Free style rules used in the Olympic Games require only a momentary touch of the shoulders to gain a fall, a match may last fifteen minutes, and a point scoring system is employed. Illegal holds are essentially the same as those prohibited by the Intercollegiate code, with the addition that use of scissors holds is forbidden. Other more minor differences also exist. To train American wrestlers for Olympic competition, the A.A.U. rules have been drawn quite similar

to the Free style, differing principally in that a one second fall is required.

Professional wrestling unfortunately has largely degenerated into a prearranged display of rough and tumble acting. In 1945 at least five different «World's Heavyweight Champions» were recognized in various sections of the country.

On Continental Europe the Graeco-Roman style (which has no connection with the Greeks and Romans and is primarily a codification by the French) is the most popular. All holds must be taken above the waist, and the use of the legs for tripping or holding is forbidden. A fall is gained when both of the opponent's shoulders touch the mat at the same time. The emphasis on the use of the upper body requires that successful wrestlers be men of great strength above the waist, and this style has never been popular in English speaking countries.

Hindu wrestling resembles Free style, but in Japan two distinct styles developed. The first sumo match reputedly took place 7 July 22 B.C. Originally the object was to kill the opponent or force his surrender, but the more dangerous holds were eliminated in the 8th century. Every detail of sumo is surrounded with elaborate ritual. Matches are held in a ring slightly over fifteen feet in diameter. A wrestler is defeated when any part of his body except his feet touches the ground, or when he is forced out of the ring. While matchings are by skill alone, weight is extremely advantageous, and the professionals are usually huge, occasionally exceeding six feet in height and 300 lbs. in weight.

Japanese tradition relates that jiu jitsu was introduced by the gods Kajima and Kadori; Occidental scholars incline to the more prosaic opinion that its elements were imported from China during the Ming dynasty (1368–1644). Forbidden to defile their swords on commoners, the samurai developed it as a means of defense against their inferiors or when unarmed. So efficient did this deadly art become that a contestant could never be sure of returning home alive. The resultant effect on its popularity was so serious that by the 19th century it had fallen into disrepute.

In 1882 Professor Jigoro Kano founded his Kodokan School of Jiudo, so refining or eliminating the objectional features that it became a popular sport. He has defined jiu jitsu as «the art or practice of gentleness or of first giving way in order to gain final victory» and jiudo as «the principle of the same.» Great stress is placed on the emotional, intellectual and moral development attributed to the sport.

Reflecting its self-defense origin, contestants wear the kimono, short trousers and belt of the early Japanese costume. Grips are taken on the clothing, and a good deal of the effectiveness of the art is lost against one not so clad. The wrestlers are divided into several grades according to ability and are matched by skill, not by weight as in Western wrestling. The proficiency of the participant is indicated by the color of his belt. A fall may be gained by throwing an opponent once cleanly, twice in a slovenly manner, by forcing him to give up, or by pinning him in one of certain positions for a given time. Only wrestlers of the fifth grade and above are permitted to use dangerous grips and then only against each other. Scissors holds are not permitted, but choking is allowed. Although bouts between wrestlers and jiu jitsuns have not been conclusive, the Japanese found their original expectation that judo would enable their wrestlers to win Olympic competitions was not fulfilled, and prior to World War II, imported westerners to teach Free style in preparation for these events.

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WREXHAM, rĕks'ăm, North Wales, a market town in the county of Denbigh, 12 miles south of Chester, in a district containing coal, lead, and iron. It is a station on the Great Western and Great Central railways, 201 miles from London, and has several churches and other places of worship, schools, a guildhall, infirmary, barracks, market-halls, public baths, electrical works, and a free library. The restored parish church, dedicated to St. Giles, was erected between the 14th and 16th centuries. It is the seat of a Roman Catholic bishopric. In St. Giles' churchyard is the tomb of Elihu Yale, founder of Yale College, New Haven, Conn., U.S.A. Pop. (1940) 25,740.

WRIGHT, SIR **Almroth Edward,** British physician and pathologist: b. Middleton Tyas, Yorkshire, Aug. 10, 1861; d. Farnham Common, Buckinghamshire, April 30, 1947. Educated at Dublin University and the universities of Leipzig, Strasbourg, and Marburg, he developed a method of preparing the serum for antityphoid inoculation in 1896. This method gained international acceptance after he had arranged for its use among British troops during World War I. He was knighted in 1906, and served as principal of the Institute of Pathology and Research at St. Mary's Hospital, London, from 1902 to 1946.

WRIGHT, Carroll Davidson, American statistician and sociologist: b. Dunbarton, N. H., July 25, 1840; d. Worcester, Mass., Feb. 20, 1909. After studying law, he enlisted in the 14th New Hampshire Volunteers at the outbreak of the Civil War, and in 1864 became its colonel. In 1865 he was admitted to the bar at Keene. He was appointed first commissioner of the U.S. Bureau of Labor in 1885, and president of Clark College. (Worcester, Mass.) in 1902. He was president of the American Statistical Association (1897–1909) and recorder of the commission appointed to arbitrate in connection with the anthracite coal strike in the fall of 1902. Besides numerous contributions to periodicals, he published *The Industrial Evolution of the United States* (1895) and *Outlines of Practical Sociology* (1899).

WRIGHT, Elizur, American abolitionist; b. South Canaan, Conn., Feb. 12, 1804; d. Medford, Mass., Nov. 21, 1885. He was graduated at Yale in 1826, was professor of mathematics in Western Reserve College (1829–1833), and became identified with the antislavery movement in 1832. He then removed to New York, where he edited the *Quarterly Anti-Slavery Magazine* (1835–1837), and was at the same time secretary of the American Anti-Slavery Society. Removing to Boston in 1838 he there edited the

Massachusetts Abolitionist, the *Daily Chronotype* (1845), and *The Commonwealth,* its successor (1850). He published *Savings Banks Life Insurance* (1872); *The Politics and Mysteries of Life Insurance* (1873), etc., and was (1858–66) insurance commissioner of Massachusetts. He wrote an introduction to Whittier's poems (1844), and published a translation of *La Fontaine's Fables* (1859).

WRIGHT, Fanny. See D'ARUSMONT, FRANCES.

WRIGHT, Frank Lloyd, American architect: b. Richland Center, Wis., 8 June 1869. In America, the architectural work of Frank Lloyd Wright has been characterized as «The New School of the Middle West,» and in Europe it has been described as «The American Expression in Architecture.» After studying civil engineering at the University of Wisconsin in 1884–88, he began practice at Chicago, Ill., in 1893, and thereafter won international distinction as architect of the Imperial Hotel in Tokyo, Japan, and many notable buildings in Europe and America. He was awarded honorary membership in architectural societies in the United States, France, Germany, and Brazil. He founded the group for cultural experiment in the arts, «The Taliesin Fellowship,» which meets annually at «Taliesin» in Wisconsin and Arizona. His books include: *An Interpretation of Japanese Prints, In the Cause of Architecture* (essays), *Modern Architecture, The Nature of Materials, An Autobiography—Frank Lloyd Wright, The Disappearing City, Architecture and Modern Life* (with Baker Brownell), and three volumes published in Europe.

WRIGHT, Harold Bell, American novelist: b. Rome, N.Y., 4 May 1872. He was engaged in the decorating business in 1887–92; was a landscape painter in 1892–97; and in 1897–1908 he was a pastor in the Christian (Disciples) Church. He later devoted himself wholly to the writing of fiction of great popular appeal. These include *That Printer of Udells* (1903); *The Shepherd of the Hills* (1907); *The Calling of Dan Matthews* (1909); *The Winning of Barbara Worth* (1911); *Their Yesterdays* (1912); *When a Man's a Man* (1916); *The Recreation of Brian Kent* (1919); *Helen of the Old House* (1921); *The Mine with the Iron Door* (1923); *A Son of His Father* (1925); *God and the Groceryman* (1927); *Long Ago Told* (1929); *Exit* (1930); and *To My Sons* (1934). D. La Jolla, Calif., 24 May 1944.

WRIGHT, Horatio Gouverneur, American military officer: b. Clinton, Conn., 6 March 1820; d. Washington, D.C., 2 July 1899. He was graduated at West Point in 1841, was superintending engineer of the building of Fort Jackson at Tortugas, Fla. (1846–56); lighthouse engineer in Florida (1852–53); and assistant to the chief of engineers in Washington (1856–61). He was active throughout the Civil War, became brigadier general of volunteers in September 1861, and took command of the Department of Ohio in August 1862. He commanded a division at the battle of the Wilderness, a corps at Spottsylvania Court House and Cold Harbor, 3 June; served as major general at the battle of Opequon Creek, 19 Sept. 1864, and contributed to the decisive victory at Cedar Creek, 19 Oct. 1864. He was brevetted major general in the United States Army for his services at the capture of Petersburg, 13 March 1865, and was mustered out of the volunteer service, 1 Sept. 1866. He returned to regular army duty as lieutenant colonel of engineers becoming brigadier general and chief of engineers, 30 June 1879, retiring 6 March 1884.

WRIGHT, John Calvin, American vocational educator: b. Elkhart Co., Ind., 24 June 1876. Educated at the Kansas State Normal School and at the University of Missouri. In 1895 he began teaching, first in Kansas rural schools and then in city high schools. In 1913 he became director of vocational education at Kansas City, Mo., and in 1917 he joined the Federal Board of Vocational Education, of which he was a director, 1922–33, and then assistant commissioner. He has published *Automotive Repair* (4 vols.), and was co-author of several volumes on vocational education. He served during the Spanish-American War with the rank of corporal.

WRIGHT, Joseph, American artist: b. Bordentown, N.J., 16 July 1756; d. New York, 1793. He obtained his art education in England and Paris, in 1783 returned to America, and in that year painted a portrait of Washington. Subsequently he executed another for the Comte de Solms, and still later a miniature profile. Among his other portraits were those of Jay and Madison. In 1792 he was made first draughtsman and die-sinker in the mint newly established at Philadelphia. He was the designer of the first coins and medals struck by the government.

WRIGHT, Joseph, English philologist: b. 31 Oct. 1855. From 1891 to 1901 he was deputy-professor of comparative philology, Oxford University, professor until 1925, and then emeritus. His numerous publications include *Primer of the Gothic Language* (1899); *Middle High German Primer* (1888, rev. 1917); *Old High German Primer* (1888, rev. 1906); *English Dialect Dictionary* (1896–1905); *Old English Grammar* (1908, rev. 1925); *Grammar of the Gothic Language* (1910); *Elementary Old English Grammar* (1923); *Elementary Middle English Grammar* (1923); *Historical New English Grammar* (1924). Died, 27 Feb. 1930.

WRIGHT, Luke E., statesman, diplomat: b. Tennessee, 1846; d. Memphis, Tenn., 17 Nov. 1922. He took a prominent and active part in the affairs of his state, especially in Memphis, where he practiced law. For eight years he was attorney general of Tennessee, and during the epidemic of yellow fever in 1878 he did much to relieve the suffering. From 1900 to 1904 he served on the United States Philippine Commission, of which he was president in 1903–04. In the latter year he became civil governor of the Philippine Islands, and was appointed governor-general soon after. This position he held until 1906, when he became Ambassador to Japan, but resigned soon after to become Secretary of War (1908–09).

WRIGHT, Mabel Osgood, American writer on nature, daughter of Samuel Osgood (1812–80) (q.v.): b. New York 26 Jan. 1859; d. Fairfield, Conn., 21 July 1934. She was married in 1884 to J. O. Wright, and made her home in Fairfield, Conn. She was contributing editor to *Bird Lore,* and published *The Friendship of Nature* (1894); *Birdcraft*

(1895); *Dogtown* (1902); *The Garden, You and I* (1906); *The Stranger at the Gate* (1913); *My New York* (1926); *Captains of the Watch* (1927); *Eudor's Men* (1931).

WRIGHT, Marcus Joseph, American soldier: b. Purdy, Tenn., June 5, 1831; d. Washington, D. C., Dec. 27, 1922. He studied law, was admitted to the bar, and practiced his profession in Memphis until the outbreak of the Civil War when he entered the Confederate Army as lieutenant colonel of the 154th Tennessee Regiment. Promoted brigadier general in 1862, he was wounded at Shiloh. In 1878 he was selected by the Department of War as agent for the collection of Confederate records for the United States government. He wrote lives of Gen. Winfield Scott, Governor William Blount, Col. David Crockett, and Gen. John Peter Muhlenberg. With Gen. A. L. Long he was coeditor of *Memoirs of Robert E. Lee* (1886). He also prepared the sketches of Confederate generals in Appleton's *Cyclopedia of American Biography.*

WRIGHT, Orville, American aviator and inventor: b. Dayton, Ohio, Aug. 19, 1871; d. there, Jan. 30, 1948. Like his older brother and lifelong associate Wilbur (q.v.), his formal education ended with a high school course. It was Orville's prowess as a prize-winning amateur cyclist that suggested the brothers' second business venture in 1892, a bicycle sales and repair shop which was even more prosperous than their earlier printing house. So closely were the brothers associated in developing the airplane that in most cases it is impossible to give individual credit for the many details of invention; however, it was Orville's suggestion that an aviator could restore his machine's balance by varying the angles of the wing tips which became the basic claim of the original Wright patent, now incorporated in the aileron controls of every plane. The brothers' gliding experiments at Kitty Hawk, N.C., starting in September of 1900, were encouraged by Octave Chanute, the noted engineer, glider experimenter, and author of *Progress in Flying Machines* (1891). In 1901, Orville constructed the first wind tunnel, with which the brothers began testing more than 200 types of wing surfaces. On Dec. 17, 1903 at Kitty Hawk, Orville made the first self-powered airplane flight in history, against a 27-mile wind. In February 1908 the Wrights' bid of $25,000 to construct a biplane for the United States Army Signal Corps was accepted, and the following September, while his brother was in France, Orville began the official army tests of the new machine. All went well until the 13th flight when the machine crashed, fatally injuring Lieut. Thomas E. Selfridge and causing Orville a broken leg and several ribs. After a short convalescence he joined Wilbur in Europe where both received the highest honors. After closing a contract with the German Wright Company they returned home to receive more honors including medals presented by President Taft at the White House. Wilbur died in 1912. When the United States entered World War I, Orville was commissioned a major in the Signal Corps Aviation Service. In 1920–1921 he developed the split wing flap, much used by dive bombers in World War II. Not until 1942 did the Smithsonian Institution make tardy amends in conceding that the Wright brothers had designed the first practical airplane. The Kitty Hawk plane, loaned to the South Kensington Science Museum in 1928, was returned to the Smithsonian after Orville's death.

WRIGHT, Robert Ramsay, British biologist and educator: b. Alloa, Scotland, Sept. 23, 1852; d. Droitwich, England, Sept. 5, 1933. He was graduated at the University of Edinburgh in 1873 and the following year accepted an appointment as professor of natural history at University College, Toronto. Professor of biology at the University of Toronto from 1887 to 1912, for the last 11 years of this term he served also as vice president of the university and dean of the faculty of arts. He was a past president of the Canadian Institute, the American Association of Anatomists, and the Royal Society of Canada. He contributed many papers on the comparative anatomy of invertebrates to scientific journals. As professor emeritus he made his home at Oxford, England.

WRIGHT, Silas, United States senator and governor of New York: b. Amherst, Mass., May 24, 1795; d. Canton, N.Y., Aug. 27, 1847. In his early childhood his family moved to Weybridge, Vt., where he grew up on his father's farm and in due course entered Middlebury College, graduating in 1815. Admitted to the bar in 1819, he began practicing at Canton, N.Y. During the next decade he held several local offices and attained the rank of brigadier general in the militia. Elected state senator in 1823, he served until 1827. A staunch nationalist and Democrat, he voted for manhood suffrage and direct election of justices, yet held that boss leadership and the spoils system were necessary in the battle against special privilege. Taking his seat in Congress in 1827, he favored high protection and helped frame the 1828 "tariff of abominations," but in 1842 frankly admitted he had taken the wrong side of that issue. Though re-elected, he resigned (1829) to become comptroller of New York, which office he also resigned in 1833 to complete the senatorial term of William L. Marcy who had been elected New York's governor. Re-elected in 1837 and 1843, Wright was held in high esteem by his colleagues. Always master of his subject, a logical and powerful reasoner, and of unflinching integrity, Thomas Hart Benton called him the "Cato of the Senate." He opposed rechartering of the Bank of the United States, urged an independent treasury system and saw the bill passed in 1840. Refusing President Tyler's offer of a Supreme Court appointment in 1844, he resigned his seat to run for the New York governorship, carrying that state for Polk. As governor he alienated powerful banking and landlord interests by advocacy of liberal reform, and also lost popular support by his suppression of the antirent disturbances. Renominated in 1846, he was defeated by the Whig candidate. An antislavery man, though not an abolitionist, he supported the Wilmot Proviso. At his death he was being talked of for the presidency. Consult Gillet, R. H., *The Life and Times of Silas Wright* (2 vols., 1874).

WRIGHT, Thomas, English antiquary: b. Tenbury, Shropshire, April 23, 1810; d. Chelsea, London, Dec. 23, 1877. He was graduated at Trinity College, Cambridge, settled in London,

and devoted himself to the study of English history, literature and antiquities. He was one of the founders of the Camden Society, and of the British Archaeological Association, and was an active member of the Percy and Shakespeare societies. He edited numerous rare works connected with early English history and literature, and was author of many others including *The History of Ireland* (1857) and *Essays on Archaeological Subjects* (1861).

WRIGHT, Thomas, English biographer: b. Olney, Buckinghamshire, England, May 16, 1859; d. there, April 3, 1936. Educated at Buxton College, Forest Gate, he was for several years principal of the Cowper School at Olney. He founded the Cowper Society (1900) and wrote lives of such literary men as Cowper, Defoe, William Blake, and Charles Dickens.

WRIGHT, Wilbur, American pioneer aviator: b. Millville, Ind., April 16, 1867; d. Dayton, Ohio, May 30, 1912. Descendant in the paternal line of an old Massachusetts family and son of a bishop of the United Brethren Church, he grew up in Dayton, Ohio. His father, keenly interested in scientific developments, evinced mechanical talent as inventor of a crude typewriter. His mother, the Virginia born daughter of a German wagonmaker, was a college graduate, an excellent mathematician, and shared her husband's scientific bent; she encouraged their four sons to use her kitchen as a laboratory for experiments. With his younger brother Orville (q.v.), Wilbur in 1889 began publication of a four-page weekly, the *West Side News,* printed on a large press which they had constructed. Wilbur edited the paper; but though it soon became fairly profitable they discontinued publication a year later to concentrate on the more lucrative work of job printing. In 1892 the brothers, who continued partners in all their enterprises, opened a bicycle salesroom and repair shop; three years later they began manufacturing original bicycle models, making their own tools to save expense. The accidental death in 1896 of Otto Lilienthal (q.v.), whose gliding experiments they had followed with rapt interest, stimulated their efforts to solve the problems of aerodynamics. From the Smithsonian Institution they obtained a brief bibliography of flying and studied the few books and pamphlets then available, including works of L. P. Mouillard, Octave Chanute, and S. P. Langley. In 1899, Wilbur built a model biplane with a five-foot wing spread which he flew as a kite. In 1900, the inventors, advised by the Weather Bureau, established a camp on the sand bar between Albemarle Sound and the Atlantic Ocean at Kitty Hawk, N.C., where Kill Devil Hill, over a hundred feet high with a ten degree slope, proved ideal for their purpose of glider experimentation. Soon they were able to make 300-foot glides under perfect control in winds of 27 miles per hour. On Dec. 17, 1903 they made their first flight in a powered airplane, the first in history, with only five witnesses. At noon that day, Wilbur made the fourth and longest flight, covering 852 feet and remaining in the air 59 seconds. In 1905 at Huffman Field, Dayton, in a circular flight, they solved the problem of equilibrium in turning, and next year took out their first patent for a flying machine. Despite the praise of *l'Aerophile* and the Aero Club of America, the United States government ignored them until late in 1907 when, after they had made successful negotiations with foreign governments, the War Department finally contracted for construction of one biplane. In 1908, Wilbur, leaving his brother to complete their War Department contract, visited France. His flights over the race course at Hunandrières, near Le Mans, roused tremendous enthusiasm. The French regarded this gaunt and taciturn ascetic, who would neither smoke nor drink, with his weather-beaten face and piercing eyes, as the apostle of a new religion. After making satisfactory arrangements with a French syndicate, Wilbur returned home. His demonstration flights up the Hudson River from Governor's Island during the Hudson-Fulton celebration in the fall of 1909 resulted in formation of the American Wright Company. He took the lead in the brothers' subsequent dealings for airplane construction in England, France, Germany, Italy, and the United States. Though they received substantial rewards, both brothers lacked the streak of avarice which would have assured them the great wealth they might have amassed. Wilbur never married, and died of typhoid fever just as the airplane was approaching its more modern development. See also AERONAUTICS. Consult Kelly, F. C., *Wright Brothers; A Biography Authorized by Orville Wright* (New York 1943).

WRIGHT, William Aldis, English scholar: b. 1836; d. 1914. He was a contributor to Smith's *Dictionary of the Bible* (1860–1863), secretary to the Old Testament Revision Company in 1870–1885, and from 1868, the year of its establishment, editor of the *Journal of Philology.* In 1888 he became vice master of Trinity College, Cambridge. With William George Clarke he collaborated on the *Cambridge Shakespeare* (1863–1866) and the *Globe* Edition of Shakespeare's complete works (1864). Among his other publications are the *Letters and Literary Remains of Edward Fitz-Gerald* (1889); *Facsimile MSS. of Milton's Minor Poems* (1899); *Fitz-Gerald's Miscellanies* (1900); *More Letters of Edward Fitz-Gerald* (1901); *Literary Remains of Edward Fitz-Gerald* (1902–03), and *Milton's Poetical Works* (1903); *English Works of Roger Ascham* (1904); *The Hexaplar Psalter* (1911).

WRIGHTSVILLE, borough, Pennsylvania, in York County, 11 miles northeast of York on the west bank of the Susquehanna River, opposite Columbia and on the Pennsylvania Railroad. Located at an altitude of 256 feet in a fertile farming region, midway between York and Lancaster, the borough is chiefly industrial. There are dress and hosiery mills, and foundries making castings, especially of gray iron. Near the borough are quarries. Wrightsville was settled in 1730, and named for John Wright who operated the ferry at this point. The town marked the farthest east of the Confederate Army in the Civil War. Government is by borough council. Pop. (1950) 2,104.

WRIGHTSVILLE, Pa., Military Operations At. In June 1863, Gen. Jubal A. Early (q.v.) was ordered to seize the bridge over the Susquehanna River between Wrightsville (q.v.) and Columbia. On the 28th a Union force, has-

tily assembled and intrenched about half a mile west of Wrightsville, was attacked by Gen. John B. Gordon's brigade, together with a battery of field guns and a battalion of cavalry. The Confederate forces, coming from York, attacked the Union defenders, under Col. J. G. Frick of the Pennsylvania militia, late in the day. The Confederate infantry attempted to cut Frick off from the bridge by a flank movement, but were thwarted. The artillery, Capt. W. Tanner's battery, then opened fire, and Frick, being without guns, retreated across the bridge, which he destroyed by fire. The burning of the bridge caused destruction of several houses in the town, but Gordon's men prevented spread of the flames. Early had to abandon his plans for an advance upon Harrisburg. The day after the battle Gordon's force marched to York, and later took part in the battle of Gettysburg. The invasion of Pennsylvania was checked here.

WRIT. In general understanding a writ is a mandatory precept issued by the authority of and in the name of the executive branch of the State for the purpose of compelling the defendant to do some particular thing mentioned in the instrument. Writs are generally classified as mandamus, habeas corpus, summons, error, quo warranto, certiorari or review. Writs are further distinguished as original and judicial. Original issued without any order of the court in the particular case, judicial issued in pursuance of a decree or order or judgment of the court. A writ of mandamus is a command issuing from a court of law of competent jurisdiction, in the name of the State, directed to some inferior court, officer, corporation or person, requiring them to do some particular thing therein specified, and which appertains to their office or duty. In order to secure a writ of mandamus it is necessary to show (1) that the petitioner has a legal right to have the thing done which it is sought to be done; (2) that it is the duty of the respondent to perform it; (3) that the writ is the only plain, speedy and adequate remedy. A writ has a purely personal effect. An injunction — either mandatory or prohibitory — is a writ framed according to the circumstances of the case commanding an act which the court regards as essential to justice or restraining an act which it esteems contrary to equity and good conscience. Quo warranto is an order to show by what authority a given act is done or office held. A writ of error is a commission to a superior court by which they are authorized to examine the record in a case on which judgment has been given in an inferior court. Habeas corpus is an order issued by a magistrate to an officer in charge of the person of the defendant and designed to give summary relief against illegal restraint of personal liberty. Summons is a demand made to a person to appear at a given time before a court or officer. Certiorari or review is an order to a superior court to review the evidence presented before an inferior court. Consult Blackstone, 'Commentaries on the Laws of England'; Hallam, 'Constitutional History' (New York 1872); Hurd, 'On the Right of Personal Liberty' and 'On the Writ of Habeas Corpus' (1876); Mather on 'Sheriff and Execution Law' (1935 ed.); Wait, W., 'Manual of Supplementary Proceedings' (1936).

WRITERS' CRAMP, or SCRIVENERS' CRAMP, or PALSY, an occupation-neurosis to which those who do much writing, especially with the hand too tightly contracted, are very liable. A person with this trouble has no complete control over the muscles of the thumb and middle and forefingers, brought into use in writing, although other manual operations are performed without difficulty. The affection seldom manifests itself until toward middle age. The various methods of treatment that have been proposed have not been very successful. Small surgical operations have been performed with occasional but far from general good results. The application of electricity to the adductor of the thumb, and the kneading of the muscles of the ball of the thumb and the lower part of the forearm, so as to promote the circulation in those parts, are said to be beneficial, but the only way to obtain perfect relief is for the patient to abstain from writing altogether. If he is obliged to write he will do so with more ease if he uses a pen with a very thick handle. For extreme cases several contrivances have been devised for assisting the patient to write by altering the movements of the fingers in writing, and giving support to the ball of the hand. The typewriter has proved the best resource of those who suffer from the ailment. See NEUROSIS.

WRITERS TO THE SIGNET, in Scotland, where lawyers generally are called writers, an incorporated legal society dating from an early period of Scottish history. Originally, the name probably applied to clerks in the office of the Secretary of State, where was deposited the seal by which the king's letters and writs for the purposes of justice were authenticated. This duty was monopolized by this close society of practitioners, members being appointed, not by public officials, but by the organization. Thus the Writers to the Signet came to control admissions to the bar, like the English Inns of Court. They still retain a certain prestige at the bar, but their former monopoly has been taken away by recent statutes.

WRITING, the art of recording ideas by means of characters or figures of some sort impressed upon some kind of material substance. History, though it does not throw complete light on the origin of writing, suffices to show certain stages in its progress, and upon these a classification has been founded, which is, however, incomplete and unsatisfactory. The simplest classification and perhaps at an initiatory stage the best, is that which divides all writing into ideographic and phonographic, or signs representing the things symbolized by words and signs representing sounds, that is, words themselves. Less satisfactory is the classification of writing into three historical stages, the figurative, the transitional or conventional, and the alphabetic. In the first of these, to which hieroglyphic writing belongs, writing is supposed to be pictorial or immediately representative of objects. After this, in the transitional period comes symbolical writing, in which abbreviated pictures are transformed into arbitrary symbols, first of things and afterward of sounds and words. Lastly, with the prevalence of phonetic writing sounds are represented first in syllables and afterward in

letters. The course of writing is generally in the direction thus indicated. but it is inaccurate and misleading to represent these stages as epochs in its progress. As the most modern writing contains traces of the first of these methods, so the earliest contains traces of the last. The majority of the letters in modern alphabets can be traced to symbols or abbreviated pictures representative of things, but as the thing originally represented is usually an object whose name begins with the sound represented by the letter, there is no evidence that the sign was not originally intended in a double sense and used as a phonograph. In Egyptian hieroglyphics we have ideographs and phonographs mixed together. This, however, does not prove the absolute precedence of ideographs, but only the imperfection of the phonographic elements in that system. The same thing occurs in the Mexican picture writing, which was long supposed to be purely ideographic. Its phonetic signs are syllabic, not alphabetic. In our own system we use figures and other symbols when phonographic signs are too slow for our purpose, and with a less perfect phonographic system this would naturally occur much more frequently. It does not appear, moreover, that any transition from pictorial to phonetic writing is necessary through arbitrary non-phonetical symbols. Both of these modifications would no doubt proceed simultaneously from independent causes. Pictorial signs not phonetized would be abbreviated as well as phonetized signs, and when the phonetized abbreviations came to prevail the non-phonetized abbreviations would be phonetized also, thus producing the appearance of a transition from arbitrary symbols to phonetic signs.

The reason why writing has had to pass through various stages of pictorial and more or less arbitrary symbolical representation before reaching the more perfect development of the alphabetic form is not very difficult to discover, and it has an important bearing on the order of development. It is not because the representation of words is in itself more difficult to conceive than the representation of things, or because when the desire for writing as a medium of communication is excited the human intellect is inadequate to the task of forming at once an entire phonetic system. Had phonetic or even alphabetic representation been the only possible means of constructing a written symbol all difficulties would doubtless have been overcome by one sustained effort, as they have actually been by many partial ones; but as an easier process was to be found and would directly suggest itself as a means of meeting the immediate demand, the more elaborate process was excluded and prevented by this process from being performed. Nothing is easier than to make a rude pictorial representation of certain objects. To draw something resembling a man would be easier than to agree on a sign to represent the word man, hence ideographs would naturally precede phonetic symbols. But for the same reason the earliest systems of writing would not be purely ideographic but mixed. There are many things which form the subject of the least sophisticated human communications which cannot be represented pictorially. When writing was first practised these things were already represented by words, and the idea would naturally occur to form a sign to represent the word, that is, a phonetic sign. These signs could not be directly pictorial, but they might be allegorical or symbolic, and in the absence of analysis of sound they probably would take that form, although the direct intention was to suggest conventionally a specific word by the symbol. This sort of symbol might be called a mnemonic. From such symbols to merely arbitrary syllabic and alphabetic symbols the transition would be easy.

It is generally agreed that writing was introduced to the western nations by the Phœnicians, and it is commonly believed that the Phœnician system was based on the Egyptian but the comparative antiquity of the Egyptian and Assyrian or Akkadian, the hieroglyphic and cuneiform systems, cannot be definitely determined. The Egyptians attributed their writing to Thoth, and the first characters are said to have consisted of portraits of the gods. The cuneiform writing, which is cumbrous and exceedingly difficult to read, has been adapted to several languages, the Akkadian, the Assyrian, the Persian, etc., in a variety of ways, ideographic, syllabic and alphabetic. The Egyptians had three distinct kinds of writing, the hieroglyphic, the hieratic and the enchorial or demotic. The first is a mixed system, containing large numbers of signs of various characters, ideographic and phonetic. It is used chiefly for inscriptions on monuments and public buildings. The hieratic is a cursive hand abridged from the hieroglyphic for use on papyri. Both these forms were sacred, and the priestly caste only were initiated in them. The demotic was introduced much later than the other forms. It was used for trading and common purposes, and in civil documents. The hieratic writing was more phonetic than the hieroglyphic, and the alphabetic character prevailed in the demotic. The first was written in any direction according to the form of the surface; the hieratic was at first written in columns, but afterward always in horizontal lines. The hieratic and demotic are read from right to left, but the individual letters are formed from left to right. The connection between the Egyptian and the Semitic writings, to which the Phœnician belongs, is by no means unanimously admitted, many scholars holding that the resemblances between them may be explained by the independent adoption of common principles. The leading Semitic forms are the Samaritan or ancient Hebrew, the Chaldee or East Aramaic, the Syriac or West Aramaic, and the Kufic or early Arabic, which continued to be used in manuscript for several centuries after the Mohammedan conquest, after which it was replaced by the Neshki or modern Arabic, which, with some slight modifications, is the same with the modern Persian. The Hebrew alphabet now in use, the Babylonian or East Aramaic, is entirely consonantal, the vowel points being of modern origin. The Phœnician which forms the basis of the western languages was of a similar character. Phœnician writing was anciently represented to have been brought by a Cadmean colony to Boeotia about the 16th century B.C. (see CADMUS); and a certain number of the Greek letters are undoubtedly of Phoenician origin. (See the section on language and writing in the article GREECE). The

Greeks at first wrote from right to left, and afterward adopted the method called *boustrophēdon,* from the motion of the ox in plowing, that is, alternately from right to left, and from left to right. Writing from left to right was said to have been introduced in the time of Homer by Pronapides of Athens. The various modifications which the Phoenician or Pelasgian forms underwent in Italy are to be found by comparison of the Oscan, Etruscan, Umbrian and early Latin inscriptions. In the ancient Greek and Roman writing, and even for a time in the mediaeval writing of Europe, the words were not separated by spaces, and no punctuation marks were used. The present cursive characters with modifications occur in Greek inscriptions of the the age of Augustus. In mediaeval manuscripts a variety of styles were adopted in different epochs and countries and for different uses, to describe which in detail would require a separate treatise. In France the various styles were called after the dynasties under which they prevailed: Merovingian, Carlovingian, Capetian, Valesian and Bourbon. There was also a variety of styles used for different purposes distinguished by such names as *majuscule* and *minuscule* (great and small letters), diplomatic minuscule and many others. Capitals were not then used as now to distinguish prominent words, but whole manuscripts were written in large or small capitals. There was also a variety of mixed styles. From the 8th to the 11th century writing with *tremblements* was affected in France. The diplomatic minuscule was a mixture of minuscule and cursive characters distinguished by an unusual prolongation of the long letters. Uncial letters, which prevailed from the 7th to the 10th century were rounded capitals with few hairstrokes. The practice of ornamenting pages began in the 8th century, and the earliest manuscripts are also without title pages. The so-called Gothic characters, in reality of scholastic origin, are merely fanciful deviations from the Roman types, such as the rounding of straight limbs, the substitution of angular facets for rounded forms, with hair-lined projections from the extremities contrasting with massive body-strokes. They became common in inscriptions from the 13th to the 15th century, and were employed in church-books from the time of Saint Louis. The Gothic cursive was introduced about the middle of the 13th century. The modern German alphabet was also introduced in the 13th century. In England a variety of styles called Saxon prevailed in the early Middle Ages. An elegant mixed style was formed of a combination of Roman Lombardic and Saxon characters. The Norman style of writing came in with William the Conqueror. The Old English form of Gothic dates from the middle of the 14th century. The English "court hand," an adaptation of Saxon, prevailed from the 16th century to the reign of George II. In regard to the antiquity of writing in other parts of Europe, it was known to the Gauls before the time of Caesar; but no traces of the ancient writing remain, and whether it was derived from the Greeks or the Phoenicians is doubtful. There are slight traces of writing in Britain previous to the Roman period, but if it were employed by the Druids, as Caesar says, it may have existed without leaving remains. The Germans claim the knowledge of writing previous to their contact with the Romans; but in their case also we are without early remains. The Runic alphabet used for many centuries in Denmark, Norway, etc., may have been employed long before the Christian era.

In the East we find one of the most striking contrasts in the history of language. The Chinese, who have an ancient system of writing which they attribute to Fou-hi, have never reached the alphabetic system. Their characters are syllabic, and as Chinese words are monosyllables, they are strictly ideographic. They have been adopted in this way by peoples speaking not only different dialects, but different languages, who apply the signs to words of different sound but of the same signification as the original. The Chinese system is said to contain 40,000 characters. They were originally hieroglyphic, but from difficulty of interpretation have become conventional. There are, of course, certain general principles of combination and construction, but to master the whole system is said to be the work of a lifetime. Only a limited portion of it can, therefore, have any real existence as a medium of communication. Sanskrit, on the other hand, possesses the most perfect known alphabet. The Hindus claim to have derived it from the gods, and call one form of it *devanâgari* (divine city). It is wholly different from the Semitic, and is founded on a much more complete and subtle analysis of sound. Its consonant signs number 33, its vowel signs 14. They are applied with an analytical method which gives a power of distinction vastly superior to that of European alphabets, and which is greatly admired by scholars. Sanskrit is written from left to right. By means of its derivatives it is widely diffused in the East. The Pali, which forms the sacred language of the Buddhists, has carried it far beyond India. The Burmese Pali character is square, the Siamese round. To complete the vagaries which have prevailed in the direction of writing, the Mexican picture writing was written from bottom to top. See Alphabet; Cuneiform Writing; Etymology; Hieroglyphics; Language, Science of; Paleography; Speech.

WROCLAW, vrô'tsläf, name given by the Poles in 1945 to the German city of Breslau (q.v.).

WRONG, George Mackinnon, Canadian historian: b. Ontario, June 25, 1860. He was educated at University and Wycliffe colleges, Toronto, and in 1883 was ordained in the Church of England. Throughout his career he engaged in academical work; he served as professor of history at the University of Toronto from 1894 until his retirement in 1927. His numerous works on Canadian history included *The Fall of Canada* (1914); *The Conquest of New France* (1918); *The Rise and Fall of New France* (1928); *Canada and the American Revolution* (1935); *The Canadians: the Story of a People* (1938).

WROUGHT IRON. See Iron—*Wrought Iron.*

WROXETER, England, a village of Shropshire, on the Severn River 6 miles east-southeast of Shrewsbury. Before the Roman conquest of Britain the site was the market center of the Cornovii, a Celtic tribe. The Romans built a city there (on the road later known as Watling

Street), naming it *Viroconium* or *Uriconium;* Roman baths, the forum, basilica, and several houses have been excavated within the limits of the city wall, which enclosed an area of 170 acres.

WRYBILL, an extraordinary plover (*Anarhynchus frontalis*) of New Zealand, which is unique in having a bill bent sideways near the tip—always toward the right. By this peculiarly adapted instrument it seems to be able to reach and obtain many small crustaceans, which are able to creep under stones out of reach of all the other shore-birds of the region, these latter having only the ordinary straight kind of beak. See PLOVER, and consult Buller, Sir W. L., *Birds of New Zealand* (London 1888), and for general discussions of variation see Robson, G. C. and Richards, O. W., *The Variations of Animals in Nature* (London 1936); and Thomson, Sir J. A., *Concerning Evolution* (New Haven 1925).

WRYNECK, a European bird (*Iynx* or *Yunx torquilla*), related to the woodpeckers, which has a habit of twisting its head in a curious manner. This bird visits Great Britain in summer, arrving in April, usually with or just before the cuckoo, and hence is named the cuckoo's mate. The food consists of insects, and chiefly of ants and their pupae. It is also said to eat elderberries. The tongue is long and extensile, like that of the woodpeckers. The nest is formed in the holes of trees, and the eggs vary from six to 10.

WU TING-FANG, wōō'tĭng'fāng', Chinese statesman and diplomat: b. Singapore, 1842; d. Canton, June 23, 1922. Following his early education in Saint Paul's College, Hong Kong, he studied law at Lincoln's Inn, London. Entering the colonial government service in 1862, he served as interpreter in the law courts until 1874; and when he returned to the East in 1877, engaged in law practice in Hong Kong. In 1882 he was appointed to the official staff of Li Hung-chang, at that time governor general of Chihli and grand chancellor of China, and in 1895 was one of the peace commissioners who negotiated the Treaty of Shimonoseki, following the Chinese-Japanese War. He later occupied high government offices at Peking. He was twice minister to the United States—1897–1902 and 1908–1909. In 1902 he aided in the negotiation of various commerical treaties, and in 1903 became vice president of the board of commerce. He was minister of the board of punishment in 1905–1906, and reorganized the penal code. Supporting the revolution in 1911, between 1916 and 1921 he occupied various posts in the Canton government. He became a member of the Permanent Court of Arbitration (The Hague). He published *America Through the Spectacles of an Oriental Diplomat* (New York 1914).

WUCHOUSEN, the great wind eagle, a mythological character, universally believed in by the numerous tribes of Algonquin Indians. Of him many fabulous stories are told. According to the Passamaquoddy legend, in which he is called The-Bird-who-Blows-the-Winds, Wuchousen lives far in the north, on a huge rock whose top reaches up into the region of the cloudland, at the very end of the sky. When he flaps his wings the winds blow over all the earth and all the cloudland. In the olden days Wuchousen was so fond of blowing, of flapping the wind with his monster wings, that men could not live in peace, for the fear of the tempest was ever upon them. So terrible were these tempests that even Kulóskap, the Master of Men and Beasts, was often afraid to venture out upon the sea to fish, as was his pleasure. At last he made up his mind to bring the wind eagle to time and make the earth safer for all. So he made a long journey into the far northland, on the very outer border of the world. There he found Wuchousen flapping his mighty wings and screeching louder than the howling tempest he was winging up.

Kulóskap protested against this, representing to the wind eagle that he had already made the world uninhabitable and requested him to modify his tempest-making. To this Wuchousen replied that since time began he had blown always in this way, that his wings needed exercise and that he proposed to go on flapping them no matter what happened to the rest of creation. In a rage, Kulóskap, changing himself into a monstrous giant, higher than the clouds, seized the wind eagle and, tying his wings together, cast him down from his high cliff into the sea thousands of feet below. Unable to move, the eagle exercised all his magic power and made the water so putrid that they poisoned all the streams and the rain that fell from the clouds, so that Kulóskap was forced to release him, for being a spirit, he could not kill him. But that he might not again incommode and endanger the world, he left one of his wings tied, when he replaced him on top of his high cliff. Since that time, in the long past, Wuchousen has been able to raise a wind only half so strong as he used to; and though he often raises a tempest, yet, flapping only one wing, he soon grows tired and then the tempest subsides.

WUCHOW, wōō-chō', China, a city and river port of Kwangsi Province, on the left bank of the Si-kiang 200 miles west of Canton. Situated in the extreme western end of Kwangsi, most export products of the province are shipped from Wuchow. The city was opened to foreign trade in 1897. Pop. 90,000.

WUHU, wōō-hōō, China, city of Anhwei Province, on the right bank of the Yangtze Kiang 185 miles west of Shanghai and 75 miles upriver from Nanking. It is served by the Chekiang-Kiangsi Railway. The principal industry is the manufacture of cotton textiles; besides cotton goods, wheat, rice, and tea are shipped through the river port. Wuhu suffered severely about 1865 in the aftermath of the Taiping Rebellion (q.v.). The city was opened to foreign trade in the year 1877. Commerce was at a standstill between 1938 and 1945, when Wuhu was in Japanese occupation. Pop. (1937 est.), 50,000.

WULFENITE, native lead molybdate. It is generally admitted that the best specimens of this mineral are among the most beautiful minerals known. It crystallizes in hemimorphic tetragonal crystals. They are usually in square tabular plates, sometimes very thin and transparent, but occasionally in elongated pyramidal forms and nearly opaque. The mineral also occurs in crystalline masses. It is very brittle, has a hardness of about 3 and is very heavy, its specific gravity ranging from 6.7 to 7.0. Its luster is resinous to adamantine, and colors are various shades of yellow, orange, red, grayish, or greenish. It is associated with other lead ores at many localities, as in Austria and New South Wales, but the United States localities are far more important. Magnificent specimens occur in the Red Cloud and Mammoth mines of Arizona, in the Organ Mountains.

New Mexico, at Eureka, Nev., and Tecoma, Utah. It was named in honor of the Austrian mineralogist, Franz Xaver von Wulfen.

WULFSTAN, wo͝olf'stăn, name of several Anglo-Saxon prelates.

Wulfstan or Wolstan, Saint, b. Long Itchington, Warwickshire, about 1012; d. Worcester, Jan. 18, 1095. Educated at Evesham and Peterborough, he became a monk in the monastery of Worcester and in 1062 was consecrated bishop of Worcester. He was one of those who submitted to William the Conqueror at Berkhampstead in 1066, and was allowed to retain his see. The crypt of the present Worcester Cathedral represents the church which Wulfstan caused to be erected between 1084 and 1089. He was a man of saintly character and loyal devotion to his work, and he is credited with having induced the merchants of Bristol to stop their traffic in British slaves. He assisted in the Domesday survey and led the defense of Worcester against the rebellious nobles, commanded by William Fitzosbern, earl of Hereford He was buried in Worcester Cathedral, and was canonized in 1203, his day being January 19.

Wulfstan, d. York, England, May 28, 1023. He was archbishop of York from 1003 and bishop of Worcester (1003–1016), and is known for his many homilies, the most famous of which is *Lupi Sermo ad Anglos,* first printed in 1703–1705 in a translation by George Hickes.

Wulfstan of Winchester, fl. 1000, a monk of St. Swithun's, Winchester. He is remembered for his metrical lives of St. Swithun and St. Ethelwold.

WULLNER, vül'nĕr, **Franz,** German pianist, conductor, and composer: b. Münster, Germany, Jan. 28, 1832; d. Braunfels, Sept. 7, 1902. He studied at Münster, Frankfurt, Berlin, and Cologne, and in 1861, after holding various musical positions throughout Germany, was named *musikdirektor* to the king of Prussia. From 1864 to 1877 he was *kapellmeister* in Munich, and later in Dresden (1877–1882). He directed the Philharmonic Orchestra of Berlin in 1883–1884, and from the latter year until his death was director of the conservatory at Cologne. He was noted as a teacher and as a composer of choral works, among them a cantata *Heinrich der Finkler; Miserere; Psalm 125; Stabat Mater.*

WUNDT, vo͝ont, **Wilhelm,** German physiologist, psychologist, and philosopher: b. Neckarau, Germany, Aug. 16, 1832; d. near Leipzig, Aug. 31, 1920. He studied at Tübingen, Heidelberg, and Berlin, became privatdocent and in 1864 assistant professor of physiology at Heidelberg where he remained until 1874. Here he wrote his first important books which pointed the way to a new psychology, one defined not by a differentiation of objects but by point of view, one that is experimental in its method, and one capable of including much of the psychology of Johann F. Herbart and Rudolf H. Lotze, the psychophysics of Ernst H. Weber and Gustav T. Fechner, and the sense-physiology of Johannes P. Müller and Hermann L. F. von Helmholtz.

In 1875 Wundt was called to the chair of philosophy at Leipzig where he remained until his death. He established the first laboratory of experimental psychology here in 1879 and in 1883 established the *Philosophische Studien,* devoted chiefly to the contributions of the Leipzig school. This ceased publication with the 20th volume in 1902, but a new series, the *Psychologische Studien* was begun in 1905.

Meanwhile, Wundt found time also for philosophy. His system of philosophy has often been characterized as the science of the sciences, for he was one of the greatest comparative philosophers of his age, integrating works of other fields to form a solid theory of his own. He attempted to "unite into a consistent system the general knowledge contained in the various sciences, and to trace back to their principles the general methods and presuppositions of science in general." Among his more important works may be listed: *Vorlesungen über die Menschen- und Tierseele* (1863); *Lehrbuch der Physiologie des Menschen* (1865); *Logik, eine Untersuchung der Principien der Erkenntnis und der Methode vissenschaftlicher Forschung* (1880–1883); *Ethik, eine Untersuchung der Thatsachen und Gesetze des sittlichens Leben* (1886); *System der Philosophie* (1889); and *Völkerpsychologie,* 10 vols. (1900–1920).

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WUOTAN. See Odin.

WUPPER, vo͝op'pĕr, river, Germany, rising in the *land* of North Rhine-Westphalia. It rises on the Westphalian frontier, and flows first northwest and then southwest, joining the Rhine between Cologne and Düsseldorf after a tortuous course of about 65 miles. It is not navigable for vessels of any size, but it provides considerable power for manufacturing purposes. Its valley is the most populous in Germany, and contains the important industrial cities of Wuppertal, Remscheid, and Solingen. In its upper course, it is called the Wipper.

WUPPERTAL, vo͝op'ĕr-täl, city, Germany, since 1945 in the *land* of North Rhine-Westphalia, formerly in the Prussian Rhine Province, situated on both sides of the Wupper River, 16 miles east-northeast of Düsseldorf, and well served by railroads and highways. The city, or *stadt,* was formed in 1929 by a coalition of the cities of Barmen, Elberfeld, Ronsdorf, Beyenburg, Cronenberg, and Vohwinkel. The city extends eight miles along the course of the river and covers an area of 57 square miles.

Before World War II, it was the German center of the textile industry, and also had manufactures of chemicals, leather, carpets, metal goods, furniture, roller and ball bearings, rubber goods, machinery, paper, firearms, organs, and pianos. Because of its industrial importance, it was heavily bombed by the Allies during World War II, nearly 50 per cent of the city being destroyed. At the end of the war it was situated in the British Zone of occupation. Pop. (1950) 363,224.

WURDHA, India. See Wardha.

WURMSER, vo͝orm'zĕr, Count **Dagobert Siegmund von,** Austrian general: b. Strasbourg, Germany, May 7, 1724; d. Vienna, Austria, Aug. 21, 1797. He served in the French Army, but

left it for the Austrian service, where he commanded a hussar regiment during the Seven Years' War, attaining the rank of major-general. During the Bavarian war of succession he commanded a special corps of the army in Bohemia, and after the peace was made commanding general in Galicia, and in 1787 general of cavalry. By the outbreak of the French Revolution his family lost their estates in Alsace. In May 1796 the critical condition of affairs in Italy after the defeat of Beaulieu led to the appointment of Wurmser to the command of the second Austrian army destined to act against Bonaparte. At the head of 60,000 men he obliged the French to raise the siege of Mantua; but the defeat of his main body at Castiglione, Roveredo and Bassano, rendered his situation extremely critical. He finally forced his way into Mantua, of which the blockade was resumed. A third Austrian army was sent into Italy, but the defeat of Arcole prevented it from relieving him; and at length, in February 1797, seeing the impossibility of any longer maintaining the defense, Wurmser surrendered Mantua to Napoleon who had previously routed two divisions of his army. Wurmser was allowed his freedom.

WURTS, John, American educator and legal writer: b. Carbondale, Pa., 10 July 1855. He was educated at Yale and after traveling in Polynesia as a newspaper correspondent (1876–77) was graduated from the Yale Law School in 1884 and practised his profession in Jacksonville, Fla., 1884–96. He was professor of the law of real property and equity at Yale 1897–1920, and then professor emeritus. In 1914–15 he was exchange professor at the University of California. He is joint author of 'Minor and Wurts on Real Property' (1910); 'Complete Revision to Date of Florida Index Digest' (1910); and author of 'The Anti-Slavery Movement with its Relation to the Federal Constitution' (1883); 'Washburn on Real Property' (1902); 'Cases in Federal Practice' (1905); 'A Bit of Judicial History' (1911); 'Jury System Under Changing Conditions' (1912); 'Law of Habeas Corpus.' D. 5 Aug. 1936.

WÜRTTEMBERG, vürt'tĕm-bĕrg, **or WURTEMBERG,** until 1918 a kingdom, now a component state, of Germany, between Bavaria, Baden, Hohenzollern, and the Lake of Constance, which separates it from Switzerland; area, 7,534 square miles. It was formerly included in the territory of Swabia (q.v.). Except a few tracts in the south, the surface is hilly and even mountainous. In the west the Schwarzwald, or Black Forest, forms part of the boundary, and the Alb or Rauhe Alp, forming part of the Franconian Jura, covers an extensive tract. The country belongs in large part to the basin of the Rhine, being drained northward into that river by the Neckar, while the Danube flows across the southern districts. A part of the Lake of Constance is also included in Württemberg. The climate is temperate. In the lower and more favorable districts the fig and melon ripen in the open air, and the vine, cultivated on an extensive scale, produces several first-class wines; maize, wheat, hops, tobacco and fruit, which is employed in cider making, are chiefly cultivated. About a third of the country is under forests, which consist mainly of oaks, beeches and pines. Of minerals, the most valuable are iron and salt, both of which are worked by the government; the others are limestone, gypsum, alabaster, slate, mill-stones and potter's-clay. The manufactures consist chiefly of cotton, woolen and linen goods, paper, wooden clocks, toys, musical instruments and chemical products. The government until November 1918 was a hereditary constitutional monarchy, the executive power being lodged in the sovereign, and the legislative jointly in the sovereign and a parliament, composed of an upper and a lower chamber. The yearly revenue (estimated) for the year ending 31 March, 1930, was 151,404,947 marks, and the expenditure was 161,003,289 marks. The public floating debt as of 1 April 1930, is 1,350,000 reichsmarks. Under the monarchy the king was invested with the supreme direction and guardianship of the Evangelican Protestant Church, though there was no established religion. Education is generally diffused and the centre of the educational system is the University of Tübingen. Besides Stuttgart (the capital), the chief towns are Ulm, Heilbronn and Esslingen The history of the state is of little general interest. Previous to the Napoleonic era the rulers had the title of duke, but in 1806, by the favor of Napoleon, the then duke gained a great accession of territory, as well as the title of king. In the subsequent arrangement of the European states by the Congress of Vienna the territorial accessions were confirmed and the kingly title formally recognized. In the war of 1866 Württemberg sided with Austria against Prussia. It became a member of the German empire on its foundation in 1871. After the collapse of the German imperial armies on the western front in November 1918 and the establishment of a republic in Berlin, the Württemberg monarch abdicated the throne and Württemberg became a constituent state of the Republic. Pop. 2,579,453. Consult Gaupp, 'Das Staatsrecht des Königsreichs Württemberg' (Freiberg 1895); Hirschfeld, 'Württembergs Grossindustrie und Handel' (Leipzig 1889); Belschner, 'Geschichte von Württemberg' (Stuttgart 1902); Heyd, W., 'Bibliographie der Württ.' (6 vols., 1895–1929).

WURTZ, vürts, **Charles Adolphe,** French chemist: b. Strassburg, 26 Nov. 1817; d. Paris, 12 May 1884. He went to Paris in 1845, in 1851 became professor at the Agronomic Institute, Versailles, in 1853 was made professor of organic chemistry at the Sorbonne and professor of toxicology at the Ecole de Médecin. From 1866 to 1876 he was dean of the Sorbonne faculty of medicine. He made important discoveries in connection with compound ammonias, glycol and adol; and rendered a valuable contribution to theoretical chemistry in distinguishing the atomic relations of organic compounds. Among his numerous works on chemistry are 'La théorie atomique' (1878); 'Leçons élémentaires de chimie moderne' (1868); 'Traité de chimie biologique' (1885). Consult Friedel, 'Notice sur la vie et les travaux de C. A. Wurtz' (1884).

WURTZ, Henry, American chemist: b. Easton, Pa., 5 June 1828; d. 10 Nov. 1910. He was graduated from Princeton in 1848, studied

further at the Lawrence Scientific School of Harvard, was State chemist of New Jersey 1854–56, chemical examiner in the United States Patent Office 1859–61, and from 1871 to 1875 edited the *American Gas Light Journal.* He was closely identified with the earlier investigations of natural and artificial gas and the use of petroleum as fuel. He proved the existence of gold in sea water. In 1888 he entered the employ of T. A. Edison (q.v.), as chemist, and afterwards made several important chemical discoveries, chief of which is that of the geometrical laws of the condensation of chemical modules. Other important investigations are described in his scientific monographs. Author of 'Obtaining Potash Compounds from Greensand Marl' (1850); 'Geometrical Chemistry' (1876); 'Discovery of Lake Superior Silver Minerals, Huntilite and Animikite' (1878), etc.

WURTZILITE, an asphalt (elaterite) mined extensively in Wasatch County, Utah, and used for roofing material, waterproof felts, building paper, rubber substitutes and paving materials. Color black, but deep red in thin plates. Practically insoluble in gasoline (76°) and only partly soluble in ether, carbon disulphide, turpentine and carbon tetrachloride.

WURTZITE (named for C. A. Wurtz, q.v.), *in mineralogy,* a dimorphous form of zinc blende. Crystallization, hexagonal; hardness 3.5 to 4; specific gravity, 3.98; lustre, resinous; color, brownish black; streak, brown; composition, a sulphide of zinc, ZnS; occurrence, in a silver mine near Oruro, Bolivia, in Portugal, Peru, and near Butte City, Mont. Its artificial manufacture is accomplished by fusing equal parts of zinc sulphate with calcium fluoride and barium sulphide.

WÜRZBURG, Bavaria, city and capital of Lower Franconia, on the river Main, 62 miles southeast of Frankfort and at the junction of the main railway lines to Nuremberg and Bamberg. The river is crossed here by three bridges, of which the first is a stone structure built in 1474–1607; while the modern bridges were built in 1887 and in 1894. The town is built on both sides of the river, but the main portion of it is on the north bank. The older portion of the city is of quaint and irregular pattern, but the modern suburbs are handsomely laid out, with broad promenades. There are many mediæval buildings in a good state of preservation and several ancient churches. Among the churches are the Romanesque cathedral dating from 1042–1189, with additions of later date; the Marienkapelle, a Gothic structure built in 1377–1441; the Haugerstiffs Church, in Italian Renaissance style, 1670–91; the Neumünster Church, dating from the 11th century, and the church of Saint Burkhard, built in 1033–44. A notable structure is the palace, built in 1720–44 as a residence for the bishops and grand dukes of Würzburg. The bishopric dates from 741, but the town existed earlier. From the 12th century the bishops had ducal authority. The bishopric was secularized by the Peace of Lunéville in 1803, and Würzburg came under Bavarian control. By the Peace of Pressburg in 1805 it became an electorate under Ferdinand III, former grand duke of Tuscany, who took the title of Grand Duke of Würzburg and joined the confederation of the Rhine. It was restored to Bavaria in 1815. A new bishopric, without ducal authority, was established in 1817. The city was bombarded and captured by the Prussians in 1866.

The University of Würzburg (q.v.) adds considerably to the importance of the town, and there are also schools of agriculture and horticulture, a royal music school and other educational institutions. The city is surrounded by vineyards which produce excellent wine. Manufactures include furniture, machinery, scientific instruments, railway carriages, brick, chocolate, beer, malt and vinegar. It is an important commercial centre. Pop. 95,113.

WURZBURG, University of, a German educational institution founded at Würzburg, Bavaria, by Bishop Julius in 1582. An earlier university of the same name existed at Würzburg for a short time after 1403, but passed out of existence. The university was founded as a Roman Catholic institution and its chairs of theology and philosophy were held by Jesuits until the suppression of the order in 1774, but theological instruction remains in Roman Catholic hands. The faculty of medicine early became famous and has remained the most important in the university; taking, with its kindred departments of dentistry and pharmacy, more than half the students enrolled. The university was reorganized after Würzburg passed under Bavarian control in 1803. The library contains over 600,000 volumes. Law, political science, and theology faculties flourish. Here W. K. Röntgen conducted the experiments which led to his discovery of the Röntgen rays in 1896.

WUSHKUM (from the name of their chief village), meaning a species of louse or flea, a tribe of the Chinookan stock of North American Indians. They call themselves *Tlaqluit,* and are the Echeloot of Lewis and Clark and the Wisham, Wishram, etc., of other writers. They occupy the north bank of Columbia River, Washington, from Tenino to the neighborhood of White Salmon River. They subsist largely on salmon, and are not reservation Indians, although they took part in the Yakima treaty of 1855. As they are given to wandering up and down the coast and as they have mixed, to some considerable extent, with neighboring tribes, it is very difficult to estimate their population.

WUTHERING HEIGHTS, Emily Brontë's one novel, was published in 1847 under the pseudonym "Ellis Bell." Though an almost complete failure with both the public and the critics it was reissued in 1849 with an introduction by Emily's more famous sister, Charlotte, the author of 'Jane Eyre.' The work is a belated and unconventional specimen of the so-called Gothic Romance or novel of terror, inaugurated by Horace Walpole's 'Castle of Otranto.' Its scene is a bleak mansion on the Yorkshire moors, the home of the Earnshaw family, into which is introduced the foundling Heathcliff, picked up by Mr. Earnshaw on the high road. The story deals with the fiercely revengeful life of Heathcliff, who develops under ill usage and neglect an appalling cruelty, coupled with an inflexible will and a strange power of fascination. He gains control of the Earnshaw property and brings up Hareton, son

of the besotted Hindley Earnshaw, whom he hates, in brutal ignorance. The one redeeming trait in his distorted and Satanic nature is his wild love for Hindley's sister, Catherine, which outlives both her marriage to Edgar Linton and her death. Thwarted by Catherine's daughter in his endeavor utterly to debase Hareton Earnshaw, Heathcliff starves himself to death, haunted and exhilarated by the spectral presence of the woman who, despite his cruelty, of which she herself felt the effect during her life, has always belonged to him in spirit.

The story is a wild and passionate one, far remote from real life, which Emily Brontë knew scarcely at all. Scenes of domestic violence succeed each other in a way which is almost too much for the reader's nerves. The characters are the creation of a lawless but extraordinarily vivid imagination, and the whole novel is written with an energy which triumphs over the obvious limitations of its author's art. The best edition, with introduction, etc., is that by Clement K. Shorter, *The Complete Works of Emily Brontë,* vol. 2.

Consult also, Shorter, C. K., *Charlotte Brontë and Her Circle;* and the essay on Emily Brontë in *Swinburne's Miscellanies.*

JAMES H. HANFORD.

WYANDOT, wī'ăn-dŏt, or **HURON** (English adaptation of the French *Ouendat,* or *Hoüandate,* later written *Guyandotte,* from the native name *Gendat,* signifying, "They are islanders"). A tribe composed of the remnants of several politically independent Iroquoian tribes and confederacies whose political integrity was destroyed by the Iroquois during the middle of the 17th century. Among these peoples may be mentioned the ancient Wendat (or Houandate), or Huron confederacy, which was composed of four tribes, namely, the Attigneenongnahac, the Attignawantan, the Arendahronons and the Tohontaenrat (for Tohontakenrat), and also, later, the affiliated tribes known as the Ataronchronons, the Wenrohronons, and the Tinnontatehronnons, and lastly the Eries.

The first known habitat of these several peoples was south and east of Lakes Huron and Erie, in the present states of Ohio and Pennsylvania and western New York, in Ontario, Canada, and the northern shore of the St. Lawrence River as far down as the site of Quebec. Today the Wyandots so-called live in Oklahoma and at Lorette, Quebec, Canada, where some Hurons, who are in fact Wyandots, dwell. All these tribes when first encountered by Europeans were organized into well-governed communities. The social and political organizations were based strictly on bloodkinship, real or fictitious. Fictitious kinship was obtained through the rites of adoption. These peoples dwelt in lodges constructed of bark, which were long in figure, sometimes having as many as 10 or 12 fires with a family on two sides of each fire. The lodges were usually collocated into villages, many of which were quite strongly palisaded. For their sustenance they depended chiefly on agriculture, raising corn and beans of several varieties, squashes and sunflowers for oil. They tanned and dressed the hides of the animals which they killed. The prepared skins they neatly and skilfully utilized in the preparation of their raiment and their bedding. Reeds and barks of various kinds were useful in making mattresses and other needed articles. The title to their lands was vested solely in the mothers of the people. The choice of a candidate for chief for either of the two grades of this office was solely a prerogative of the mothers of the clan to which the chiefship belonged. The chief held his office during his good behavior.

WYANDOTTE, wī'ăn-dŏt, city, Michigan, in Wayne County, on the Detroit River, eight miles south by west of Detroit. It is served by the Michigan Central, the Detroit and Toledo Shoreline, and the Detroit, Toledo and Ironton railways. It is the home of more than 30 industries several of them the largest of their kind. The city is noted especially for its chemical products which are derived from the vast salt beds underlying the city. Its manufactured products are widely diversified. In addition to chemicals they include: metal toys and novelties, trunks, compression gaskets, spark plugs, metal wheel rims, soda, dairy products, beverages, and brass pipe fittings. A number of the large steel freight boats and steel passenger boats plying the Great Lakes were constructed at the Wyandotte shipyards. Wyandotte had a blast furnace and rolling mill in 1853 and a steel analysis laboratory as early as 1862.

The religious and educational advantages of the city compare favorably with much larger communities, there being nine churches, three public schools, five parochial schools and one private school. There is a well-equipped public library.

The community was settled in 1820, incorporated as a village in 1854, and as a city in 1866. It has a mayor and council form of government. Pop. (1950) 36,846.

WYANDOTTE CAVE, Crawford County, Indiana, a natural formation, west of Corydon and smaller than Carlsbad Caverns and Mammoth Cave, but having a greater number and variety of stalactites and stalagmites perhaps than any except the first mentioned in the United States. It has been explored for a distance of 23 miles. The chambers and galleries are numerous, some about 350 feet long and 180 feet high. Some of the remarkable features are Monument Mountain, about 175 feet high, and 75 feet above its crests is the grand dome. The Pillared Place contains several clusters of stalactites, and the Pillar of the Constitution, a large stalagmite 30 feet high and 75 feet in circumference. There are 144 places of unusual interest named.

Consult Hovey, H. C., *Celebrated American Caverns* (1896); and Indiana State Geological Reports.

WYANT, wī'ant, **Alexander Helwig,** American artist: b. Port Washington, Ohio, Jan. 11, 1836; d. New York City, Nov. 29, 1892. After trying the saddlery business, he turned to art, became a painter of landscapes at Cincinnati, exhibited in the National Academy of Design in 1865, was elected associate of the academy in 1868, and academician in 1869. In 1865 he went to Europe, becoming a pupil of Hans Gude at Carlsruhe. He attained high rank in landscape art, painting almost exclusively American scenes, and being particularly successful in views from the Adirondack wilderness. His chief characteristics are subtle tones, the evanescent moods of nature that he was quick and able to catch, and a delicate

quality of workmanship. His work is well represented in the Metropolitan Museum, New York. He was a founder of the American Water-Color Society. Among his works are 'Scene on the Upper Susquehanna' (1869); 'Pool on the Ausable' (1871); 'In the Adirondacks' (Metropolitan Museum); 'A North Woods' Brook'; 'An Old Clearing'; 'Pool in the North Woods'; 'New Jersey Meadows' (1872); 'Sunset on the Prairie' (1876); 'Reminiscence of the Connecticut' (1878); 'Evening' (1885); 'Sunset near Killarney' (1886); 'October Day' (1892).

WYATT, wī'at, **James,** English architect: b. Burton Constable, Staffordshire, 3 Aug. 1746; d. Marlborough, Wiltshire, 5 Sept. 1813. He was taken to Rome in 1760 by Sir William Bagot, and during the next six years studied architecture in that city and in Venice. Returning to London, he brought himself into notice by his designs for the Pantheon, in Oxford street, a building for many years famous as the rendezvous of the fashionable world. He received innumerable commissions for private residences in all parts of the kingdom; but his designs, for the most part in a sort of Græco-Italian style, have little at the present day to recommend them. About 1782 he turned his attention to Gothic architecture, being one of the first to attempt its revival; and for many years was employed as a restorer of cathedrals and parish churches, in the course of these labors making sad havoc, at Salisbury, Hereford, Durham and elsewhere. It must be said, however, that his imperfect conceptions of Gothic art were shared by his contemporaries and approved by the taste of his time, in large measure. His most famous work in this style was Fonthill abbey, erected for Beckford in 1795. He held the position of surveyor-general subsequent to 1796, and in 1802–03 was president of the Royal Academy. George III employed him at Windsor. Wyatt is often referred to as «The Destroyer.»

WYATT, Sir **Matthew Digby,** English architect and art writer: b. Rowde, near Devizes, Wiltshire, 1820; d. London, 21 May 1877. He made a diligent study of the architecture of Italy, France and Germany, returning to England in 1846 to publish his 'Geometrical Mosaics of the Middle Ages' (1848). In 1856 he was appointed architect to the East India Company, and made many important designs for public works in Great Britain and India; in 1866 was awarded the royal gold medal of the Royal Institute of British Architects; and in 1869 was knighted and made Slade professor of fine arts at Cambridge. His chief books are 'Metal Work and its Artistic Design' (1852); 'Industrial Arts of the 19th Century' (1853); 'Art Treasures of the United Kingdom' (1857); 'Fine Art' (1870); 'Architect's Handbook in Spain' (1872).

WYATT, Sir **Thomas,** English poet: b. Kent, about 1503; d. Sherborne, Dorsetshire, 11 Oct. 1542. He was graduated from Cambridge in 1518, may have studied at Oxford, and subsequently went on his travels to the Continent. After his return to England he appeared at court, where the reputation he had already acquired as a wit and a poet introduced him to the notice of Henry VIII, who retained him about his person and knighted him in 1537. He was employed on several diplomatic missions to different powers, and was a friend of Thomas Cromwell (q.v.), in whose fall he ran some risk of being involved. In 1542 he was returned to Parliament as knight of the shire for Kent. A close student of foreign literature, Wyatt introduced the sonnet into England from Italy. In this he is commonly associated with Henry Howard, Earl of Surrey, but is more correctly to be regarded as the pioneer. None of Wyatt's verse, sacred or secular, appeared in his lifetime. Some of the secular poems were printed (96 are assigned to Wyatt) in the 'Songes and Sonnettes' (1557) of Richard Tottel, commonly known as 'Tottel's Miscellany.' There are among the extant works 31 sonnets, and satires in heroic couplets, imitated from Persius and Horace. Wyatt's poems evince more elegance of thought than imagination, while his mode of expression is far more artificial and labored than that of Surrey. Consult Nott's edition of Wyatt and Surrey with the elaborate memoir prefixed thereto (1816); also the article by Churton Collins in T. H. Ward's 'English Poets' (1883), and Simond's 'Sir Thomas Wyatt and his Poems' (1889). Consult also Foxwell, A. K., 'Study of Sir Thomas Wyatt's Poems' (New York 1912) and Padelford, F. M., 'Early XVIth Century Lyrics' (London 1907).

WYCHERLEY, wich'ėr-li, **William,** English wit and dramatist: b. Clive, Shropshire, about 1640; d. London, 1 Jan. 1716. About 1655 he went to France for his education, but he returned to England a short time before the Restoration, and was entered a gentleman commoner of Queen's College, Oxford, which he left without a degree, and took chambers in the Middle Temple. He paid, however, little attention to the law, but became a man of fashion in the town, and made himself known as author of 'Love in a Wood, or Saint James's Park,' a comedy, published about the end of 1671. This piece brought him into much notice, and his popularity was increased by comedies that soon afterward followed: 'The Gentleman Dancing-master,' published in 1673; 'The Country Wife,' produced in 1672 or 1673, and 'The Plain Dealer,' 1674. He became a favorite of the meretricious Duchess of Cleveland, and was much regarded by Villiers, the witty and profligate Duke of Buckingham. About 1680 he improved his circumstances by marrying the Countess of Drogheda, a young, rich and beautiful widow. At her death soon afterward she settled her fortune upon him; but, his title being disputed, the costs of law and other encumbrances produced embarrassment, which ended in arrest. He remained in confinement seven years, until released by James II, who, it is said, was so pleased with his comedy of 'The Plain Dealer' that he ordered his debts to be paid, and added a pension of £200 per annum, which he lost at the revolution. The succession to his father's estate, which was strictly entailed, does not appear to have relieved him from the embarrassments into which he had again fallen, and from which he found a deliverance only a few days before his death in marrying a young woman with a fortune of £1,500. Besides the plays already mentioned he wrote poems of no value or

interest. His plays are excessively licentious. He was a friend of Dryden, and in his later years of Pope, but Pope's statements regarding their connection are not much to be depended on. Among latest editions of his plays is that by W. C. Ward (London 1893); Hazlitt, William, 'Lectures on the English Comic Writers' (ib. 1819; new ed., New York 1910); Lansdowne, Lord, 'Memoirs of the Life of William Wycherly, Esq.; with a character of His Writings' (London 1718).

WYCKOFF, wī'kŏf, **Walter Augustus,** American sociologist: b. Mainpuri, India, 12 April 1865; d. 15 May 1908. He was graduated at Princeton in 1888, and after further study in Europe began in July 1891, the life of a day laborer, working his way from Connecticut to California and spending 18 months in this manner. His aim was to study from the inside the economic conditions surrounding American wage-earners, and the immediate outcome of his experiment was his three sociological works: 'The Workers — the East' (1897); 'The Workers — the West' (1898); 'A Day with a Tramp and Other Days' (1901). In 1893–94 he went around the world twice as a private tutor, in 1895 was made a lecturer on political science at Princeton, and in 1898 became an assistant professor of political economy there. His works were widely read and aroused considerable discussion.

WYCLIFFE, wĭk'lĭf. See WICLIF, JOHN.

WYE, wī, a river partly in Wales, partly in England, with its source in Plynlimmon, Montgomeryshire. After a circuitous and winding course of about 130 miles, having passed through Radnorshire, Herefordshire and separated Monmouth from Gloucestershire, it falls into the Severn below Chepstow. It is distinguished for the beauty and variety of its scenery, especially in the neighborhood of Tintern Abbey. The tide at Chepstow sometimes rises 46 feet. Large vessels cannot ascend beyond Chepstow Bridge, but barges of from 18 to 30 tons reach Hereford. A canal from Hereford connects the Wye with the Severn at Gloucester. Other towns on the river are Monmouth, Ross and Builth. Tintern Abbey, one of the noblest ruins of England, is on the banks of the Wye.

WYETH, John Allan, American physician: b. Marshall County, Ala., 26 May 1845; d. New York, N. Y., 28 May 1922. He received his education at the University of Louisville, and at Bellevue Hospital Medical College. During the Civil War he served as a private in Company I of the Fourth Alabamian Cavalry. After practising as attending surgeon to Mount Sinai and Saint Elizabeth hospitals, he founded the New York Polyclinic Medical School and Hospital, the pioneer organization for post-graduate medical study in the United States. For a number of years he was president of the faculty, and surgeon-in-chief of that institution. He was president of the American Medical Association the New York Academy of Medicine, the New York State Medical Association and the New York Pathological Society. In 1878 he was awarded the first and second prizes of the American Medical Association, and the Bellevue Alumni Association Prize in 1876. He published 'A Text-Book on General Surgery' (1888); 'Osteo-Plastic Operation for Correction of Deformities of the Nose and Palate' (1892); 'Life of Lieutenant-General Nathan Bedford Forrest' (1899); 'With Sabre and Scalpel' (an autobiography, 1915).

WYKEHAM, wĭk'ạm, William of. See WILLIAM OF WYKEHAM.

WYLIE, wī'lĭ, **Robert,** American artist: b. Isle of Man, 1839; d. Pont Aven, Brittany, France, 4 Feb. 1877. He was brought to this country when a child, and after some study in the Pennsylvania Academy was sent by his trustees to study in France in 1863. Settling at the village of Pont Aven he was presently surrounded by a colony of artists. In the Paris Salon of 1872 he obtained a second-class medal, but not till after his death did his paintings attract much attention. His 'Death of a Vendean Chief' (1876) hangs in the Metropolitan Museum, New York.

WYMAN, wī'mạn, **Jeffries,** American anatomist: b. Chelmsford, Mass., 11 Aug. 1814; d. Bethlehem, N. H., 4 Sept. 1874. He was graduated from the Harvard Medical School in 1833, was professor of anatomy and physiology at Hampden-Sidney Medical College, Richmond, Va., 1843–47, and Hersey professor of anatomy at Harvard from 1847 until his death. He established there the Museum of Comparative Anatomy and for many years was indefatigable in efforts for its increase, was president of the Boston Society of Natural History 1856–70, became curator of the Peabody Museum, Cambridge, in 1866, and published over 175 scientific papers, including 'On the External Habits, Characters and Osteology of the Gorilla' (1847); 'On the Nervous System of the Bull-Frog' (1853); 'Observations on the Development of the Skate' (1865); 'Observations and Experiments on Living Organisms in Heated Water' (1867); and 'Fresh-water Shell-Mounds of the Saint Johns River, Florida' (1875). He was one of the earliest American supporters of the theory of evolution. Consult biographical sketches by Asa Gray, O. W. Holmes, S. Weir Mitchell, F. W. Putnam, and Burt G. Wilder.

WYMAN, Robert Harris, American naval officer: b. Portsmouth, N. H., 12 July 1822; d. Washington, D. C., 2 Dec. 1882. He entered the navy in 1837, and while attached to the Gulf Squadron during the Mexican War, took part in the siege and capture of Vera Cruz and the expeditions that captured Tuspan and Tampico. He was stationed at the naval observatory in Washington in 1848–50 and 1853–54, and in the Civil War commanded the *Yankee* and *Pownee* and the Potomac flotilla in 1861; and the *Santiago de Cuba* on blockading duty in 1862–64. He became commodore in 1872, and rear-admiral in 1878; and was commander-in-chief of the North Atlantic Station in 1879–82.

WYMAN, Walter, American surgeon: b. Saint Louis, Mo., 17 Aug. 1848; d. 1911. He was graduated at Amherst in 1870, and at the Saint Louis Medical College in 1873; served in city hospitals 1873–75, and after 1876 was in the Marine Hospital service, being made assistant surgeon in 1876, chief medical purveyor of the quarantine division in 1888, and supervising surgeon-general in 1891. He was an earnest

advocate of the sanitation of ports not only in the United States, but in the West Indies and South America, holding that if this were enforced yellow fever would be entirely eradicated from the Western hemisphere. On his recommendation the government set apart a large tract of land at Fort Stanton, New Mexico, for a hospital whither all consumptive patients in the United States marine hospitals could be transferred.

WYMORE, city, Nebraska, in Gage County; alt. 1,222 feet; on the Big Blue River, 54 miles south of Lincoln; on the Chicago, Burlington and Quincy Railroad. There are railroad machine shops and a flour mill. It is a shipping center for grain and livestock. Pop. (1950) 2,258.

WYNANTS, wī'nănts, or **WIJNANTS, Jan,** Dutch painter: b. Haarlem, between 1615 and 1620; d. about 1680. Very little is known of his life except that he was master of Adrian Vandevelde, Wouwerman and other eminent painters, and that he was naturally indolent and given to pleasure. His works are consequently few, but are highly valued for their technical merits. They consist of landscapes of small size, the figures and cattle in which were often executed by other hands. He is represented in the galleries of Amsterdam, The Hague, Munich and in the National Gallery, London.

WYNDHAM, Sir **Charles,** English actor: b. Liverpool, March 23, 1837; d. London, Jan. 12, 1919. He was the son of a physician, studied medicine and surgery in Germany and passed all his examinations brilliantly. During the Civil War he enlisted with the Union forces in the United States and served continuously until the close of the war, being present at the battles of Chancellorsville, Fredericksburg and Gettysburg and through the Red River campaign with General Banks. On quitting the army he made his initial American stage appearance in *Brothers and Sister* and two years later returned to England, where he supported Henry Irving and Ellen Terry in many plays. When he reappeared at the Wallack Theatre, New York, in 1869 he made an excellent impression as a light comedian, and organized a touring company of his own, which went to all of the larger cities of the United States. His repertory was extensive. *The School for Scandal,* in which he appeared as Charles Surface, was one of his greatest successes, and *Pink Dominoes* which he produced in 1877, ran for 500 nights. For 20 years Sir Charles successfully managed the Criterion, New and Wyndham's theatres in London. He was knighted by King Edward in 1902. Consult Scott, *The Drama of Yesterday and Today* (1899).

WYNDHAM, George, English cabinet officer: b. London, Aug. 29, 1863; d. 1913. He was educated at Eton and Sandhurst Royal Military College. He served through the Suakim campaign and at Cyprus in 1885, and was private secretary to A. J. Balfour (q.v.) 1887–1892. He also sat in Parliament for Dover from 1889, was Parliamentary Under-Secretary of State for War 1898–1900, became chief secretary for Ireland in 1900 and entered the Cabinet in 1902. In March 1903 he introduced the Irish land purchase bill subsequently passed. His resignation as chief secretary was brought about by the Orange Unionists. He published an edition of *North's Plutarch* in the *Tudor Classics* (1894); *Shakespeare's Poems* (1898); *Ronsarde and La Pléiade* (1906).

WYNDHAM, Sir **William,** English statesman: b. Orchard-Wyndham, Somerset, 1687; d. Wells, Somerset, June 17, 1740. He was educated at Oxford and entering the House of Commons for his native county, identified himself with the Tories, became secretary of war in 1711, and in August 1713 was transferred to the office of Chancellor of the Exchequer. He was suspected of treasonable relations with the Pretender, and lost his office on the death of Queen Anne. On the outbreak of the rebellion in Scotland under the Earl of Mar in 1715, an order for Wyndham's confinement was issued, and he was arrested at his house in Somerset, but escaped. A reward of $5,000 was offered for his apprehension. After lurking for some time in disguise he surrendered himself and was committed to the Tower. Released without a trial, he remained until his death a leader of the Parliamentary opposition to the ministry of Sir Robert Walpole. He was a very graceful, clear, forcible and spirited orator. One of his sons, Percy, took the name of O'Brien and in 1756 was made Earl of Thomond.

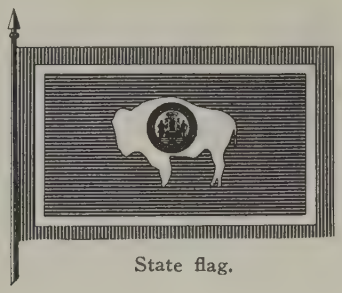
WYNNE, wĭn, **Charles Whitworth.** See Cayzer, Sir Charles William.

WYNNE, city, Arkansas, and Cross County seat; alt. 257 feet; 48 miles west of Memphis, Tenn.; on the Missouri Pacific Railroad. Located in productive farming country, Wynne is the trading center of a district including a number of small municipalities. Besides local and county roads, one state and one federal highway serve it. There are wholesale groceries, and the customary assortment of retail establishments. Making handles, ginning cotton, rice drying, and bottling are the principal industrial occupations. Wynne is a shipping point for fruits, especially grapes, apples, and peaches. Pop. (1950) 4,142.

WYNTOUN, wĭn'tŏn, **Andrew of,** Scottish rhyming chronicler: b. about 1350; d. after 1420. He was a canon regular of the priory of Saint Andrews, and was in 1395 prior of Saint Serf's Inch, in Lochleven, probably holding this office until his death. Wyntoun's *Orygynale Cronykil of Scotland* is the first historical record in the Scottish vernacular. It received little attention until 1795; when David McPherson published an annotated edition of a part of it. David Laing edited a complete edition of this work (3 vols., Edinburgh 1872–1879) and an edition from the Wemyss Manuscript was prepared for the Scottish Text Society (1906). Wyntoun's Chronicle bears the usual character of the historical writings of the age in the indiscriminate mixture of tradition with history, but he appears to have been faithful to his authorities, whom he sometimes literally transcribes. Wyntoun's scholarship appears to have been considerable and the candor and generosity with which he speaks of the enemies of his country are commendable.

WYOMING, wī-ō'mĭng, one of the Rocky Mountain states. It is bordered on the east by Nebraska and South Dakota, on the north by Montana, on the west by Montana, Idaho and

Utah, and on the south by Utah and Colorado. The word *wyoming* is thought to be derived from the Indian word *mecheweami-ing,* meaning "at the big plains."



State flag.

Land area	97,506 square miles
Water area	408 square miles
Total area	97,914 square miles
Latitude	41°—45° N.
Longitude	104° 03'—111° 03' W.
Altitude (average)	6,700 feet
Population (1950)	290,529
Capital city—Cheyenne; Pop. (1950)	31,935
Admitted as a state	July 10, 1890
Bird	Meadowlark
Flower	Indian Paint Brush
Motto	*Cedant Arma Togae* (Let Arms Yield to the Toga)
Nicknames	Equality State; Sagebrush State; Wonderland of America
Song (adopted 1955)	*Wyoming*
Tree	Cottonwood

State seal.

Physical Characteristics.—Wyoming is a state of high plains and mountains. The Continental Divide crosses the state from the northwestern corner to the southern border east of center. The great plains in the eastern part of the state gradually rise to the foothills of the Rocky Mountains. The topography is diversified with plains, low and high mountains, and occasional badlands. The largest mountain masses are in the southern, north central, and northwestern parts of the state. There are many high plateaus with elevations between 4,500 and 7,500 feet.

Wyoming's climate is dry and cool. The dryness serves to temper the coldness of the winters. Cheyenne, for which extensive records are available, may be taken as having typical Wyoming climate. Cheyenne has a mean temperature of 44.6°, an average daily maximum temperature of 56.8°, an average daily minimum temperature of 32.3°; highest temperature of record, 100°; lowest temperature of record,—38°; average precipitation, 14.99 inches. Local variations in climate are considerable, however, since altitudes vary from 3,125 feet in the northeastern corner of the state to over 13,000 feet in the western mountains. The state's average precipitation is 15.8 inches. The growing season varies from 30 days to 156 days.

Wyoming's rivers flow out of the state in all directions, but most of the drainage is to the north and east into the Missouri. The North Platte, Belle Fourche, and Cheyenne rivers flow east; the Wind, Big Horn, and Powder flow north; the Snake and Bear flow west; and the Green flows south. The state supplies water for the Missouri-Mississippi system, the Columbia system, the Colorado system and the Great Salt Lake. Wyoming's lakes are generally small, its principal ones being Yellowstone and Jackson. Reclamation projects provide many smaller areas of water surface, and there are innumerable small lakes in the mountains.

The state has about 1.5 million acres of irrigated land, about one fortieth of its area. The irrigated areas are mainly near the Laramie and Platte rivers in eastern Wyoming, in various parts of the Big Horn Basin, and just east of the Big Horn Mountains. Federal irrigation projects put into operation within the state include the Riverton, Shoshone, and Kendrick projects, which also provide hydroelectric power. If completely exploited, Wyoming's water resources would allow for irrigation of approximately three million acres, or one 20th of the state's area.

Political Divisions.—*Cities.*—Chief cities with their 1950 populations in parentheses are: Cheyenne (31,935), the capital and oil refining center; Casper (23,673), oil and wool production center; Laramie (15,581), transportation and industrial center; and Sheridan (11,500) and Rock Springs (10,857), coal mining centers. (For populations of other cities and towns, see back of state map.)

Counties.—The counties and their county seats are as follows:

County	County Seat	County	County Seat
Albany	Laramie	Natrona	Casper
Big Horn	Basin	Niobrara	Lusk
Campbell	Gillette	Park	Cody
Carbon	Rawlins	Platte	Wheatland
Converse	Douglas	Sheridan	Sheridan
Crook	Sundance	Sublette	Pinedale
Fremont	Lander	Sweetwater	Green River
Goshen	Torrington	Teton	Jackson
Hot Springs	Thermopolis	Uinta	Evanston
Johnson	Buffalo	Washakie	Worland
Laramie	Cheyenne	Weston	Newcastle
Lincoln	Kemmerer		

The People.—Of Wyoming's 1950 population of 290,529, 284,009 were whites and 6,520, nonwhites. Males numbered 154,853 and females, 135,676. The 1940 population of 250,742 included 246,597 whites, 2,349 Indians, 956 Negroes, 643 Japanese, and 102 Chinese. Of the whites, 16,779 were foreign-born, most of whom had come from England (1,490), Germany (1,392), Sweden (1,353), Russia (1,325), Italy (1,215), Mexico (1,198), and Scotland (1,086). Although approximately 93 per cent of the people were American-born, almost two thirds were migrants from other states.

Wyoming's 1950 rural population of 145,911 approximated 50.2 per cent of the total. Most of those classed as rural, however, lived in villages and towns, communities of less than 2,500 being classified as rural. About 19.5 per cent of the people actually lived in rural farm or ranch areas.

Natural Resources.—*Fauna and Flora.*—Wyoming's animals and plants vary with the elevation. At lower elevations are found coyotes, prairie dogs, ground squirrels, pocket gophers and cottontail rabbits. At middle elevations are found coyotes, jack rabbits, cottontail rabbits,

antelope, mule deer and a few moose. At higher elevations there are snowshoe rabbits, black bear, elk, and an occasional grizzly bear and mountain lion.

At lower elevations there are broad-leaved cottonwood and box elder. At middle elevations one finds trembling aspen, yellow pine, narrow-leaved cottonwood, saltbush, yucca and sage-brush; at higher elevations there are spruce, fir and lodgepole pine. The highest parts of the state, above timber line, are characterized by arctic flora. The mountains are wooded up to timber line, and this forest area comprises 13 per cent, or 12,500 square miles, of the state.

Minerals.—Wyoming's known coal reserves are the greatest of any of the states. More than half of the state is underlaid with bituminous coal. Reserves are estimated at six hundred billion tons. Seventeen of the 23 counties produce coal, but the five main fields are at Rock Springs, Hanna, Kemmerer, Sheridan and Gillette.

Wyoming has known petroleum reserves of 800,000,000 barrels. This compares with a cumulative production of 751,000,000 barrels up to January 1, 1948. Many important discoveries were made in the oil boom which began in 1942. These discoveries involved both the finding of entirely new fields, and the discovery of new producing horizons in old fields. From 1942 to 1947 41 new fields were found in 15 counties. During the same period new producing horizons were developed in 23 old fields in eight counties. The exploration seismograph has been widely used to locate buried structures. Wyoming's first production below 10,000 feet was discovered in 1946 in the Church Buttes Field in Uinta County. In 1947 six wells were drilled below 10,000 feet.

There are large iron reserves near Hartville in Platte County, which have been worked by the Colorado Fuel and Iron Company at its Sunrise Mine since 1900. There are also vast deposits of titaniferous magnetite (iron) ore in the Laramie Mountains and extensive reserves of low-grade vanadium ore in the western part of the state. Nonmetallic minerals of which there are considerable reserves are bentonite, vermiculite, sodium sulphate, trona, feldspar, phosphate, potash, gypsum and anorthosite.

Gold and silver have been found in only small quantities, although the search for them has continued for more than a century. Copper has been produced in comparatively small quantities from time to time. The greatest production was at Encampment, 1902–1908, valued at two million dollars.

Soils.—Wyoming's soil is generally fertile, but rather thin. Lack of water makes it impossible to use most of the land except for grazing. Along the eastern border the soil is brown with calcareous subsoil; in east central Wyoming there is grayish-brown soil with calcareous subsoil. In most of southern Wyoming and in the Big Horn Basin there are gray or brown arid-region soils.

Water Power.—The Bureau of Reclamation had 45,800 kilowatts of installed capacity in five hydroelectric plants, and 800 miles of high voltage transmission lines connecting the plants, in 1948. In general, reclamation projects in the state are multiple-purpose. The Kortes Project, begun in 1946, is primarily for power, and when completed will have a capacity of 30,000 kilowatts. The Boysen Project, begun in 1947, is for flood control, irrigation, silt control and power. It will have a power capacity of about 10,000 kilowatts.

Natural resources of growing importance in Wyoming are the state's scenic attractions, its pleasantly cool summer climate, and its fishing, hunting and skiing opportunities which bring many tourists.

Parks, Reservations and Preserves.—One seventh of Wyoming (8,658,185 acres) is in national forests; and 2,540,000 acres are in national parks and monuments. Five forests lie entirely within the state; and four others are partly in the state. The national parks are Yellowstone, 2,222,000 acres and Grand Teton, 96,000 acres. The national monuments are Devil's Tower, Shoshone Cavern, Fort Laramie and Jackson Hole—the last named having 221,621 acres.

There is one Indian reservation, the Wind River, 808,500 acres, in Fremont County, where there were located 1,351 Shoshoni and 1,346 Arapaho, as of 1945.

Birds and game animals are protected in the national parks. The State Game and Fish Commission regulates hunting and fishing elsewhere, changing rules as needed to maintain proper balances.

Production.—*Agriculture.*—The most important agricultural activity is livestock production. Ninety-five per cent of the farm and ranch area of the state is used for cattle and sheep range. Normally there are about one million cattle in the state and three million sheep. The sheep population, however, declined in the 1940's until there were only about 2,070,000 in 1949. Wyoming fleeces are the heaviest in the United States, averaging ten pounds. Wyoming ranks second to Texas in the number of sheep and lambs produced and in total wool production.

The United States Agricultural Censuses of 1940 and 1945 showed that Wyoming's farm and ranch units were becoming fewer and larger. In 1940 the 15,018 farms and ranches averaged 1,866.2 acres; in 1945 the 13,076 farms and ranches averaged 2,532.6 acres.

Five per cent of Wyoming's farm and ranch area is crop-producing. More than half of the crop area is devoted to native hay, much of which is irrigated. The remaining crop area is partly irrigated and partly dry-land. Crop production for 1947 was: hay, 1,115,000 tons, wheat 296,000 bushels, oats 153,000 bushels, barley, 152,000 bushels, sugar beets 454,000 tons. These figures were considerably above the 1935–1944 averages.

Wyoming's forest lands produced 54,000,000 board feet in 1945.

Minerals.—Wyoming's assessed coal production reached 8,038,648 tons in 1947. Its assessed petroleum production reached 40,662,627 barrels in 1947, an all-time high for the state. Wyoming experienced an oil boom in the early 1920's; and a second boom in production began in 1942. Other extractive industries have been developed on only a comparatively small scale.

Wyoming's only important manufacturing industry is oil refining. Not all of the state's production of oil, however, is refined within its borders; much of the crude production going by pipeline to Salt Lake City, Denver, and to points in Missouri.

Transportation and Communications.—Although the Continental Divide traverses Wyoming in a northwesterly direction, this backbone of the continent is quite low at several places in southern Wyoming, making it possible for railways and highways to pass through without the necessity of

solving the problems of extremely high altitudes. The main line of the Union Pacific Railway and Highway 30, the Lincoln Highway, consequently cross southern Wyoming. The Chicago and Northwestern, and Burlington railroads serve central and northern Wyoming, with connections to the north, east and south. North-south transportation facilities are generally poor. The state's line mileage of railways is 1,877.61. In early 1954 there were 27,172 miles of highways and roads, of which 5,548 miles were surfaced, and 33 commercial and municipal airfields, with three regularly scheduled airlines in service. Communications media included 92,100 telephones, 16 radio stations, two television stations, 10 daily newspapers, and 35 other newspapers.

Economic and Financial Factors.—As of June 30, 1954, the state's 25 national banks held $231,433,000 in assets and $214,914,000 in deposits; 28 state banks had $93,102,000 in assets and $84,987,000 in deposits.

Wyoming has only a small industrial population. The railroad workers are organized in the railroad brotherhoods and the American Federation of Labor. The miners, teamsters, building trades and other crafts belong to the American Federation of Labor. Oil workers belong to the Congress of Industrial Organizations. The three different labor organizations are generally together on political issues in Wyoming. The two principal groups of workers, the miners and the railroad employees, have regularly followed their national organizations in the matter of strikes.

Government.—*Executive.*—Wyoming has a multiple executive elected by popular vote. The executive officers provided for by the state constitution are the governor, secretary of state, treasurer, auditor, and superintendent of public instruction. Except for the governor, each has a department of government under his immediate control. Basic administrative authority is vested in various boards and commissions. A number of the more important boards and commissions are made up of the five constitutional executive officers serving in an ex-officio capacity. The governor's term runs for four years.

GOVERNORS OF WYOMING

TERRITORIAL

John A. Campbell		1869–1875
John M. Thayer		1875–1878
John W. Hoyt		1878–1882
William Hale		1882–1885
Francis E. Warren		1885–1886
George W. Baxter		1886
Thomas Moonlight		1887–1889
Francis E. Warren		1889–1890

STATE

Francis E. Warren	Republican	1890
Amos W. Barber	"	1890–1893
John E. Osborne	Democrat	1893–1895
William A. Richards	Republican	1895–1899
De Forest Richards	"	1899–1903
Fenimore Chatterton	"	1903–1905
Bryant B. Brooks	"	1905–1911
Joseph M. Carey	Democrat	1911–1915
John B. Kendrick	"	1915–1917
Frank Houx	"	1917–1919
Robert D. Carey	Republican	1919–1923
William B. Ross	Democrat	1923–1924
Frank Lucas	Republican	1924–1925
Nellie Tayloe Ross	Democrat	1925–1927
Frank C. Emerson	Republican	1927–1931
Alonzo M. Clark	"	1931–1933
Leslie A. Miller	Democrat	1933–1939
Nels H. Smith	Republican	1939–1943
Lester C. Hunt	Democrat	1943–1949
Arthur Griswold Crane	Republican	1949–1951
Frank A. Barrett	"	1951–1953
C. J. Rogers (acting)	"	1953–1955
Milward L. Simpson	"	1955–

Legislature.—The state legislature is bicameral, with 27 senators elected for four years, and 56 representatives elected for two years. Elections are from the counties at large. Four of the 23 counties return two senators. The number of representatives varies, with two counties returning six. The legislature meets the second Tuesday in January of odd-numbered years. The length of the session is limited to forty days, but special sessions may be called. In the regular session of 1947, for the first time, an Interim Committee was provided for, to study various problems and to submit recommendations to the 1949 session.

Courts.—Wyoming has a state supreme court of three justices elected for overlapping eight-year terms. Its jurisdiction is primarily appellate. There are also seven district courts with single judges elected for six-year terms. The district courts have general original jurisdiction and limited appellate jurisdiction from inferior local courts.

Public Welfare.—The five elective executive officers constitute the Board of Public Welfare with supervision over the Department of Public Welfare. Likewise, these five officers comprise the Board of Charities and Reform, with supervision over the Tuberculosis Sanitarium at Basin, the Training School at Lander, the State Hospital for the Insane at Evanston, the Soldiers' and Sailors' Home at Buffalo, the Penitentiary at Rawlins, the Boys' Industrial Institute at Worland, the Girls' School at Sheridan, the Children's Home at Casper, and over the Saratoga Hot Springs Reserve at Saratoga, and the Hot Springs State Park at Thermopolis.

Local Government.—This is organized in the usual pattern of western states. Each county has a board of three county commissioners with general administrative and legislative authority. The commissioners are elected, as are the county clerk, surveyor, sheriff, treasurer, attorney, superintendent of schools, coroner, justice of the peace, and constables. Cities and towns vary in their governmental organization. The cities of Laramie and Sheridan operate under special charters granted by the territorial government. Others operate under general state laws. Most Wyoming communities have the mayor-council form of government, but Cheyenne and Sheridan have the commission form, and Laramie uses the manager form. The constitution provides that the legislature shall provide for a system of township organization and government which may be adopted by any county, but this section of the constitution has not been implemented.

Educational System.—Wyoming had only one institution of higher learning until 1947 when two junior colleges were established, one at Casper and one at Powell. In 1948 two other junior colleges were established, one at Sheridan and one at Torrington. All four junior colleges are supported by the local school districts. Three of them, however, those at Powell, Sheridan and Torrington are named University of Wyoming Centers, and are closely coordinated with the state-supported University of Wyoming.

The University of Wyoming was established in 1887, as a land-grant institution. It grew slowly, attaining an enrollment of 1,000 for the first time in 1925. The enrollment in 1947–1948 was 3,300. In 1948 the university included colleges of agriculture, commerce and industry, education, engineering, law, and liberal arts. There

is also a school of pharmacy. The university offers work to the master's degree in almost all fields, and work to the doctor of education degree and to the degree, doctor of philosophy, in the four fields of agriculture, chemistry, education and geology. The university is managed by a board of trustees composed of nine members appointed by the governor with the consent of the senate for overlapping six-year terms. The governor, the president of the university, and the state superintendent of public instruction are ex-officio members of the board.

The state superintendent of public instruction has supervision of the elementary and secondary schools of the state. A state board of education was established in 1919 and is appointed by the superintendent with the consent of the governor. The board oversees vocational and other schools receiving state aid, prescribes standards for elementary and secondary schools, and supervises the examination of superintendents and teachers for the public schools. The state board of education appoints a commissioner of education who acts as secretary to the board, and executes the educational policies of the board under the general direction of the superintendent.

The Wyoming Education Association employs a full-time secretary who publishes the *Wyoming Education News.*

In 1947–1948 the public school enrollment totalled about 55,000; there were 2,600 teachers. The average public school teacher was paid $2,370 in 1947–1948. There are several parochial elementary schools, but only one parochial high school, St. Mary's in Cheyenne.

An Equalization Fund was established by the legislature in 1935. The purpose of the fund is to equalize educational opportunity by providing assistance needed by school districts to maintain the program established by law.

Wyoming's educational level is relatively high. The 1940 census reports reveal that the median of school years attained by Wyoming's population is 9.2 while that for the United States is 8.4. Only six per cent of Wyoming's people above 25 years of age in 1940 had less than five years of schooling as compared with 13.5 per cent in the United States.

History.—Before the arrival of the white man, various Indian tribes roamed over the region now known as Wyoming. Among these tribes were the Sioux, Cheyennes, Arapaho, Crow and Shoshoni.

The first white men to reach Wyoming were probably the Vérendrye brothers, Frenchmen who traveled west-southwest from the Mandan villages late in 1742, and finally on New Year's Day, 1743, came to a place from which they could see to the west a mountain range—perhaps Wyoming's Big Horn Mountains. Towards the end of the 18th century, other Frenchmen penetrated to the Wyoming country via the North Platte River. Spanish trade goods reached the region, but they were probably brought by Indians, rather than by the Spaniards themselves. No Spanish expedition is known to have gone as far north as Wyoming.

Meriwether Lewis and William Clark did not enter Wyoming, but one of their men, John Colter, is usually credited with being the first white man to view the wonders of Yellowstone Park. Colter left the returning expedition to trap the tributaries of the upper Missouri. Employed by Manuel Lisa, the St. Louis fur trader, Colter spent part of the winter of 1807–1808 in northwestern Wyoming. He presumably crossed from the Big Horn Basin into Jackson Hole and into Teton Basin in Idaho, and then returned through Yellowstone Park. In 1810 he told William Clark of his experiences, and Clark included Colter's route on his 1814 map of the Lewis and Clark Expedition. Colter's stories of Yellowstone were first received with skepticism and incredulity. The name "Colter's Hell" was applied to the region that the intrepid trapper had visited.

John Jacob Astor, who was interested in the Oregon fur trade, sent an overland expedition, led by Wilson Price Hunt, which crossed northern Wyoming on its way west in 1811. In the following year Robert Stuart, another Astor employee, led a small party from Oregon through Wyoming, suffering great hardships. They lost their horses to Indians, wandered northward through Star Valley, crossed to the Green River valley, passed over the Continental Divide in the vicinity of South Pass (probably south of the pass) and made their way eastward along the North Platte River.

Early in 1824 a party representing the Rocky Mountain Fur Company entered Wyoming from Montana, traversed the Big Horn Basin, and crossed through South Pass. Jedediah Smith, Thomas Fitzpatrick and James Clyman were in the party. They are generally credited with being the first white men to go through South Pass, gateway to the west.

Increasing numbers of trappers penetrated the Wyoming country in the 1820's and 1830's. Hundreds of fur men ransacked the region for the precious beaver pelts. They lived not unlike Indians, and often died at the hands of the red men. William H. Ashley in 1825 gathered many of the trappers together on the Green River near Pinedale in the first fur trappers' rendezvous. In the next fifteen years the rendezvous was an annual affair. Trappers, white and red, assembled in early summer at a prearranged place to dispose of their winter's catch, to get fresh supplies, and to enjoy the conviviality they had missed during the long winter. Twelve of the 16 rendezvous were held in western Wyoming. Rivalry developed between various fur companies, but with the decimation of the beaver by 1840, Wyoming's "beaver gold" disappeared.

Other motives sent people along the trapper's trails. Sportsmen, scientists and missionaries had accompanied the fur trade caravans bound for the rendezvous. Among these were the Methodist missionaries, Jason and Daniel Lee, Thomas Nuttall, botanist, John K. Townsend, ornithologist, all in 1834; the Reverend Samuel Parker and Dr. Marcus Whitman in 1835; and notably Mrs. Whitman and Mrs. Spalding, who came with their husbands in 1836. They were the first white women to enter Wyoming. Father Pierre Jean de Smet, Roman Catholic missionary, came with the supply train of 1840.

The 1840's saw a crescendo of westward migration along the well-marked trails to Oregon, California and Utah. Wyoming was looked upon as part of the "Great American Desert," which had to be crossed as quickly as possible to reach more promising lands beyond.

Two small Wyoming communities offered the weary travellers opportunities to secure supplies, repairs for their wagons, and replacements for their worn out draft animals. Fort Laramie, near

WYOMING

Top: The world's largest elk herd at its winter feeding grounds in Jackson Hole.

Center: The Emerald Pool in Yellowstone National Park.

Right: A Wyoming dude ranch.

Color photos (top) Ray Atkeson from Shostal; (center) F. Ragsdale from FPG; (right) W. R. Wilson from FPG

WYOMING

© Screen Traveler from Gendreau

Wool production is an important industry in Wyoming where exceptionally heavy fleeces are produced. Here, on a large sheep ranch, ewes are shown ready for shearing.

Courtesy United States Department of the Interior

Looking out over a portion of Grand Teton National Park to spectacular jagged peaks of the Teton Range.

WYOMING

1950 Total Population 290,529

Absaroka(mts.)(C1)
Acme (E1) 200
Afton (B3) 1,319
Akwenasa (B4) 50
Aladdin (H1) 10
Albany (F4) 50
Albert (creek) (B4) .....
Albin (H4) 208
Alcova (F3) 36
Alcova (res.) (F3)...
Alva (H1) 51
Anchor (D2) .....
Antelope (creek) (G2) .....
Antelope (hills)(D3)
Arapahoe (D3) 193
Arcola (H4) 15
Arlington (F4) .....
Arminto (E2) 30
Arvada (F1) 85
Aspen (mts.) (C4)...
Aspentunnel (B4) 20
Atlantic (peak)(D3)
Atlantic City (D3)... 20
Auburn (A3) 400
Bacon (ridge) (B2).
Badger (creek) (E2)
Badger Basin (C1)...
Badwater (creek) (E2) .....
Baggs (E4) 206
Bairoil (E3) 300
Banner (F1) 4
Basin◉ (E1) 1,220
Bear (creek) (H4)...
Bear (riv.) (B4) .....
Bear Creek (G2) 6
Bear Lodge (mts.) (H1) .....
Bear River Divide (mts.) (B4) .....
Beaver (creek) (D3)
Beaver (creek)(H2)
Bedford (A3) 268
Belle Fourche (riv.) (H1) .....
Bentonite Spur (H1) 12
Beulah (H1) 50
Big Horn (E1) 200
Big Piney (B3) 206
Big Sandy (C3) 20
Big Sandy (res.)(C3)
Bighorn (mts.) (E1)
Bighorn (riv.)(D1)..
Bigtrails (E2) .....
Bill (G2) 6
Bitter (creek)(C4)...
Bitter Creek (D4) 150
Black Thunder (creek) (G2) .....
◉ County Seat

Blacks Fork, Green (riv.) (C4) .....
Blazon (B4) .....
Bondurant (B2) 6
Bonneville (E2) 75
Bonneville(mt.)(C3)
Border (B3) 35
Bosler (G4) 75
Boulder (C3) 20
Boulder (lake)(C3).
Boxelder (G3) .....
Boysen (D2) 100
Boysen (res.) (D2)..
Bright (H2) 4
Brilliant (B4) 15
Buckhorn (H1) 5
Buffalo◉ (F1) 2,674
Buffalo Bill (dam.) (C1) .....
Buffalo Bill (res.) (C1) .....
Buffalo Fork, Snake (riv.) (B2) .....
Buford (G4) 62
Bull Lake (res.)(C2)
Burlington (D1) 150
Burns (H4) 216
Burris (C2) 90
Burwell (mt.) (C2)..
Byron (D1) 350
Caballo (creek)(G1)
Calpet (B3) 79
Camp Ferris (E3) 20
Canyon (B1) .....
Careyhurst (G3) .....
Carlile (H1) 2
Carpenter (H4) 104
Carter (B4) 75
Casper◉ (F3) 23,673
Casper (mt. range) (F3) .....
Casper A.F.B. (F3).
Cassa (G3) 10
Centennial (F4) 68
CHEYENNE (H4) 31,935
Cheyenne (riv.)(H2)
Chugwater (H4) 283
Chugwater (creek) (H4) .....
Church Buttes (B4). 75
Clareton (H2) 3
Clark (C1) 100
Clark Fork, Yellowstone (riv.) (C1)..
Clear (creek) (F1)..
Clearmont (F1) 225
Clifton (H2) 5
Cloud (peak) (E1)..
Cody◉ (D1) 3,872
Cokeville (B3) 440
Colony (H1) .....
Columbine (F2) 40

Como (F4) 6
Continental (peak) (D3) .....
Cooper (lake) (G4)
Cora (C3) 4
Cottonwood (creek) (B4) .....
Cowley (D1) 463
Crazy Woman (creek) (F1) .....
Crosby (mt.) (C2)...
Croton (G1) .....
Crow (creek) (H4)..
Crowheart (C2) 4
Daniel (B3) 75
Dayton (E1) 316
Deadman (mt.)(B2)
Deaver (D1) 118
Devils Tower (H1)... 30
Devils Tower Nat'l Mon. (H1) .....
Diamond G Ranch (C2) .....
Diamondville (B4)... 415
Dickie (D1) 35
Dines (C4) 237
Divide (H4) 2
Dixon (E4) 124
Doubletop (peak) (B2) .....
Douglas◉ (G3) 2,544
Dry (creek) (C2) .....
Dry Fork, Cheyenne (riv.) (G2) .....
Dry Fork, Powder (riv.) (F2) .....
Du Noir (riv.) (C2)
Dubois (C2) 279
Dull Center (H2) 8
Duncan (C2) 17
Dwyer (G3) 16
Eagle (peak) (B1)...
East Fork, Green (riv.) (C3) .....
E. Thermopolis(D2) 246
Echeta (G1) .....
Eden (C3) 200
Eden (res.) (C3) .....
Edgerton (F2) 203
Egbert (H4) 50
Elk (B2) 34
Elk Basin (D1) 200
Elk Mountain (F4). 196
Elkol (B4) 40
Elmo (F4) 213
Emblem (D1) 250
Encampment (F4).... 288
Encampment (riv.) (F4) .....
Ervay (E3) 3
Esterbrook (G3) 15
Ethete (D2) 50

Etna (A2) 450
Evanston◉ (B4) 3,863
Evansville (F3) 393
Fairview (B3) 400
Farson (C3) 150
Federal (H4) 10
Ferris (mts.) (E3)...
Fifteen Mile (creek) (D1) .....
Fishing Bridge (B1)
Fivemile(creek)(D2)
Flattop (H3) 2
Fletcher Park (G3).. 5
Fontenelle (B3) 35
Fontenelle (creek) (B3) .....
Fort Bridger (B4)..... 100
Fort Fred Steele(E4) 40
Fort Laramie (H3)... 300
Fort Laramie Nat'l Mon. (H3) .....
Fort Washakie (C2).1,500
Fortress (mt.) (C1).
Fossil (B4) 10
Four Corners (H1).. 30
Foxpark (F4) 110
Francis E. Warren A.F.B. (G4) .....
Frannie (D1) 180
Freedom (B3) 510
Freeland (F3) 5
Fremont (lake)(C3)
Fremont (peak) (C2) .....
Frontier (B4) 500
Gannett (peak)(C2)
Garland (D1) 60
Garrett (G3) 29
Gebo (D2) 200
Gillette◉ (G1) 2,191
Glendo (G3) 215
Glenrock (G3) 1,110
Goose (creek) (E1).
Goose Egg (F3) 20
Gooseberry (creek) (D1) .....
Grand Teton (peak) (B2) .....
Grand Teton Nat'l Park (B2) .....
Granger (C4) 122
Granite (mts.) (E3).
Granite Canon (G4) 120
Grass Creek (D2).... 150
Gray (peak) (B1)....
Great Divide (basin) (E3) .....
Green (mts.) (E3)...
Green (riv.) (C4)....
Green River◉ (C4).3,187
Green River (mt.) (C2) .....

Greybull (E1) 2,262
Greybull (riv.) (D1)
Greys (riv.) (B3).....
Gros Ventre (riv.) (B2) .....
Grover (B3) 350
Grovont (B2) .....
Guernsey (H3) 721
Guernsey (res.)(H3)
Gunn (C4) .....
Halfway (B3) 25
Hamilton Dome(D2) 187
Hams Fork (riv.) (B4) .....
Hanna (F4) 1,326
Hartville (H3) 229
Hat Creek (H3) 1
Hawk Springs (H4).. 163
Haystack (mt. range) (F3) .....
Hazelton(peak)(E1)
Heart (lake) (B1)...
Hells Half Acre(E2) 6
Hiland (E2) 7
Hillsdale (H4) 78
Hoback (B2) 5
Hoback (peak)(B2)
Hoback (riv.) (B2)..
Holmes (F4) 25
Holmes (mt.) (B1)..
Horse (creek) (B3).
Horse (creek) (H4).
Horse Creek (G4).... 10
Horseshoe (creek) (G3) .....
Horton (H1) .....
Hudson (D3) 293
Hulett (H1) 236
Hunt (mt.) (E1).....
Huntley (H4) 69
Hyattville (E1)..... 125
Index (peak) (C1)...
Inyan Kara (creek) (H1) .....
Inyan Kara (mt.) (H1) .....
Iron Mountain (G4) 23
Isabel (mt.) (B3).....
Jackson◉ (B2) 1,244
Jackson (lake) (B2)
Jackson (peak)(B2)
Jay Em (H3) 30
Jelm (G4) 2
Jenny Lake (B2)..... 7
Jireh (H3) 7
Kane (D1) 21
Kaycee (F2) 211
Kearney (F1) 11
Keeline (H3) 17
Kelly (B2) 18
Kemmerer◉ (B4).....1,667
Kendall (B2) 8

WYOMING

111°
110°
109°
108°
45°
44°
43°
42°
41°
MONTANA
SOUTH DAKOTA
NEBRASKA
COLORADO
UTAH
IDAHO
YELLOWSTONE NATIONAL PARK
GRAND TETON NAT'L PARK
BIG HORN MTS.
BIG HORN BASIN
WASHAKIE
HOT SPRINGS
OWL CREEK MTS.
WIND RIVER RANGE
WIND RIVER IND. RES.
FREMONT
SUBLETTE
SWEETWATER
UINTA
LINCOLN
TETON
PARK
CARBON
NATRONA
CONVERSE
NIOBRARA
GOSHEN
PLATTE
ALBANY
LARAMIE
Gardiner
Yellowstone Park
Tower Falls
Mt. Washburn 10,343
Canyon
Mt. Holmes 10,300
Gray Pk. 10,300
Electric Pk. 11,155
Hebgen Res.
W. Yellowstone
Lake Outlet
Old Faithful
Thumb
Yellowstone Lake
Fishing Bridge
Eagle Pk. 11,360
Shoshone L.
Lewis L.
Heart L.
Big Springs
Cooke
Chance
Warren
Aberdeen
Elk Basin
Frannie
Deaver
Cowley
Kane
Lovell
Byron
Garland
Powell
Ralston
Painter
Badger Basin
Clark
Parkman
Ranchester
Dayton
Tongue
Wolf
Big H
Hunt Mtn. 12,151
Shell
Shell Cr.
Emblem
Burlington
Greybull
Otto
Basin
Manderson
Hyattville
Cloud Pk. 13,165
Buffalo Bill Res.
BUFFALO BILL DAM
Cody
SHOSHONE CAVERN NAT'L MON.
Shoshone
Pahaska
North Fork
Wapiti
Fortress Mtn. 12,873
Valley
South Fork
Needle Mtn. 12,190
Pitchfork
Meeteetse
Sunshine
Dickie
Gooseberry Cr.
Worland
Ten Sleep
Hazelton Pk. 10,54
Fifteen Mile Cr.
Nowood
Mt. Burwell 11,738
Mt. Crosby 12,405
Grass Creek
Winchester
Gebo
Kirby
Lucerne
Hamilton Dome
Anchor
Thermopolis
E. Thermopolis
Bigtrails
No Water Cr.
Owl Cr.
Lamont
Moran
Jackson Lake
Buffalo Fork
Elk
Jenny Lake
Grand Teton Pk. 13,766
Mt Leidy 10,317
Table Pk. 11,901
Driggs
Victor
Tetonia
Felt
Jackson
Wilson
Jackson Pk. 10,707
Snake
Gros Ventre
Teton Pass
Diamond G Ranch
Duncan
Dubois
Green River Mtn. 10,175
Doubletop Pk. 11,115
Hoback
Alpine
Bondurant
Kendall
Gannett Pk. 13,785
Fremont Pk. 13,730
New Fork Lakes
Willow L.
Fremont L.
Cora
Merna
Horse Cr.
Daniel
Pinedale
Halfway
Boulder
Boulder Lake
Mt Bonneville 12,630
Wind River
Arapahoe
Ethete
Fort Washakie
Riverton
Saint Stephens
Hudson
Lander
Pavillion
Morton
Kinnear
Crowheart
Burris
Dry Cr.
Muddy
Fivemile Cr.
Pilot Butte Res.
Bull Lake Res.
Boysen
Boysen Res.
Boysen Cr.
Boonneville
Badwater
Lysite
Lost Cabin
Shoshoni
Moneta
Poison
Hiland
Waltman
Armi
Mushrat
Ervay
Granite Mts
Rattlesnake
Freedom
Thayne
Bedford
Turnerville
Auburn
Grover
Afton
Fairview
Smoot
Wyoming Pk. 11,363
Mt. Thompson 9,748
Mt. Isabel 10,154
Geneva
Star Valley
Middle Piney
Marbleton
Big Sandy
South Piney Cr.
Big Piney
Atlantic Pk. 12,734
Atlantic City
South Pass City
Split Rock
Sweetwater
Beaver
Little Popo Agie
Popo Agie R.
Antelope Hills
Green Mts.
Continental Pk.
St. Marys Pk.
Calpet
Big Sandy Res.
Eden Reservoir
La Barge
Border
Pegram
Cokeville
Fontenelle
Farson
Eden
Sandy
Little Sandy
Bairoil
Lamont
Camp Ferris
Semi
Ferris
Great Divide Basin
Nugget
Fossil
Frontier
Kemmerer
Sage
Diamondville
Elkol
Opal
Blazon
Brilliant
Muddy
Bear River Divide
Hams Fork
Smiths Fork
Fontenelle Cr.
Green River
Blacks Fork
Granger
Church Buttes
Carter
Albert
Evanston
Le Roy
Fort Bridger
Lyman
Urie
Aspentunnel
Piedmont
Mountainview
Knight
Akwenasse
Robertson
Oakwood
Lonetree
McKinnon
Manila
Bridgeport
Winton
Superior
South Superior
Dines
Reliance
Gunno
Point of Rocks
Thayer Junction
Wamsutter
Rock Springs
Quealy
Bitter Creek
Aspen Mts.
Salt Wells Cr.
Rawlins
Sinclair
Fort Fred
Continental Divide
Tullis
Bagge
Dixon
Savery
Battle Creek
Longitude

WYOMING

107°
106°
105°
104°
103°
45°
44°
43°
42°
41°
SCALE OF MILES
0 10 20 40
State Capitals
County Seats
Railroads 180
All railroads are numbered as per accompanying list, making possible quick and accurate identification of each line.
RAILROADS
42 Chicago and North Western
45 Chicago, Burlington & Quincy
56 Colorado & Southern
57 Colorado & Wyoming
137 Northern Pacific
180 Union Pacific
181 Wyoming
CAMPBELL
CROOK
WESTON
NIOBRARA
CONVERSE
NATRONA
JOHNSON
SHERIDAN
ALBANY
LARAMIE
PLATTE
GOSHEN
S. DAK
NEBR.
BIG HORN MTS.
BEAR LODGE MTS.
LARAMIE RANGE
MEDICINE BOW MTS.
SHIRLEY BASIN
CASPER AIR FORCE BASE
FRANCIS E. WARREN AIR FORCE BASE
FORT LARAMIE NAT'L MON.
SCOTTS BLUFF NAT'L MON.
DEVILS TOWER NAT'L MON.
FOSSIL CYCAD NAT'L MON.
WIND CAVE NAT'L PARK
Sheridan
Buffalo
Gillette
Moorcroft
Newcastle
Casper
Douglas
Glenrock
Lusk
Torrington
Wheatland
Laramie
Cheyenne
Scottsbluff
Gering
Chadron
Hemingford
Bridgeport
Edgemont
Hot Springs
Custer
Keystone
Crawford
Harrison
Alliance
Harrisourg
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8571

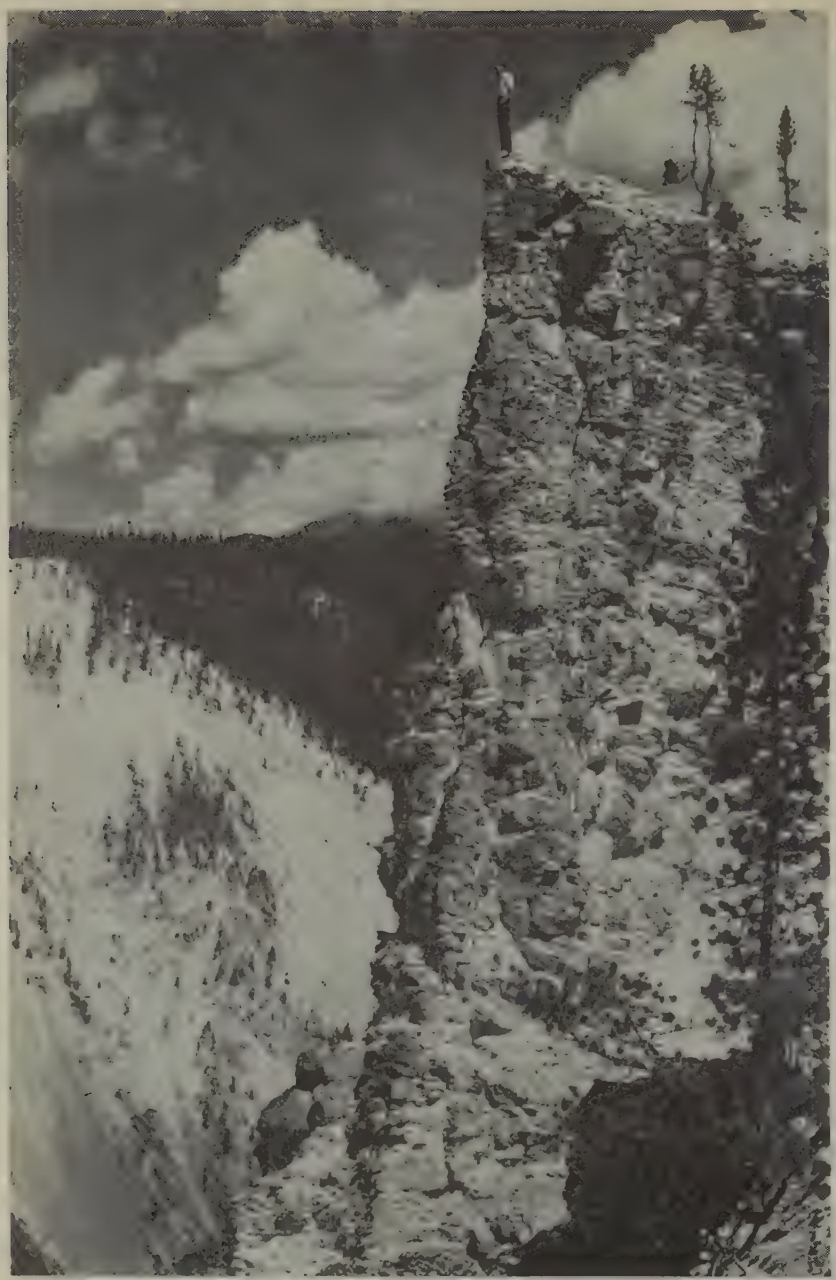
Keyhole (res.) (H1)
Kinnear (D2) 32
Kirby (D2) 99
Kirtley (H3) .....
Knight (B4) 12
Kyle (F4) 30
La Barge (B3) 110
La Barge(creek) (B3)
Lagrange (H4) 221
Lake Outlet (B1) .....
Lamar (riv.) (B1) ...
Lamont (E3) 100
Lance (creek) (H2).
Lance Creek (H2) 2,000
Lander◉ (D3) 3,349
Laramie◉ (G4) 15,581
Laramie (mt. range) (G3) .....
Laramie (peak) (G3)
Laramie (riv.) (G4)
Lawver (G2) 2
Le Roy (B4) 15
Leidy (mt.) (B2) .....
Leiter (F1) 3
Leo (F3) 41
Leverett (H2) .....
Lewis (lake) (B1) ...
Lightning (creek) (G2) .....
Lindbergh (H4) 5
Lingle (H3) 403
Little Bear (H4) .....
Little Laramie (riv.) (G4) .....
Little Medicine(G3) 6
Little Medicine Bow (riv.) (F3) .....
Little Missouri (riv.) (H1) .....
Little Popo Agie (riv.) (D3) .....
Little Powder (riv.) (G1) .....
Little Sandy (creek) (C3) .....
Little Thunder (creek) (G2) .....
Lodgepole (creek) (H2) .....
Lodgepole (creek) (H4) .....
Lonetree (B4) 70
Lookout (G4) 15
Lost Cabin (E2) 73
Lost Springs (G3) 9
Lovell (D1) 2,508
Lucerne (D2) 13
Lusk◉ (H3) 2,089
Lyman (B4) 483
Lysite (E2) 50
Madison (plat.) (B1)
Manderson (E1) 107
Manville (H3) 154
Marbleton (B3) 20
Marshall (G3) 20
Mayoworth (F2) 5
Mc Fadden (F4) 225
Mc Kinley (G3) 21
Mc Kinnon (C4) 154
Medicine Bow (F4). 328
Medicine Bow (mt. range) (F4) .....
Medicine Bow (riv.) (F3) .....
Meeteetse (D1) 404
Meriden (H4) 16
Merna (B3) 50
Middle Fork, Powder (riv.) (F2) .....
Middle Piney (creek) (B3) .....
Midwest (F2) 2,000
Mills (F3) 866
Monarch (F1) 500
Moneta (E2) 12
Moorcroft (E1) 517
Moose (B2) 65
Moran (B2) 120
Morton (D2) 18
Moskee (H1) 70
Mountainview (B4).
Muddy (creek) (B4)
Muddy (creek) (D2)
Muddy (creek) (F3)
Muskrat(creek) (E2)
Natrona (F2) .....
Needle (mt.) (C1) ...
New Fork (lakes) (C2) .....
New Haven (H1) .....
Newcastle◉ (H2) 3,395
Niobrara (riv.) (J3).
No Water (creek) (E2) .....
Node (H2) 4
North Fork, Owl (creek) (D2) .....
North Fork, Powder (riv.) (F2) .....
North Fork, Shoshone (riv.) (C1) .....
North Fork, Wind (riv.) (C2) .....
North Laramie (riv.) (G3) .....
North Platte (riv.) (J4) .....
Nowood(creek) (E1)
Nugget (B4) 10
Old Faithful (B1) ....
Old Woman (creek) (H3) .....
Opal (B4) 67
Orin (G3) 50
Oriva (G1) .....
Orpha (G3) 40
Osage (H2) 284
Oshoto (G1) 7
Otto (D1) 400
Owl Creek (mts.) (D2) .....
Pahaska (C1) 50
Painter (C1) 35
Parkerton (G3) 90
Parkman (E1) 75
Pass (creek) (F4) ....
Passaic (F1) 5
Pathfinder(res.) (F3)
Pavillion (D2) 241
Piedmont (B4) 29
Pilot Butte (res.) (D2) .....
Pine Bluffs (H4) 846
Pinedale◉ (C3) 770
Pitchfork (C1) 50
Point of Rocks (D4) 46
Poison (creek) (E2).
Poison Spider (creek) (F3) .....
Popo Agie (riv.) (D3) .....
Porcupine (creek) (G2) .....
Powder (riv.) (F1) ..
Powder River (F2) ... 42
Powell (D1) 3,804
Quealy (C4) 147
Ralston (D1) 64
Ranchester (E1) 251
Rattlesnake (mt. range) (E3) .....
Rawhide (creek) (G1) .....
Rawhide (creek) (H3) .....
Rawlins◉ (E4) 7,415
Recluse (G1) 21
Red Fork, Powder (riv.) (F2) .....
Reliance (C4) 700
Riverside (F4) 50
Riverton (D2) 4,142
Robertson (B4) 24
Rock River (G4) 424
Rock Springs (C4).10,857
Rockeagle (H3) 2
Rocky (mts.) (C1) ..
Rockypoint (G1) 4
Ross (G2) 25
Rozet (G1) 50
Ryan Park (F4) 150
Saddlestring (F1) 10
Sage (B4) 25
Saint Marys (peak) (D3) .....
Saint Stephens (D3). 150
Salt (riv.) (B3) .....
Salt River (mt. range) (B3) .....
Salt Wells (creek) (D4) .....
Sandy (creek) (C3) ..
Saratoga (F4) 926
Savageton (G2) .....
Savery (E4) 55
Savery (creek) (E4).
Seely (H1) 5
Seminoe (mts.) (E3)
Seminoe (res.) (F3)
Seminoe Dam (E3).. 59
Shawnee (G3) 25
Shell (E1) 61
Shell (creek) (E1) ....
Sheridan◉ (F1) 11,500
Shirley (F3) 20
Shirley (basin) (F3).
Shoshone (lake) (B1)
Shoshone (riv.) (D1)
Shoshone Cavern Nat'l Mon. (C1)...
Shoshoni (D2) 891
Sierra Madre (mts.) (E4) .....
Sinclair (E4) 775
Slate (creek) (C3) ...
Slater (H4) 12
Smiths Fork, Bear (riv.) (B3) .....
Smoot (B3) 280
Snake (riv.) (B2) .....
S. Fork, Cheyenne (riv.) (H2) .....
S. Fork, Powder (riv.) (F2) .....
S. Fork, Shoshone (riv.) (C1) .....
S. Pass City (D3) 15
S. Piney (creek) (B3) .....
S. Superior (D4) 780
Speer (H4) 10
Spotted Horse (G1). 4
Story (F1) 335
Stroner (H1) 3
Sundance◉ (H1) 893
Sunrise (H3) 450
Sunshine (C1) .....
Superior (D44) 1,580
Sussex (F2) .....
Sweetwater (riv.) (D3) .....
Sybille (creek) (G4).
Table (peak) (B2) ...
Teckla (G2) 9
Ten Sleep (E1) 289
Teton (mt. range) (B2) .....
Thayer Jct. (D4) 37
Thayne (A3) 229
Thermopolis◉ (D2).2,870
Thompson(mt.) (B3)
Thornton (H1) .....
Thumb (B1) .....
Tie Siding (G4) 50
Tongue (riv.) (E1) ...
Torrington◉ (H4)...3,247
Tower Falls (B1) .....
Tullis (E4) 3
Turnercrest (G2) 10
Turnerville (A3) 73
Ucross (F1) 45
Ulm (F1) 45
Underwood (G4) 10
Upton (H1) 951
Urie (B4) 25
Uva (H3) 35
Valley (C1) 100
Van Tassell (H3) 34
Veteran (H4) 48
Walcott (F4) 25
Waltman (E2) 6
Wamsutter (E4) 103
Wapiti (C1) 13
Washburn (mt.) (B1) .....
Wendover (H3) 30
Weston (G1) 2
Wheatland◉ (H3)....2,286
Wheatland (res.) (G4) .....
Whitman (H3) 2
Wild Cat (G1) 2
Willow (creek) (F2)
Willow (lake) (C2).
Wilson (B2) 200
Winchester (D2) 57
Wind (riv.) (C2) .....
Wind River (D3) 300
Wind River (mt. range) (C2) .....
Wind River Ind. Res. (C2) .....
Winton (C4) 665
Wolf (E1) 75
Wood (riv.) (C2) .....
Worland◉ (E1) 4,202
Wyarno (F1) 6
Wyoming (mt. range) (B2) .....
Wyoming (peak) (B3) .....
Yellowstone (lake) (B1) .....
Yellowstone (riv.) (B1) .....
Yellowstone Nat'l Park (B1) .....
Yellowstone Park (B1) 250
Yoder (H4) 128

◉County Seat

Ewing Galloway, N.Y.

Top: A winter view of the State Capitol at Cheyenne. *Center:* Cattle roundup on a ranch. *Bottom:* Devil's Tower, a national monument in the northeastern section of the state.

WYOMING



Left: The Grand Canyon of the Yellowstone in Yellowstone National Park, as seen from Artist Point.

Triangle Photo Service

Below: Haying in a 1,200-acre meadow near Moran, Wyoming.

Ewing Galloway, N.Y.

the junction of the Laramie and North Platte rivers in eastern Wyoming was for many years the best known settlement in the Rocky Mountain region. Fort Laramie was established as a private trading post in 1834. In 1849 it was sold to the United States government. The other Wyoming port of call for the overland travelers was Fort Bridger on Blacks Fork of the Green River in southwestern Wyoming. The famous storyteller, scout and guide, Jim Bridger, opened the post in 1843. Both of these forts were busy places in summer, and very quiet in winter.

Second Lieut. John C. Frémont of the Corps of Topographical Engineers visited Fort Laramie in 1842. He followed the Oregon Trail to western Wyoming and returned by the same route. In 1843 Frémont again visited southern Wyoming, and moved on to the west coast. The first United States troops visited Wyoming in 1845 when Col. Stephen W. Kearny led five companies of the First Dragoons over the Oregon Trail to South Pass.

In the dozen years beginning in 1841 more than 150,000 persons crossed South Pass on the way to the Pacific Slope. Perhaps 50,000 crossed in the single year of 1850. By August 14 of that year the register at Fort Laramie recorded 39,506 men, 2,421 women, and 609 children. Brigham Young led the main party of Mormons across Wyoming in 1847.

The Indians understandably were alarmed at the number of whites who were moving along the Oregon Trail. Wild game disappeared for many miles on either side of the broad highway. Various misunderstandings arose, and occasionally white travellers suffered from Indian depredations. A great treaty council was held below Fort Laramie in 1851. Perhaps 10,000 Indians, Sioux, Cheyennes, Arapaho, Shoshoni and Crows, were present to hear Col. Thomas Fitzpatrick and Superintendent D. D. Mitchell, the government commissioners. The Indians were promised an annuity of $50,000 in goods for 50 years in return for promises that they would allow unmolested passage to the west and a treaty of peace was made. The Fort Laramie Treaty no doubt mitigated hostilities for a number of years. In 1854, however, just below Fort Laramie occurred the Grattan Massacre. Lieut. John L. Grattan, a corporal, 27 privates and an interpreter were killed. Although relations between Indians and whites were strained thereafter, there was little violence in Wyoming until the 1860's. An effort to open the Bozeman Road from Fort Laramie to the Montana gold fields culminated in open war in northern Wyoming. The road led through a favorite Sioux hunting ground east of the Big Horn Mountains. Near Fort Phil Kearny, which was established in 1866 a few miles south of present Sheridan, occurred the Fetterman Massacre, December 21, 1866. Eighty-two men, including Lieut. Col. William J. Fetterman, were ambushed and slain. War continued until another Fort Laramie Treaty in 1868 provided for withdrawal of garrisons from the Bozeman Road. In the same year a treaty made at Fort Bridger established the Wind River Reservation in Central Wyoming for the Shoshoni. The Arapaho were moved to the same reservation in 1878; and the two tribes, about 1,000 persons in each, have remained there. Northern Wyoming was not made safe for whites until after the Custer Massacre which took place in Montana near Wyoming's northern border in 1876.

In the meantime many prospectors, beginning in the 1840's, had searched the Wyoming country for gold without much success. Perhaps $2,000,000 was taken from the South Pass region in the late 1860's and early 1870's, but otherwise the search for precious metals in Wyoming was, and has remained, disappointing.

Stage lines operated along the Oregon Trail in the 1850's. Ben Holladay moved his line south to the Overland Trail in 1862. The Pony Express provided fast communication in 1860–1861, and the telegraph, faster still in 1861 and thereafter.

The Union Pacific Railway entered Wyoming in 1867 and had crossed into Utah by 1869. Cities sprang up along the route in southern Wyoming, Cheyenne, Laramie, Carbon, Rawlins, Rock Springs, Green River and Evanston. This influx of population gave strength to a movement to organize Wyoming Territory. The Wyoming region had been from time to time a part of various territories, and was a part of Dakota Territory in 1868 when Congress passed an act, July 25, creating Wyoming Territory. The territory was actually organized in 1869 with four counties, Laramie, Albany, Carbon and Carter (Sweetwater), each extending the length of the territory from north to south.

One of the first acts of the territorial government was to give women the right to vote. The measure was signed by the governor, December 10, 1869. Wyoming's priority in extending general suffrage to women has given rise to the nickname "Equality State"; and the date that the measure was approved, December 10, is celebrated as Wyoming Day.

The 1870 census showed 9,118 people. Rapid growth thereafter brought demands for statehood, which led to the admission of Wyoming as the 44th state, July 10, 1890. The state was given the same boundaries as the territory had had.

Cattle had wintered at Forts Laramie and Bridger in the 1840's with the aid of supplemental feed and water. Later—according to one story, in 1854—it was discovered that cattle could survive the northern winter if left to roam unattended on the open range. After the Civil War, Texas longhorns were trailed into the region and turned loose to forage for themselves until roundup time. Later, particularly in the early 1880's, improved breeds were trailed from Oregon. For a number of years the open range cattle industry flourished. The Laramie County Stock Growers Association of 1873 became the Wyoming Stock Growers Association of 1879. Profits were surprisingly good, since grazing on government land cost nothing. The cattlemen dominated territory politics. The term "Cattlemen's Commonwealth" was no misnomer. The terrible winter of 1886–1887, however, dispelled the dream. The summer of 1886 had been unusually hot and dry. Too many cattle were competing for the available grass. When the abnormally hot and dry summer was followed by an unusually severe winter, hundreds of thousands of cattle died. Those cattlemen who were fortunate enough to avoid bankruptcy reorganized their industry thereafter. In particular they made provision for supplementary winter feed and water.

Sheep had been trailed into Wyoming from Oregon before the winter of 1886–1887. They had been received with hostility by the cattlemen. Although the comparatively few sheep also suffered in the winter of 1886–1887, there was rapid

expansion of the sheep industry thereafter. In the 1890's, the Wyoming range was divided about equally between cattle and sheep; and that status of balance has endured. Wyoming sheep and sheepmen continued to suffer at the hands of cattlemen until after a cattlemen's party killed two prominent sheepmen and a herder at Bonanza in the Big Horn Basin in 1909. The arrest, trial and conviction of the guilty cattlemen terminated the use of extralegal methods in settling range disputes. The Wyoming Wool Growers Association and the National Wool Growers Association had become strong enough to secure the rule of law.

In an earlier period cattlemen had found it desirable to take the law into their own hands in dealing with cattle thieves—rustlers. Range detectives were not very successful, partly because juries often would not convict on the evidence presented. When prosecution in the courts failed, individuals believed to be rustlers were shot or hanged without benefit of trial. Cattlemen, however, continued to lose cattle and settlers with small herds in Johnson County in northern Wyoming were particularly suspect. These settlers in turn believed that their rights were not respected in the official roundups of the Stock Growers Association. The settlers determined to hold their own roundup, whereupon the association laid plans to make a surprise raid into Johnson County. A list of alleged rustlers who were to be killed on sight was prepared. Twenty-five Texans were brought to Cheyenne and joined to a similar number of Wyoming cattlemen. Taking every precaution to keep their movements secret, the raiders left Cheyenne by special train, April 4, 1892. They mounted their horses at Casper on April 6 and proceeded across country. They killed two of the men on their list when they surrounded them on the KC ranch, but word of their activities reached Buffalo, county seat of Johnson County. The sheriff organized a posse considerably outnumbering the cattlemen's party. Informed of this development the cattlemen fortified the TA ranch 12 miles from Buffalo, and soon were besieged by the enraged posse. Word went quickly to the governor, and from him to the president of the United States. Cavalry were dispatched from Fort McKinney to arrest the cattlemen. They surrendered and were taken to Cheyenne for trial. The case against the cattlemen was eventually dismissed, much to the chagrin of the people of Johnson County.

A few individual cattlemen later returned to the practice of hiring gunmen to frighten or kill rustlers. The notorious Tom Horn was active in this business. Horn was finally arrested for killing a boy, whom he apparently had mistaken for the father, was convicted and hanged for the crime in 1903.

As the 20th century progressed, Wyoming citizens conformed more and more to the ways of people farther east. The state's population growth in the 1920's, 1930's, and 1940's corresponded very closely to the nation's population increase, evidence of the state's maturity. Most of the state remained a great pasture for cattle and sheep. Scattered reclamation projects made possible intensive agriculture on 1,500,000 of the state's 62 million acres. Great coal reserves were drawn on for eight or nine million tons annually. Numerous oil pools were tapped, with peaks of production in the early 1920's and the late 1940's. The tourist business became of great importance in the state's economy. The spirit of territorial days, however, was revived every summer in almost every community with rodeos, stampedes, chuck wagon days, or similar celebrations.

During World War II, and after, efforts were made with small success to bring manufacturing industries to the state. There was a feeling that, with oil refining the only major manufacturing industry, the state was sorely in need of more industry to balance its economy.

Fifty-one per cent of the state's area had remained public domain, and there was much controversy regarding the use and ultimate disposal of the public property. Often sportsmen and dude ranchers were aligned with the government against the cattlemen and sheepmen. President Franklin D. Roosevelt's creation of the Jackson Hole Monument in 1943 aroused a storm of disapproval from private interests in the community and state. The cry of state's rights which had been heard in Wyoming since 1890 was loud as ever after half a century.

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WYOMING, Pa., borough in Luzerne County; on the Susquehanna River; about 5 miles northeast of Wilkes-Barre; on the Delaware, Lackawanna, and Western, and the Lehigh Valley railroads. It is in the heart of the anthracite mining region, has silk and metal industries, and is noted as the scene of the Battle of Wyoming of 1778. (See PENNAMITE WARS; WYOMING VALLEY.) Pop. (1940) 4,728; (1950) 4,511.

WYOMING, University of, located at Laramie, Wyo. It was charted by the territorial legislature in 1886 and opened to students in 1887. The first state legislature in 1890 enlarged the scope of the university and made the state agricultural college, provided by federal grants, a part of the university organization. The institution, which is coeducational, includes colleges of law, liberal arts, education, engineering, commerce and industry, and agriculture. There is also an extension division which conducts extension lectures throughout the state, and a department for teaching by correspondence. See also WYOMING—*Educational System.*

WYOMING VALLEY, a crescent shaped valley, 21 miles long, in Luzerne County, Pa., traversed by the northern branch of the Susquehanna River. It is a fertile alluvial plain, with rich deposits of anthracite coal, and is noted for its beautiful scenery. The valley was claimed by Connecticut under its charter of 1662 and settled in the 1750's and 1760's by people from that colony. The ensuing dispute between Pennsylvania and Connecticut was not settled until after the American Revolution (see PENNAMITE WARS).

During the revolution a large proportion of the men of the Wyoming Valley joined the Continental Army; but a number of Tories remained in the valley and in 1778, when they were joined by British troops and Indian allies, an attack

was made upon the settlers who had taken refuge in Forty Fort, near Wilkes-Barre. The settlers did not number over 400, chiefly boys and old men; the British force, including the 700 Indians, was about 1,100. After a desperate battle fought on the 3d of July 1778 the settlers were completely defeated, about two thirds being killed. They were forced to capitulate, and after the surrender many of the prisoners were tortured and killed by the Indians. The greater part of the inhabitants of the valley were compelled to flee to other settlements and endured great hardships.

WYOMINGITE, a rock consisting almost entirely of leucite and phlogopite, abundant in the Leucite Hills in Sweetwater County, Wyoming. Contains so much potash that it may become a source of that material.

WYON, wī'ŭn, **William,** English engraver and designer of coins and medals: b. Birmingham, 1795; d. Brighton, Sussex, Oct. 29, 1851. Having won several prizes for medals offered by the Society of Arts, he went in 1816 to London and was appointed second engraver at the mint, a post which he filled until the close of his life. In 1831 he was elected an associate of the Royal Academy, and in 1838 an academician, being the first of his department who had ever obtained these honors. His works, comprising coins, pattern pieces of coins not used, medals and seals are numerous. His coins cover a period of nearly 30 years, including the latter part of the reign of George IV, the reign of William IV, and the first 13 years of the reign of Victoria. Far more numerous than these are his war, scientific, artistic and testimonial medals, executed from his own or John Flaxman's designs, and in the highest style of art.

WYSPIANSKI, vĭs-pyän'y'-skē, **Stanislaw,** Polish painter, poet and dramatist: b. Cracow, 1869; d. there, 1907. A pupil of the historical painter Jan Matejko, he continued his studies in France and Italy. Of his 16 plays, some were of classic Greek but most of Polish inspiration. The latter include *The Legion* (1900), *The Wedding* (1901), *Deliverance* (1903), *November Night* (1904).

WYSS, vēs, **Johann Rudolf,** Swiss author: b. Bern, March 4, 1782; d. there, March 31, 1830. He was educated at various German universities, became professor of philosophy at Bern in 1806, and later also chief librarian. His *Der Schweizerische Robinson* (1812–1827), an imitation of Defoe, was translated into various languages, the first series appearing in English (*The Swiss Family Robinson*) in 1820, the second in 1849. Wyss also wrote *Vorlesungen über das höchste Gut* (1811), and *Idyllen und Erzählungen aus der Schweiz* (1815–1822); *Reise im Berner Oberland* (1808); and edited the collection *Die Alpenrosen* (1811–1830). Wyss is the author of the Swiss national anthem, *Rufst du, mein Vaterland?* (1811).

WYTHE, with, **George,** American patriot: b. 1726 in the county of Elizabeth City, Va., a short distance from Yorktown; d. Richmond, June 8, 1806. From his mother Wythe received a life-long bent toward scholarship, and from a Quaker ancestor, George Keith (q.v.), his opposition to slavery. Wythe was trained in the law by an uncle. His connection with the Virginia House of Burgesses began on Feb. 27, 1752. Hence he knew in a practical way the steps which led to the revolution, whose course he was destined to influence. He was a member of the Continental Congress and a signer of the Declaration of Independence. He sat in the Philadelphia Convention of 1787 and exerted himself to secure the ratification of the Constitution by Virginia the following year. For 10 years he was a member of the Virginia Supreme Court of Appeals, and for more than 20 years sole chancellor of the state. However, George Wythe is not to be judged chiefly as a statesman or jurist. He was greatest in his role as teacher. Either in his law office or as professor in William and Mary College, he was the teacher of Thomas Jefferson, John Marshall, James Monroe, Henry Clay and scores of other men only less prominent than these. With Jefferson, in particular, Wythe maintained a friendship and interchange of thought which had a bearing upon national concerns. So highly did Jefferson prize the work of Wythe as a teacher, that he exerted himself to establish, in 1779, in the College of William and Mary a chair of law, expressly for the occupancy of his "master and friend," as he delighted to call Wythe. Wythe was the first professor of law in the United States. William and Mary College was the second in the English-speaking world to have a chair of Municipal Law, George Wythe coming to such a professorship a few years after Sir William Blackstone. In three signal instances Wythe was a forerunner. As early as 1764 he wrote Virginia's first remonstrance to the House of Commons against the Stamp Act, taking so advanced a position in regard to that ominous act as to alarm his fellow burgesses. He was perhaps the first judge to lay down, in 1782, the cardinal principal that a court can annul a statute deemed repugnant to the Constitution, thus anticipating by a score of years the classic decision of his great pupil, John Marshall, in the case of *Marbury* v. *Madison*. He was an ardent advocate for the emancipation of the slaves, not only infusing his students with his abolition sentiment, but actually freeing his own slaves and making provision for them in his will. His death occurred in Richmond, Va., in 1806, from poison administered by his great-nephew, who hoped to come thus into the inheritance of his estate. "No man," says Jefferson, "ever left behind him a character more venerated than George Wythe. His virtue was of the purest kind; his integrity inflexible, and his justice exact; of warm patriotism, and devoted as he was to liberty and the natural and equal rights of men, he might truly be called the Cato of his country, without the avarice of the Roman; for a more disinterested person never lived. Temperance and regularity in all his habits gave him general good health, and his unaffected modesty and suavity of manners endeared him to every one. He was of easy elocution, his language chaste, methodical in the arrangement of his matter, learned and logical in the use of it, and of great urbanity in debate. Not quick of apprehension, but with a little time profound in penetration, and sound in conclusion. His stature was of middle size, well formed and proportioned, and the features of his face manly, comely, and engaging. Such was George Wythe, the honor of his own and

the model of future times." Wythe was the author of *Decisions in Virginia by the High Court of Chancery* (1795); 2d ed., with *Memoir* (1852).

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WYTHEVILLE, wĭth'vĭl, town, Virginia, Wythe County seat; altitude 2,350 feet; 65 miles southwest of Roanoke; on the Norfolk and Western Railroad. Livestock is raised in the county. The town's industries include meat packing, flour and lumber milling, and the manufacture of hosiery, shirts, underwear, and furniture. There is a public library and a number of interesting old houses. The town, settled in 1790, was named in honor of George Wythe, Virginia patriot and jurist. It was incorporated in 1839 and has the city manager form of government. Pop. (1950) 5,513.

WYTHEVILLE, Military Operations at. During the Civil War the lead mines and works near Wytheville assumed much importance. On July 13, 1863, Col. John T. Toland, with the 2d West Virginia cavalry and 34th Ohio mounted infantry, about 800 men, started from Fayetteville, W. Va., to damage the lead works and destroy the railroad near Wytheville. On the evening of the 18th Toland arrived within five miles of the town and detached two companies to destroy a railroad depot and track 10 miles west. He marched his remaining force into the town, which was defended by less than 200 men, under Major Bowyer. Most of these were distributed in houses and some in the streets supporting two guns. There was an obstinate fight in the streets, lasting an hour, when the town was taken and eight or ten of the best houses burned. The two guns and many small arms were captured and some prisoners taken, but all were abandoned when the return march was taken up next morning.

The command reached Fayetteville on the 23d after a march of about 300 miles. The expedition had failed of its object, with the loss of 78 killed, wounded and missing, of whom 17 were killed, including Colonel Toland and two other officers. Colonel Powell, commanding the 2d West Virginia cavalry, was severely wounded and captured. The Confederates reported a loss of six killed and 12 wounded.

On May 2, 1864, General Crook started from Charleston on the Kanawha to destroy the Virginia and Tennessee Railroad and join General Sigel in the Shenandoah Valley. One of his columns of 2,600 cavalry, under General Averell, was directed upon Saltville to destroy the salt works, and then rejoin the main column under Crook at Dublin Station. After a very difficult march through the mountains and some sharp skirmishing Averell reached Tazewell Court House on the afternoon of the 8th. Here he learned that Saltville was defended by earthworks and artillery, and was held in strength by Gen. W. E. Jones. Averell abandoned the idea of attack and turned toward Wytheville, near which he arrived on the afternoon of the 10th.

Here he encountered Col. John H. Morgan, who had followed him from Saltville and by a detour first gained the town with a brigade and two battalions. A detachment of Morgan's command had been pushed out to a small gap in the mountain, through which alone Averell could approach the town from the road on which he was marching. The detachment was immediately attacked and Morgan marched to its assistance with all his command, and Averell fell back to a commanding ridge 800 yards from the gap. The contest continued four hours, or until nightfall, in a succession of attacks on the one side and retreats on the other. Morgan fell back a short distance and Averell withdrew and next morning marched for Dublin, where he arrived in the evening and, resuming his march, joined Crook at Union on the 15th. Averell had 114 killed and wounded, and lost nearly 100 in prisoners. Morgan lost 50 or 60 killed and wounded.

When General Stoneman made his raid into southwestern Virginia in December 1864, he captured Wytheville on the 16th, partially burned it and next day sent a detachment to destroy the lead mines, which was done without loss. On Stoneman's second raid in southwest Virginia and western North Carolina in March 1865, Col. J. K. Miller, with 500 picked men of his cavalry brigade, captured Wytheville April 6th and destroyed the depot of supplies at that point and the bridges over Reedy Creek and at Max Meadows. At Wytheville, Miller was attacked by Confederate infantry and cavalry, but after hard fighting repulsed them, and withdrew with a loss of 35 killed, wounded and missing, and rejoined the main column on its march for Salisbury, N. C.

WYTTENBACH, vĭt'ĕn-bäĸ, **Daniel Albert,** Dutch scholar: b. Bern, Switzerland, Aug. 7, 1746; d. Osgeest, Holland, Jan. 17, 1820. He studied at Marburg, Göttingen and Leiden; became professor of Greek at the Remonstrant Gymnasium at Amsterdam in 1771, of philosophy at the Athenaeum in 1779, and succeeded in 1799 to Ruhnken's chair of rhetoric at Leiden.

His greatest work is the edition of Plutarch's *Morals,* with copious annotations, and an admirable *Greek Index to Plutarch's Works* (1795–1830). Other works are *Epistola Critica* (1769); *Praecepta Philosophiae Logicae* (1782); *Eclogaesen Selecta Principum Historicorum Capita* (1793; 1829); Plato's *Phaedo* (1825). He retired in 1816, and died after some years of blindness.

WYTTENBACH, Johanna Gallien, Dutch author: b. Hanau, c.1770; d. Leiden, April 27, 1830. Daughter of a sister of the eminent scholar D. A. Wyttenbach (q.v.), in 1816 she married her aged uncle to whom she had given 20 years of devoted service as housekeeper, secretary, and literary assistant. This unusual marriage, for which the king of Holland granted a special license, was arranged to ensure her the pension of a professor's widow. After her husband's death she lived for some years in Paris. At Marburg University's tercentenary celebration (1827) she was awarded a doctorate. Among her works are *Théagène* (1815); *Das Gastmahl der Leontis* (1821); and the novel *Alexis* (1823).

WYZEWA, Teodor de (real last name WYZEWSKI), French author of Polish origin: b. Zvanec, Russian Poland, Aug. 30, 1863; d. Paris, April 8, 1917. Brought to France as a child, in 1881 he was appointed professor of philosophy at the college of Châtellerault. With E. Dujardin he founded the *Revue Wagnérienne* (1884), and subsequently was foreign literature critic of the *Revue des Deux Mondes.* A prolific author, he also translated into French many Russian classics.

X The twenty-fourth letter of the English alphabet (see article on letter A), corresponding to the twenty-first of the Latin, from which both its position and shape are derived (the increase in number being due merely to the differentiation of *i* and *j*, and of *u*, *v*, and *w* in the English alphabet). Its name *ix* or *ex* is also of Latin origin. The combination of consonants written *x*, namely *ks*, does not exist initially in English; those words which show it are all foreign and, with hardly an exception, Greek (for example, *xylophone*). *Xavier* is a Spanish local name, and *Xerxes* simply the Greek rendering of the Persian word *ḫšāyathiya* (king). The Romans could not pronounce the Greek name (*xei*) of the letter, but substituted *ix* for it, not so much by inverting the order of the sounds in the name as by prefixing a vowel and then dropping the final vowel. The symbol appears in the Etruscan alphabet also, but only in *abecedaria* (which nevertheless have ⊞ , *samech*, in addition). Etruscan inscriptions also have *X* with the numerical value of 10, and it is possible that this use in Latin was taken over from the Etruscans, the upper part (*V*) indicating one half the amount—perhaps suggested by a rude sketch of the hand with fingers and thumb outstretched. On the other hand, the *V*-symbol (5) may have been the older, and the use of *X* for 10 inspired by the apparently doubled *V*.

In modern times in algebra *x* is used to designate an unknown quantity, and hence also in the sciences (as in *X-rays*), though the concept is far from modern. For example, in Diophantus, an Alexandrian mathematician (fl. about 350 A.D.), a symbol ς is used, which may have been of Egyptian origin, though it has been regarded as a compendium of αϱ , that is, ἀριθμός (number). Its similarity to ϛ′ *hex* (six) is, then, entirely fortuitous. As an abbreviation *X* is used sometimes in the sense of "extra"; for example, it is used for the additional (or extra) decretals of Gregory IX. It is also used for the older Christus-symbol (☧) as an abbreviation of *Christ-* in *Xmas*, and in Greek inscriptions for *chilio-*, "thousand(s)."

The use of *X* with the phonetic value *ks* is proper to the western subdivision of the ancient Greek alphabet that came to be adopted in Italy. Hence its appearance in modern western European alphabets with the same value, whereas in the Attic (eastern) Greek alphabet X (χ) has the value of an aspirated *k* (*kh* or *ch*), for which the western had 𐌚 . In Attic *x* is written Ξ (ξ), and this is represented by the variant ⊞ of the Chalcidian *abecedaria*, which is also the Palestinian ⋕ , the Moabite ⋕ , Cretan and Phoenician ⋕ , square Hebrew ס . Its name is *sāmekh*, "fish," and in the proto-Sinaitic texts a drawing of a fish has been identified with the Canaanitish ⋕ . Another view interprets *sāmekh* as "prop"(?), which is closer to the hieroglyphic ⊸ (subsequently ⋕). In any event, the Semitic value is *s*, and in early Greek inscriptions not only does Ξ appear beside I (ζ) for *sd* (or *zd*), just as in early Latin *z* means *s* or *ss*, but also κσ and χσ appear for *x*, a fact which shows that *sāmekh* was felt to be inadequate. A few early Ionic inscriptions have a symbol ⊟ or ⊡ (*h*) used in combination with *s* to signify *x*. If this had been confused with *sāmekh*, it is easy to see how the latter, used alone, might come to have the value *x*. However, evidence is lacking to prove this intermediate stage, and X (in some Greek alphabets +) has been held to be derived from ⊞ (see above); in the Messapic alphabet X or + actually has the value *s*, not *x*. It is, nevertheless, noteworthy (1) that the combination *-ks-* often becomes *-khs-* and *-hs-* (Gothic *wahsjan* has *-hs-* from an older *-ks-*; compare *ahsa* beside Latin *axis*), and this becomes *ch* or *h* (Welsh *achel*, "axis"; *chwech*, "six"); (2) that another development of the same combination is *-ss-* or *s*, as in Irish *dess* beside Latin *dexter*, "right-handed"; *mos* beside Latin *mox*, "soon," like Vulgar Latin *dester* (Italian *destro*, French *destrier*), and Provençal *eis(s)ir* from Latin *exire*. In the later Greek numerical use of alphabetic symbols ξ′ means "sixty," and this appears also in the Cyrillic Old Church Slavonic. The Greek name *xei* was modeled on *pei* (π), taken from the Semitic *pē*. In Old English runes ᛉ , later Ψ , appears instead of the older Latin *x*; its name was *eolhs*, but the meaning, "elk"(?), and derivation (perhaps from ᛉ , *z*) are dubious.

Nearly all modern English words containing the prefix *ex-* were borrowed from French, and show a curious variation of pronunciation; thus *x* is *gz* before accented vowels (as in *examine, exert*), but *ks* after accented vowels (as *execute, exit*). In Latin *x* was always *ks*, but this became *gz* in early French and the French pronunciation was borrowed into English. Subsequently the influence of the normal English pronunciation of *ex-* in Latin words influenced that of most words in which the accent was thrown back onto the first syllable, though the old pronunciation still survives beside the new in a few words (*exile, exigence*), and some have both pronunciations even before accented vowels (*exhale, exhilarate, exude*). In Old English, especially in late West Saxon, metathesis of *sx* to *cs*, written *x*, is not uncommon (e.g., *axe*, "ashes," *axian*, "ask." The final combination *-ks* is stable (*vex, wax, axe*). For bibliography see the article on the letter A.

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X-RAYS, Medical Use of. With the advent of X-ray mankind gained one of the most powerful tools in the long course of medicine. For the first time it became possible to peer into the innermost recesses of the body without the aid of the surgeon's scalpel. It was possible to carry medical diagnostic methods to hitherto completely inaccessible areas of the human body by painless efficient techniques. When Prof. Wilhelm Konrad Roentgen made his epochal discovery in 1895 he realized the vast possibilities of the door he had opened and sought to advance the X-ray method right from its inception toward its present advanced status. From that late evening when he first observed the glimmer of a fluorescent screen and grasped the significance of this new illumination until he published his historic paper entitled "On a New Kind of Ray," Roentgen acted with great comprehension of what this discovery meant in the fields of medicine, research, industry, physics, and all the other areas which X-ray has so vitally affected.

From its inception the diagnostic uses of X-ray have been chiefly divided into fluoroscopic and radiographic techniques. Frequently fluoroscopic examination of portions of the human body precedes other X-ray methods and constitutes a way of examining the body in motion. It is accomplished by placing the patient between the X-ray tube and a special fluorescent screen. When the rays strike the screen they cause the particles in the screen to glow strongly enough to be well seen in a completely darkened room. When the patient is placed between the X-ray tube and the screen, the difference in density of various parts of the body casts a varying shadow on the screen, enabling the observer to distinguish between different parts of the body. This effect is further enhanced by the observer having accommodated the pupils of his eyes by wearing special goggles before going into the darkroom. In addition, various techniques are adopted to accentuate contrast in this method such as the use of radio-opaque solutions which cast a dense shadow on the screen.

One of the most frequent uses of fluoroscopy lies in the investigation of the alimentary canal or digestive system. This method was pioneered by Dr. Walter B. Cannon of Harvard University. In order, for example, to diagnose disease of the esophagus or swallowing tube the patient is given a solution to drink which is dense enough to cast a clear-cut shadow on the fluorescent screen. The opaque media usually employed here and for other parts of the digestive system is barium sulphate. The patient stands behind the screen in the darkroom holding a glass of barium sulphate and the observer takes a position in front of the screen with special controls of the X-ray unit at hand. The patient is then told to drink from the glass, and on the screen one is able to see the entire swallowing mechanism and follow the barium into the stomach. Of course if there is any disease affecting the esophagus such as inflammation, a swallowed bone, or a tumor, the drink of barium sulphate will outline the effect of the disease on the structure of the esophagus. For example if the patient had swallowed, whole, a chunk of meat which had lodged midway down the esophagus the barium sulphate would then stop at that point and indicate just where the meat was located. If it became necessary to do surgery the exact location of the obstruction would be of extreme value to the surgeon.

A similar technique is employed for investigation of the stomach. The stomach is filled with barium sulphate and outlined on the fluorescent screen. The motion and action of the stomach is clearly seen and abnormalities of function as well as structure may be identified. Examination of the large colon or intestine is also carried out with this method in which case the barium is administered as an enema from the rectum and the observer is enabled to visualize the rectum and the colon. Many persons have been saved from cancer and other catastrophic diseases by discovering the curable conditions that precede cancer in the colon, and by having them corrected in time.

Examination of the heart as a moving organ is best done under the fluoroscopic screen. Where previously doctors labored with listening and tapping aids to draw a mental picture of their patients' hearts it now became possible to see the heart in its functioning state and to watch it expand and contract. At the present time this method has become so well accepted that it is a rare heart specialist who does not have a fluoroscopic device in his office for this purpose. At the same time that the heart is examined the lungs are inspected and the movement of the diaphragm is observed.

The fluoroscopic screen has different meanings for the various specialties in medicine. The orthopedic or bone surgeon checks his fractures with it. The industrial or military surgeon uses it to locate metallic fragments caused by either industrial accident or military gunshot. The pediatrician or baby doctor looks for an inhaled candy ball or toy. The chest physician searches for early evidence of lung tumor. This partial list of present uses of fluoroscopy is always being expanded.

Radiographic techniques for the purpose of obtaining a picture of some part of the interior of the body are a standard of medical practice all over the world. These methods differ from fluoroscopy in that a still picture is obtained with no projection of the motion of the part X-rayed except by taking enough separate films to simulate a cycle of motion. These stills, however, play a most important role in medical diagnosis and generally show a finer detail throughout than is possible to obtain on the fluoroscopic screen.

The enumeration of all the various aspects of taking X-ray films would be far too lengthy for our purposes. Suffice it to say that there is no part of the body which is exempt from the probing of the X-ray eye and that medical diagnosis has become markedly dependent upon X-ray findings; so much so that a complete medical specialty has grown up around Roentgen's discovery and doctors devote years to training in the various aspects of X-ray or radiology, as it is more properly designated.

The uses of special substances to show organs in the body reach into many branches of medicine. The kidney specialist may wish to investigate the location and effect of a kidney stone. There is available to him several medications which, when injected intravenously, will opacify the internal kidney structures as well as the tubes leading to the urinary bladder and the bladder itself. X-rays taken at this time show these structures in considerable detail enabling the doctor to locate the site of disease. In some cases he will inject the contrast media through

an instrument inserted from below into the bladder.

The gall bladder is a relatively frequent offender and a contrast medium has been perfected which, when taken by mouth, will render the gall bladder dense enough to be seen on an X-ray film. In this way gall bladder function and the possibility of stones are determined. Even after the gall bladder is removed there are ways of studying the remaining bile passages with contrast media and X-ray films.

The problem of sterility or inability to bear children has come under X-ray observation. The specialist may inject opaque material which will render the female reproductive tract opaque and demonstrate the structures on X-ray film. In this way the exact cause of sterility may be found and its correction attempted.

X-ray studies have been of great assistance to the neurologist and neuro-surgeon. Plain films of the skull and spine may point the way to the diagnosis. Specialized techniques are also available. For example in the diagnosis of spinal column disease one may inject an opaque solution and watch its passage up and down the spinal canal with the fluoroscope. One may also inject air for special brain studies, especially to diagnose and locate brain tumors.

Preventive medicine has vastly benefited by the employment of X-ray. We are all familiar with chest surveys for the early diagnosis of tuberculosis with its result on decreased time of treatment and diminished risk to contacts. This screening technique has been applied in government, industry, armed services, and community life.

In more recent years there have been many advances made in refining techniques for the purpose of early diagnosis, especially in the heart and cancer fields. Keeping pace with the newer methods of heart surgery there have been ways developed of showing the inner structures of the heart. This is of particular importance in children born with defective hearts who had previously been condemned to ever-constricting activity and ultimate death. These cases include the so-called blue babies with a faulty circulation of the blood giving them a bluish cast. Diagnostic methods now make possible an early diagnosis of just where the heart defect may be and enable the surgeon to bring to bear his new surgical techniques.

Another development of note enables the radiologist to take films at designated levels in the body in an attempt to show more precisely the site of disease. This technique is known as laminography and is particularly important in the chest where tuberculous cavities must be located precisely for the chest surgeon.

The X-ray apparatus is undergoing constant change and there is a steady flow of specialized accessories designed to facilitate more modern procedures. Perhaps the most promising at present is an electronic device which greatly enhances the fluoroscopic image.

X-rays are also employed as a method of treatment and have a wide application ranging from the acne or pimples of the adolescent to the widely prevalent bursitis or shoulder pain and the treatment of deep seated cancers in remote areas of the body.

The hazards of X-rays are being re-emphasized in this age of atomic radiations. Improper use may result in damage being done to all personnel concerned and the history of radiology is replete with its martyrs. At present, in the hands of trained radiologists, X-ray radiations are safely controlled.

Few discoveries have had as far-reaching effects and universal application as that of Professor Roentgen. His X-rays are employed all over the world and have made an immeasurable contribution to the early diagnosis, control and treatment of disease. It is equally true that the full possibilities of the X-ray method are not yet understood and that we may anticipate increasing usefulness of this tool in the future.

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X-RAYS, Physical Nature of. X-rays or Roentgen rays were discovered by a professor of physics, Wilhelm Konrad Roentgen, on Nov. 8, 1895, at the Royal University of Würzburg in the German town of that name. Roentgen was experimenting with a primitive vacuum tube, then known variously as a Hittorf, a Crookes or a Lenard tube, which was essentially a pear-shaped glass bulb provided with two metallic electrical-conducting terminals, called a cathode and an anode, hermetically sealed through the walls of the bulb. The cathode inside the bulb usually took the form of a small concave metal disc on the inner end of a metal stem passing through the neck of the pear-shaped bulb in a way not unlike the actual stem in the fruit. The other terminal, the anode, was usually sealed through the glass on one side of the pear at a point where a small teat-shaped projection for this purpose was blown into the glass wall.

The air pressure in such a bulb was reduced to the order of one millionth of normal atmospheric pressure by means of a vacuum pump. If the terminals of the tube were then connected to a source of high-voltage electrical current, the cathode being connected to the negative terminal, the glass walls of the tube, particularly at the opposite end of the bulb from the cathode, would be seen in the dark to emit an "apple green" fluorescent glow.

W. K. Roentgen's Experiments.—Roentgen was experimenting with such a tube completely enclosed in an opaque black cardboard box when he happened to notice that a fluorescent screen lying on the bench nearby and consisting of a piece of paper coated with the chemical substance barium platino-cyanide, emitted light when and only when the tube inside the cardboard box was being supplied with the high-voltage electrical current.

After interposing various objects between the tube and the fluorescent screen, he concluded that its fluorescence must be produced by an invisible radiation traveling in straight paths from the tube to the screen. He showed that shadows could be cast in the fluorescent illumination of the screen by many objects, particularly heavy metals such as lead, which clearly absorbed the invisible rays much more completely than some lighter substances such as wood, cardboard, paper, or aluminum. He reported that "behind a bound book of about one thousand pages I saw the fluorescent screen light up brightly, the printer's ink offering scarcely a noticeable hindrance." The bones in his own hand cast shadows on the screen while the rays passed easily through the flesh. In the short space of scarcely more

than two weeks, with very rudimentary equipment and with astonishing ingenuity, Roentgen performed a series of brilliant experiments which established, in broad outline at least, a large fraction of all the basic qualitative phenomena connected with X-rays.

Scientific Importance of X-Rays.—News of the discovery spread through the world like wildfire, and applications were made almost immediately, especially in the realm of medical diagnosis. In retrospect it is clear, however, that the discovery had far greater significance in the realm of physical research than in any of these immediate applications. It marked the opening of the era of what came to be loosely called "modern physics," a period during which man's understanding, control, and use of the submicroscopic features of the world of nature—molecules, atoms, electrons, nuclei and their constituents—were developed to an astonishing degree. In this development of our physical knowledge of the world through research, the rays discovered by Roentgen have played one of the central roles.

"Cathode rays," which are rapidly moving electrons, were already known to be produced in vacuum tubes such as Roentgen used, and in fact in Lenard's form of the tube a sufficiently thin window was provided to allow the cathode rays to stream out into the air. But Roentgen established that X-rays were also generated on the inner surfaces of the glass walls of the Hittorf or Crookes vacuum tube wherever these surfaces were bombarded with the cathode rays, the stream of rapidly moving electrons.

Provisionally we may conceive an electron as a small particle with a single unit of negative electrical charge ($e = 4.803 \times 10^{-10}$ absolute electrostatic units) and with a mass of 9.1×10^{-28} grams. Electrons exist in huge numbers in all forms of matter. Swarms of them form the outer cloaks surrounding the nuclei of all atoms, where their characteristic motions, configurations, and energies of attachment account for most of the characteristic chemical and physical properties possessed by the approximately 92 well-known stable elements of chemistry.

The electrons which bombarded the walls of Roentgen's tube are not to be confused with the X-rays which they produced at their point of impact. The electrons came chiefly from the cathode terminal of the Crookes tube. Most of the electrical energy supplied from the high-voltage generator to the terminals of the tube resulted in imparting high velocities (kinetic energy) to these electrons, and this energy was chiefly released as heat to the glass walls wherever they received the electron bombardment. Such heat could and frequently did melt the glass envelope. (Only a fraction of one per cent of the energy input is converted into X-rays ordinarily.)

The source of supply of electrons in the earliest tubes was maintained by literally splashing them out of the cathode through bombardment of the latter by positive ions created in the residual gas of the tube by the electrical discharge itself. The operation of such "gas filled" tubes was, in consequence, quite sensitive to small changes in the low residual gas pressure and therefore undesirably erratic.

The X-ray tube in consequence passed through an evolution. At an early stage a refractory metal "target" was provided inside the vacuum envelope. The bulk of the cathode rays could strike against the surface of this target in a small, rather concentrated "focal spot" which had various provisions to remove the heat generated there by the bombardment. This focal spot then became the source from which the X-rays came. At another stage William David Coolidge found a way to dispense with the gas as a means of obtaining electrons from the cathode and provide a "pure electron discharge" supplied by a "thermally emitting" cathode filament kept hot by a source of electrical current.

X-Ray Spectra.—When the rapidly moving electrons are suddenly stopped by the metal target, the impact produces a mixture of X-rays of two distinct categories: (1) a line spectrum of X-rays characteristic of the material of which the target is composed, superposed upon (2) a continuous spectrum of X-rays in which all wavelengths or frequencies are present. The latter range from wavelengths so long that they are absorbed completely in the glass walls or the exit window of the tube, to wavelengths having a well-defined upper limiting frequency (and lower limiting wavelength) beyond which there are no X-rays whatever at shorter wavelengths or higher frequencies. This upper frequency limit is called the "quantum limit of the continuous X-ray spectrum."

As the preceding statements imply, X-rays exhibit all the characteristics of a transverse undulatory electromagnetic wave phenomenon and indeed constitute a region of the general spectrum of electromagnetic radiations to which also belong the regions of radio waves, infrared radiation, visible light, ultraviolet light, and nuclear gamma rays. These various regions merge indistinguishably into one another, differing only in regard to one quality which may, however, be described in several different ways, as the wavelength, λ, the frequency, ν, or the quantum energy, $h\nu$, of the radiation; for it has been found that whenever radiation interacts with matter it always does so in discrete amounts or bundles of energy called quanta. In all phenomena of wave propagation the product of the frequency, ν, by the wavelength, λ, gives the phase velocity of the radiation. The phase velocity of all electromagnetic radiation in free space (vacuum) is $c =$ 299,792 kilometers per second. The quantum energy of the radiation is proportional to the frequency, and the ratio between quantum energy and frequency is Max Planck's famous universal constant, h. The convenient conversion rule follows from this that if we divide the constant number, $12{,}398 \times 10^{-8}$ by either one of the following two quantities, (1) quantum energy expressed in electron-volts * or (2) wavelength, λ, expressed in centimeters, we obtain the other of these two quantities.

It soon became apparent that the continuous spectrum from X-ray tubes running under higher applied voltages exhibited superior power of penetrating material screens. Such penetrating X-rays were called in the beginning "hard X-rays." Less penetrating radiation was said to be "softer." These names have been retained in use, but it later came to be understood that "hard" radiation is more penetrating because it is shorter in wavelength (or higher in frequency

* A convenient unit of energy in physics is the electron-volt. This is the energy acquired by an electron when it is accelerated through a potential difference of one volt. It is equivalent to 1.6021×10^{-12} ergs or 1.6021×10^{-19} watt-seconds.

or in quantum energy). It has been found that save for certain important abrupt deviations (called "absorption discontinuities"), each atom of a given atomic number Z (a term we shall presently explain) absorbs X-rays to an extent approximately as the cube of the wavelength and as the fourth power of the atomic number.

Generation of the Continuous Spectrum.—To form a clearer picture of how the continuous X-ray spectrum is generated in the target, let us imagine the structure of this metal target on a scale of linear dimensions ten billion times natural size. Each atom would then be about the size of a moderately large room and the nucleus of the atom in the middle of that room would be about the size of a pinhead. In spite of its relatively tiny size, almost the entire mass ("weight") of the atom is nevertheless concentrated in the nucleus. With the increase in size we have envisioned, if our pinhead had the same matter density as actual nuclei possess, it would have the fantastic mass of two tons, even if it were the lightest of all nuclei (a proton). If it were a tungsten atom (tungsten is a refractory heavy metal very frequently used for X-ray tube targets), the pinhead nucleus would weigh about 370 tons.

The rest of the atom, the great bulk of the space in our room, would be occupied only by the atomic electrons. For each tungsten atom there would be seventy-four of these electrons, which we might picture as darting rapidly about in the room with terrific velocity like a cloud of extremely agile gnats or other insects, so that all parts of the room would be continuously explored by them with great rapidity.

We must be careful not to push the analogy too far. Although the electrons, like the gnats, have little mass compared to the nucleus, unlike the gnats they are bound to the nucleus by, and they repel each other with, gigantic forces. They also have other far less familiar wavelike properties which profoundly affect and condition the behavior of a given electron in terms of the behaviors of neighboring electrons. Thus, although most of the (370 tons) mass of our tungsten atom is in the little pinhead nucleus and the rest of the room (atom) is in a sense almost empty space, that space is highly forbidden ground for encroachment by the similar parts of any neighboring tungsten atoms.

One of the important duties which the electrons accomplish in their ceaseless flying about is, through their force fields, to insure the rigidity of the three-dimensional atomic lattice work which constitutes the structure of any solid (in our present case, tungsten). Fast electrons accelerated by X-ray tube voltages of tens or hundreds of kilovolts can, however, be driven at high speed through such a structure although the energy transferred from the fast electron to the atomic electrons is very high (of the order of one to ten million electron volts per centimeter of its path).

We may picture one of these fast electrons from the X-ray tube cathode driven into the heart of the tungsten target by the high voltage with which it has been impelled against it and weaving its way through the cloud of electronic gnats. At the center of each atom (our "room") through which this dashing visitor passes is the tiny pinhead 370-ton nucleus which (in the case of tungsten) has a positive charge some 74 times as great as an electron and of course of opposite sign. If the fast electron passes this positively charged nucleus at some distance from it, there will be so many negatively charged electrons between the two as to "shield" the fast electron very considerably from the strong attraction of the nucleus; but occasionally, by chance, the fast electron may pass close enough to the nucleus to be very strongly deflected by its attraction. When such an event occurs, the impulsive kick or acceleration which the fast electron experiences will cause some (perhaps a substantial fraction) of its kinetic energy to be converted into a quantum of electromagnetic radiation in accord with principles, familiar to the radio engineer, according to which any charged body which experiences an acceleration can be expected to emit electromagnetic radiation.

In the case of a "head-on" collision between a fast electron from the X-ray tube cathode and a tungsten nucleus, the maximum possible energy available to be converted into a "photon" of radiation is the entire kinetic energy of the bombarding electron; an energy which, if expressed in electron volts, is essentially equal numerically to the voltage applied to the terminals of the X-ray tube. The photons of radiation which constitute that part of the continuous spectrum of X-rays which appears at its quantum limit (the highest frequency, or shortest wavelength of the spectrum) are formed by such head-on collisions with nuclei at the very surface of the target. In these collisions the entire kinetic energy of the fast electron, before it has had an opportunity to be dissipated in any other way, is converted completely in a single elementary process into a quantum of radiation. Between this most favorable (but rare) case of 100 per cent conversion of electron kinetic energy into a quantum of X-radiation and the cases of more distant interactions between electrons and nuclei in which only a small fraction of the kinetic energy is so converted, all gradations are possible. This explains the presence of an entire continuum of wavelengths, frequencies, or quantum energies in the continuous X-ray spectrum.

The line spectrum, which is also emitted by X-ray tubes, is found to consist of several series of distinct, well-defined lines whose wavelengths, frequencies, or quantum energies depend on the particular atoms of which the target is made. They are in fact the characteristic response made by the electron "gnats" surrounding the atoms of the target to the disturbance created among them by the passage of the bombarding cathode-ray electrons.

Laue Spots.—An advance of tremendous importance was made in 1912 when at the suggestion of Professor Max von Laue in Munich the two physicists W. Friedrich and P. Knipping tried directing a fine pencil of X-rays at a crystal of zinc blende (zinc sulphide). They found that the X-rays were "reflected" in a large number of well-defined directions by the crystal so as to form a regular pattern of spots (now known as Laue spots) on a photographic emulsion placed in the vicinity. It rapidly became evident that a similar phenomenon could be expected for any crystal, the pattern of spots being closely related to the atomic lattice-work structure of the crystal. The analytically correct but somewhat intricate explanation of these spots given by von Laue became much easier to understand intuitively after the work of William Henry and William Lawrence Bragg (father and son) in England in the following year.

To understand this we need to explain briefly what has been revealed, chiefly by studies with X-rays, about the so-called atomic lattice structure of crystals. It is found that the atoms in a crystal arrange themselves in three-dimensional lattice-work patterns of which one of the simplest, the only one we shall attempt to describe, is that of rock salt (consisting of sodium and chlorine atoms in equal numbers). We picture a plane surface dotted with sodium and chlorine atoms in an alternate square array such as one would obtain if the center of each black square of a checkerboard were occupied by a sodium atom and the center of each white square by a chlorine atom. Next we picture a three-dimensional array consisting of such checkerboards piled upon each other in layers so adjusted that each sodium atom has a chlorine atom just above and below it and each chlorine a sodium just above and below it. In the case of sodium chloride the vertical separation between adjacent layers is the same as the horizontal separation between adjacent atoms in each square array. (In the actual crystal the atoms support each other in this rigid array through the force fields set up by their respective electronic structures, and there is of course no question of tangible surfaces or checkerboards other than as a help to the imagination of the reader.)

Anyone who has looked from a railway train at a grape vineyard or an orchard of fruit trees laid out in regular square array will recall how the vines or trees not only align themselves in two mutually rectangular directions but also form straight rows in a great number of other directions as well. With a little imagination it will be easy to see that, in the three-dimensional atomic crystal lattices, there will in a similar way be a great number of differently directed plane surfaces which can be passed through the lattice work in uniformly and densely studded patterns of atoms; and that, for every plane so tilted, there will in fact be an infinite number of other planes parallel to the one in question for which the same will be true. Each such set of parallel planes will constitute a layered array in which all adjacent pairs of planes have the same common interplanar spacing, although the spacing may be different for differently tilted arrays.

In Laue, Friedrich, and Knipping's experiment, each of these differently titled arrays of planes accounted for each of the differently directed Laue spot reflections of the primary beam. It is important, however, to understand that not any X-ray wavelength would be so reflected if it fell at an arbitrary angle upon a set of planes of arbitrary spacing. The reflection is strong only when a certain condition obtains between the wavelength, λ, the angle of glancing incidence on the planes, θ, and the interplanar spacing, d, known as the Bragg condition, namely $n\lambda = 2d\sin\theta$ where n is a small whole number, the "order" of the reflection. This Bragg condition is the analytical statement of the requirement that the X-ray wavelets emitted from a specified distant source point, after reflection by the planes (as though each were a mirror), must recombine at another distant observation point in exact phase coincidence. This occurs because the path traversed by an X-ray wavelet reflected by any one plane differs from that of a wavelet reflected by a neighboring plane by exactly a whole number of X-ray wavelengths. Any wavelength, λ, incident on a specified array of planes of spacing, d, at a specified angle, θ, for which the above Bragg condition is not fulfilled, will pass on into (and perhaps through) the crystal until it has been absorbed, but it will not be appreciably reflected. What we have described, therefore, is frequently referred to as "selective reflection." It is easy to see how this principle can be used to analyze the radiation from an X-ray tube into its component wavelengths by studying the X-ray intensities selectively reflected from systems of crystal planes at different reflection angles.

Moseley's Atomic Numbers.—The next important step followed rapidly when in 1914 Henry Gwyn-Jeffreys Moseley, in two classic papers applying the principle of selective crystal reflection, presented a systematic study of the characteristic line spectra emitted by targets of various metals when "excited" by cathode-ray bombardment in an X-ray tube of special construction which permitted rapid and convenient substitution of several different target materials. He found that, unlike optical spectra, the characteristic X-ray spectra of atoms are relatively simple, consisting, for a given target element, of widely spaced groups of but a few lines. The groups were recognizable in all the elements examined by Moseley (some seventeen elements in his first work). The simple pattern of lines was very much the same in each spectral group over this wide range of elements, save for the actual wavelength position in the spectrum at which a given line occurred; and it was of extreme significance that as Moseley passed from element to element in the "periodic table" of increasing atomic weights, the wavelength of a given line in the pattern, as observed successively in the spectrum of each element, varied in a regular and quite uniform way with only one or two exceptions when plotted as a function of the ordinal number of the element in the series.

Furthermore, Moseley found that, even in the few exceptional cases, a completely uniform behavior of line wavelength as a function of ordinal number could be obtained by exchanging the order of one or two adjacent pairs of elements from the original order of increasing atomic weight. Moseley showed that if ordinal numbers, Z (since come to be called the "atomic numbers") are assigned to the elements as follows H-1, He-2, Li-3, Be-4, B-5, C-6, N-7, O-8, F-9, Ne-10, Na-11, Mg-12, Al-13, Si-14, P-15, S-16, Cl-17, A-18, K-19, Ca-20, and so on to Zn-30, then the square root of the frequency of a given X-ray line in any element is a linear function of the atomic number (nearly proportional to it in fact). Although Moseley's assignment of atomic numbers required in some cases reversal of the generally prevalent order of increasing atomic weights, it turned out to be actually of much more fundamental significance than the weight; it represents the number of positive unit charges possessed by the nucleus of each atom and therefore is an index of the number of electrons that nucleus can bind to itself in its outer cloak.

Only the year before, in 1913, Niels Bohr had proposed a quantitative model of the hydrogen atom based in part on a general earlier proposal of Lord Ernest Rutherford, who conceived the atom (correctly) as a heavy positively charged nucleus surrounded by a swarm of electrons equal in number and in charge (but of opposite, that is negative, sign) to the nuclear charge. It seemed

a safe guess at the time that the swarm of electrons must be in rapid motion because of a mathematical theorem due to Earnshaw which gave convincing proof that no system of point charges could ever be in static equilibrium under the action of their own fields. On the other hand, according to the electromagnetic theory of radiation propounded by James Clerk Maxwell, any such system of moving charges must radiate electromagnetic waves and hence must lose energy. As a result, the cloud of electrons would be expected to "fall" inward closer and closer to the nucleus, and it became difficult to see what would place the final limitation upon this catastrophic shrinkage unless some new principle of stability were injected into the picture. Bohr conceived the electrons as executing orbits about the central nucleus, but added the revolutionary new concept that out of the infinitude of classically possible orbits and energies that such electrons could possess, only certain orbits possessing well-defined energies had the special property of not dissipating their energy into radiation.

According to Bohr's proposal, spectral lines were emitted when and only when the electronic orbits executed a transition from one of these nonradiating states to another such state of lower energy, the frequency emitted being given by the energy set free in the transition divided by Planck's quantum of action, h. Bohr's theory, which has turned out to be one of the major steps of progress in the quantum theory (originated by Max Planck), predicted a formula for the wavelengths of the lines to be expected from atoms of atomic number, Z, and this formula successfully explained the wavelengths of the lines observed in the spectrum of hydrogen, the simplest of all atoms. Bohr's theory had indeed been constructed precisely for the purpose of explaining these hydrogen lines.

It was a matter of great significance, however, when Moseley showed that Bohr's formula also succeeded in predicting with quantitative success the wavelength of the K X-ray lines in the entire series from aluminum ($Z = 13$) to Zn ($Z = 30$) which he had just measured. This was the first strong evidence of any family relationship between the atoms of chemistry, and it was an important opening wedge in the conquest of our understanding of the atomic world.

Compton Effect.—The next extremely important fundamental contribution which came from the field of X-ray research was made by Arthur Holly Compton in 1923. It had already been observed by Joseph Alexander Gray (1920) that short wavelength X-radiation, after scattering from carbon and other low atomic number atoms, was somewhat more absorbable than the primary radiation, but still of a "hardness" so clearly related to the primary radiation as to exclude its being a characteristic fluorescent radiation from the scatterer. Compton gave the following daring explanation of this effect. He supposed the bundles of radiation energy, $h\gamma$, instead of being associated with spreading waves, to be propagated through space from the source in the form of projectiles. When one of these projectiles (or "photons"), each with momentum $h\gamma/c$, was scattered by a loosely bound electron in some low atomic number scattering material such as carbon, the electron would recoil under the impact, the more so the larger the angle of scattering and the higher the quantum energy (and hence the momentum) of the projectile. The kinetic energy thus given to the electron at the expense of the photon explained the "softening" of the scattered radiation in a completely and quantitatively correct way. Using characteristic line radiation from a molybdenum target tube, Compton showed that in the spectrum of the scattered radiation there appeared lines each of which was shifted toward longer wavelengths than its corresponding line in the primary radiation by an amount in complete accord with his theoretical explanation. The recoil electrons were also detected and shown by Compton and Simon to have the requisite speeds and directions of recoil. Even more than this was ascertained, for Jesse W. M. DuMond and Harry A. Kirkpatrick succeeded in showing that the shifted line above referred to was notably broader than the unshifted line and this was satisfactorily explained by them (with complete quantitative verification in all respects), to be due to the randomly directed velocities possessed initially by the atomic electrons which were the agents that scattered the photons. The presumptively dynamic character of the electronic clouds in atoms both for gases and for solid metallic bodies was thus experimentally verified.

De Broglie's Wave Theory.—In the same year (1923) Louis Victor de Broglie made a very bold suggestion regarding electrons, namely that besides their aspect as particles they might also possess undulatory properties. He came to the conclusion that a stationary electron, which Albert Einstein had predicted must possess a "rest energy" m_0c^2, must therefore have associated with it a frequency m_0c^2/h. He concluded further that a moving electron would behave in many respects like a train or small bundle of plane waves of wavelength, h/p, where p was its kinetic momentum. Both Einstein's and de Broglie's superlative insights were regarded as fantasies at first. The energy m_0c^2 has since then become only too familiar as a commonplace closely associated with its military application in atomic bombs. De Broglie's electron waves were actually verified, with quantitative corroboration of his formula, four years later by Clinton Joseph Davisson and Lester Halbert Germer, who showed that electrons were selectively reflected from a monocrystal of nickel in just the same manner as we have explained above for the reflection of X-rays. Erwin Schrödinger had, almost immediately, seized upon de Broglie's idea of the electron as a "matter wave" and with rare skill and insight had refined it in the form of a differential equation which in a sense fused the wave-like properties with the character of the electron as a mass particle obeying the laws of mechanics. From this point of view the stationary states of the electrons in atoms, which Bohr had been obliged to postulate *ad hoc*, appeared as permanent modes of vibration (standing waves) of a complex quantity, Ψ, the probability amplitude with distinct improvements and clarifications of several puzzling difficulties that had afflicted the simpler Bohr theory. In 1927 Schrödinger proposed an alternate theory of the Compton effect based entirely on the wave picture of both electrons and photons, in which the initial and final states of the initially free recoiling electron interfere with each other to form a space grating of standing matter waves which reflect undulatory X-radiation like the atomic layers in a crystal. The change in wavelength in this picture of the modified scattering process is to be

ascribed to a Doppler effect caused by the velocity of recoil of the reflecting space grating. No basis for preferring either Compton's or Schrödinger's viewpoint can be found, and indeed we have here one of the striking examples of the famous "wave-particle duality" which, thanks to the work of Schrödinger, Werner Heisenberg, Bohr, and others is now recognized to be a common property of all forms of energy, be it matter or radiation.

The discovery of the Compton effect with its two complementary interpretations, together with the quantum theory of optical and X-ray spectra and the wave-like properties of electrons, led directly to Heisenberg's famous "principle of indetermination" and to Bohr's principles of "complementarity" and "renunciation," a discussion of which is outside the scope of this article. These important ideas form the groundwork of quantum theory upon which repose most of the advances made in theoretical atomic and nuclear physics during the first half of the 20th century by Nils Bohr, Erwin Schrödinger, Werner Heisenberg, Arnold Sommerfeld, Wolfgang Pauli, Paul Adrien Maurice Dirac, Enrico Fermi, and many others. The insight thus gained into the weird subatomic world has obliged us to revise completely our intuitive notions of space, time, and causality, and has certainly brought about one of the most drastic and deep-rooted revolutions in human thinking that have occurred in the entire history of the race. See also ATOMIC THEORY; ELECTRON THEORY; QUANTUM THEORY.

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JESSE W. M. DUMOND.

X-RAYS APPLIED. X-rays have become a most important tool for the analysis and study of matter in the solid state. X-ray powder diffraction is a unique technique for the identification of crystalline substances and has been applied to a large variety of analyses with spectacular results. It is also used to reveal other characteristics, such as crystallite size, orientation, and strain. X-ray fluorescence spectroscopy has now been developed into a practical tool for qualitative and quantitative analysis of substances, whether crystalline or amorphous, solid or liquid. Two important advantages of these X-ray methods are that they are nondestructive and that the results can be obtained in a fraction of the time required for routine chemical analysis. Commercially available X-ray equipment for analytical purposes has been developed to the point where X-rays are obtained with the mere flick of a switch; and related apparatus for recording the X-ray pattern has been improved to a degree which permits far greater precision and convenience than was formerly possible. A few simple, easy-to-follow precautions are necessary for the safe use of the equipment.

The methods of single-crystal structure analysis are given in the article on CRYSTALLOGRAPHY, which should be read in conjunction with this article.

X-ray Diffraction.—X-rays, like visible light, have the properties of electromagnetic radiation but have much shorter wavelengths. The spectrum produced by an X-ray tube consists of a few intense lines superimposed upon a broad continuous ("white") band of wavelengths, as shown in Fig. 1. The wavelengths of the lines are determined solely by the atomic number of the element composing the target of the X-ray tube. Each element produces a few characteristic lines. Wavelengths decrease as the atomic numbers of the elements increase. The intense Kα lines (actually composed of two lines with nearly the same wavelengths)* are used for diffraction. The Kα lines from a copper target have an average wavelength of 1.54 Å (Å $= 10^{-8}$ cm.). The Kβ line, 1.39 Å, may be selectively removed by a filter of thin nickel foil (see Fig. 1). For a molybdenum target, Kα = 0.71 Å, while Kβ = 0.63 Å, and the latter may be removed by a zirconium foil.

The atoms in crystalline substances are arranged in a symmetrical, repeating three-dimensional pattern, and the distances between planes of atoms are of the magnitude of X-ray wavelengths. Hence, crystals act as three-dimensional gratings for X-rays in a manner analogous to the diffraction of ultraviolet or visible light by a ruled one-dimensional grating. Under appropriate conditions the electrons associated with each atom

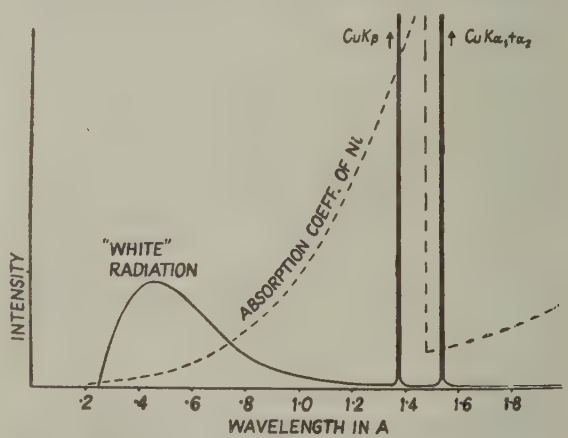


Fig. 1. Spectrum from copper target X-ray tube operated at 50,000 volts. (From C. W. Bunn, *Chemical Crystallography,* Clarendon Press, Oxford 1945.)

scatter the incident X-ray beam in a coherent manner, so that in certain specific directions the scattering from millions of atoms will be in phase at the same time. William Lawrence Bragg reduced this complex phenomenon to the simple equation

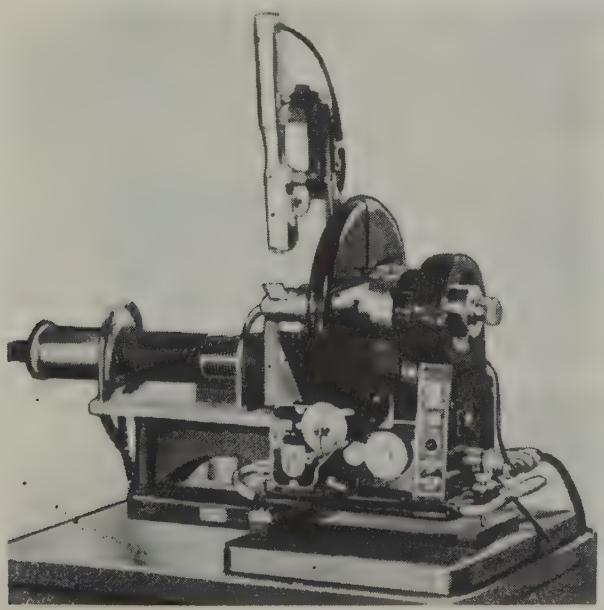
$$n\lambda = 2d \sin \theta \qquad (1)$$

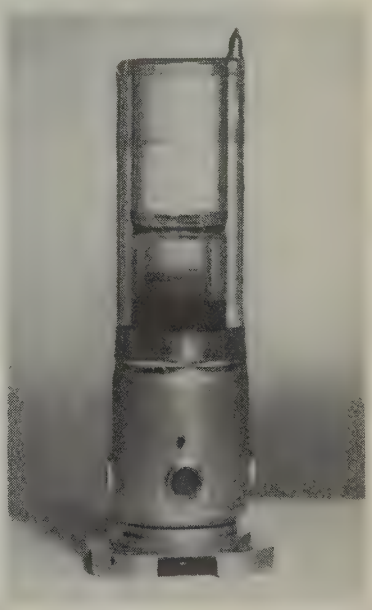
where n is a small integer giving the order of reflection analogous to the ruled grating; λ, the wavelength of incident X-rays; d, the distance between planes of atoms; and θ, the angle between the incident X-ray beam and the atomic planes. There is only one θ angle at which the reflected rays are in phase for a given value of d and λ.* At other angular positions of the crystal there is destructive interference and no reflections occur.

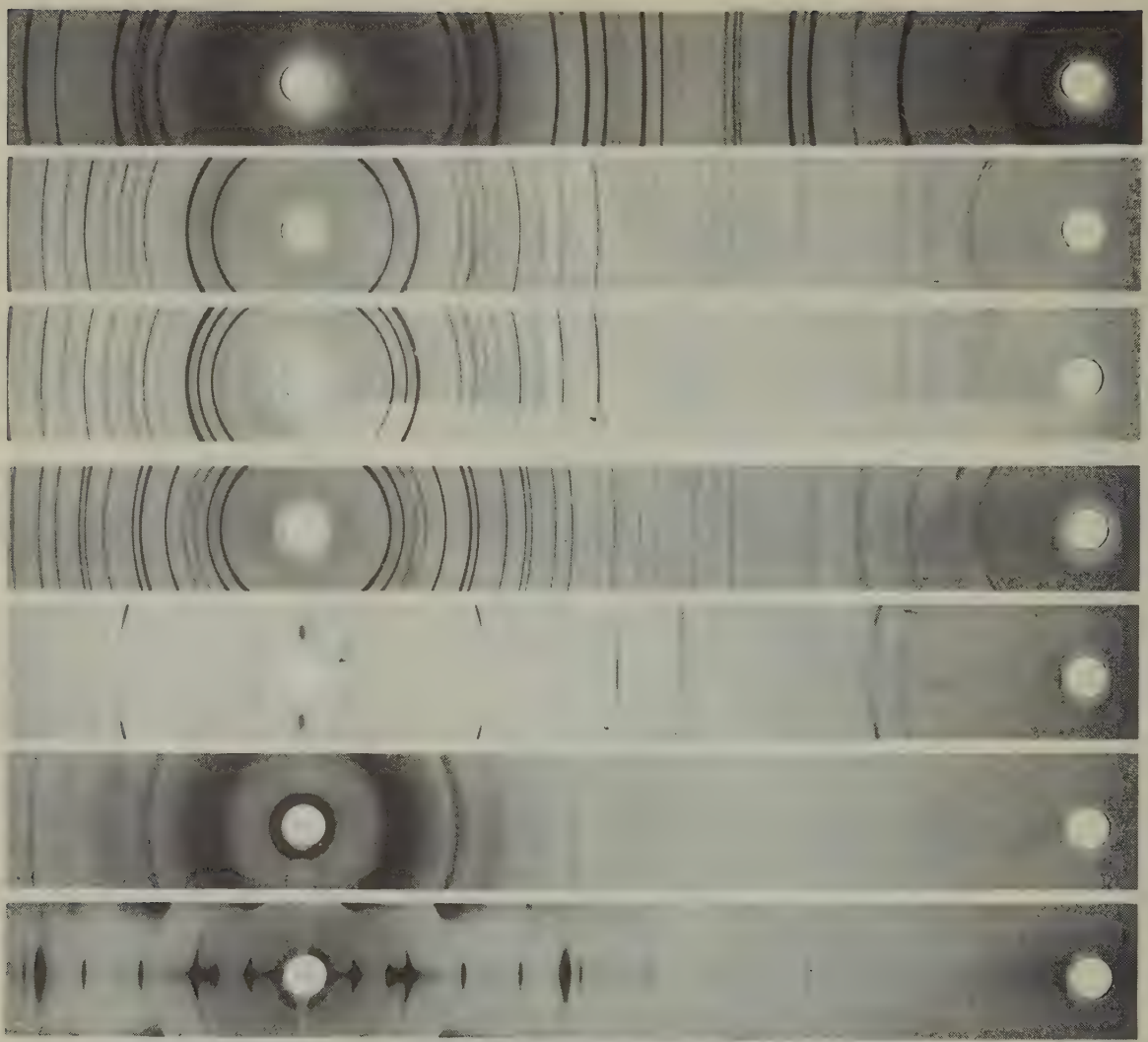
Consider, for example, the case of reflection of CuKα X-rays, λ = 1.54 Å, from one set of atomic planes of a flat, single-crystal plate of quartz in which $d = 3.34$ Å. When this set of planes makes an angle of 13.3° (θ) with the incident X-rays, a reflection occurs at an angle of 26.6° (2θ) with respect to the incident beam. A second-order reflection, $n = 2$, occurs at $2\theta = 54.9°$

* The diffraction phenomena may be visualized as reflections, and this term is frequently used in this article.

Above: X-ray diffractometer. A, high voltage generator; B, X-ray tube; C, goniometer; D, powder cameras; E, electronic circuits. *Below left:* X-ray spectrograph for fluorescence analysis. *Below right:* Modern sealed-off X-ray tube for diffraction analysis.







X-ray powder photographs (top to bottom): aluminum with unfiltered Cu radiation; quartz with nickel filtered copper radiation; quartz with nickel filter on bottom of film; lead nitrate (compare with diffractometer chart), brass wire, montmorillonite—a clay mineral; natural chrysotile asbestos fibers.

X-ray powder photographs (top to bottom): tungsten wire showing preferred orientation; tungsten wire coated with rhenium and fired; same but unfired showing amorphous pattern.

There are no other reflections between these two angles. A crystal oriented for reflection from another set of atomic planes, say $d = 4.25$ Å, will cause the first-order reflection of CuKα X-rays at 20.9° (2θ). If a polychromatic X-ray beam is used, then each d-spacing will reflect each wavelength at different angles and the pattern will become very complicated. Hence monochromatic X-rays are generally used for diffraction.

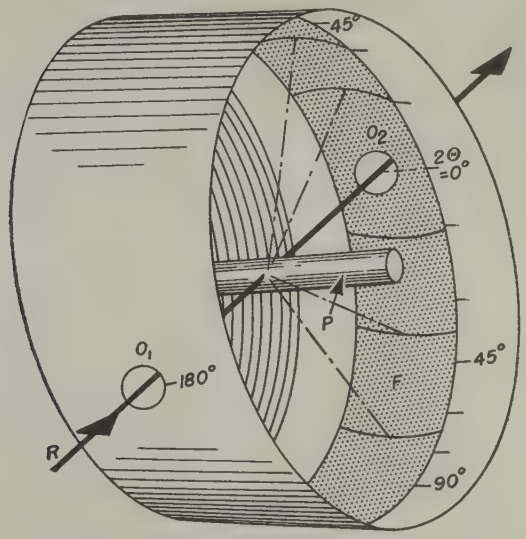


Fig. 2. Principle of the powder camera.

If the crystal is crushed to form a fine-grained powder, there will be many crystallites with the correct θ orientation for each of the d-spacings, and consequently all possible reflections from the various sets of atomic planes can occur simultaneously. This is the so-called powder method, the most widely used of all X-ray techniques. A small amount of powder may be glued onto a thin (0.005″ to 0.010″ diameter) glass fiber which is rotated continuously in the X-ray beam. The probability of having crystallites in all possible orientations is large. The recording instrument used, called a powder camera, is shown schematically in Fig. 2, and consists of a light-tight cylindrical chamber for mounting the film concentric with the axis of the specimen, and a collimator tube to give a fine pencil-like beam of X-rays. Each crystallite may produce a reflection which will appear as a spot on the processed film. For any given value of d there will be a large number of crystallites in various orientations, each producing its own spot. The reflected rays will form the surface of a cone, with its apex at the specimen and subtending the angle 4θ. Each d-spacing produces a separate concentric cone, and these appear on the film as a series of arcs whose curvature depends upon the particular reflection angle. The d-spacings are determined by measuring the linear distances on the film from the direct beam to each of the arc lines, converting these quantities into angular values (2θ), and substituting in the Bragg equation, since λ is known. The intensities of the lines will vary over wide limits. Usually each substance has a few strong lines and a number of weaker lines. The exposure times for the accompanying powder photographs range from one to four hours.

Powder patterns can be automatically recorded with high precision and resolution with the X-ray diffractometer, shown schematically in Fig. 3. The specimen is prepared in the form of a flat surface about 10 x 20 millimeters. The divergent primary beam of X-rays converges after reflection from the specimen, passes through a narrow slit, and enters the X-ray detector. The detector is driven at twice the speed of the specimen, so that the specimen surface is always at θ when the detector is at 2θ. The detector is coupled by means of electronic circuits to a strip chart recorder which plots the pattern, line by line. This technique is made possible by the use of highly sensitive X-ray detectors of the type shown in Fig. 4. An advantage of these detectors

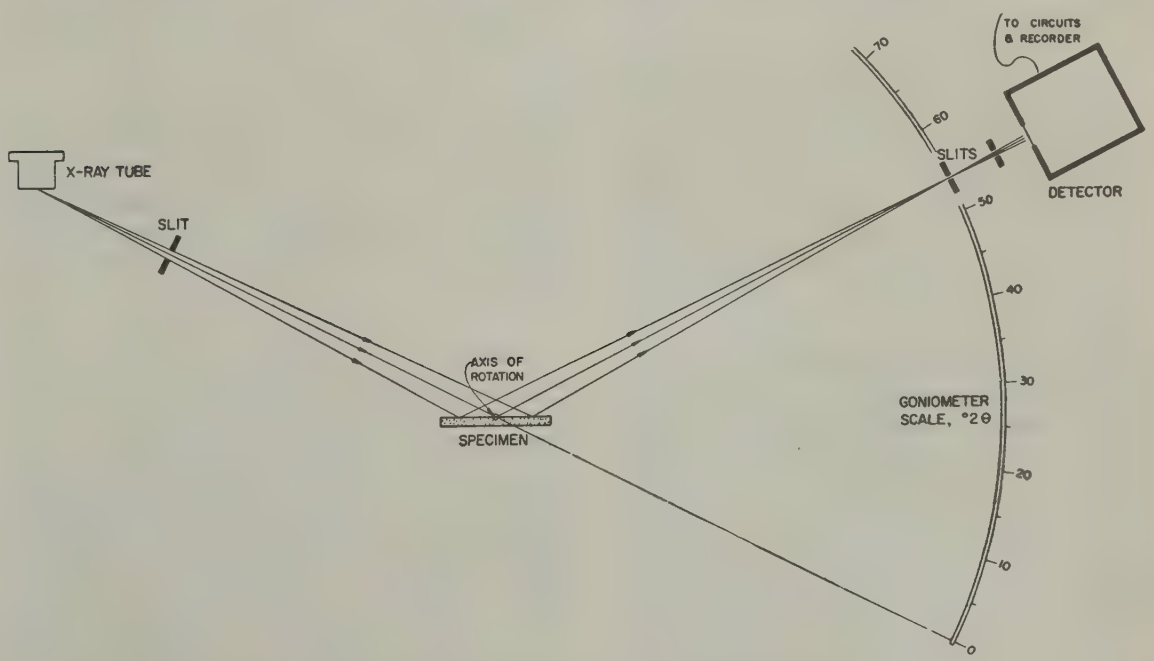


Fig. 3. Principle of the X-ray diffractometer.

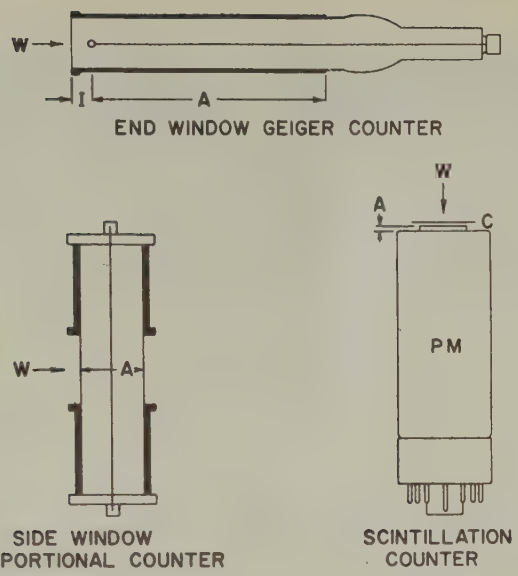


Fig. 4. X-ray detectors. W indicates direction of X-ray beam and window of counter; A, the path in which the X-rays are absorbed; I, inactive path; C is the scintillation crystal; and PM the photomultiplier tube.

is that the X-ray reflections can be measured instantly and quantitatively.

Identification of Crystalline Solids.—One of the most useful and important applications of the X-ray powder-diffraction method is in the identification of solid crystalline substances. The basis of the method is the fact that each substance gives a characteristic X-ray pattern, and no two chemically distinct substances give identical patterns. The positions of the lines and their relative intensities do not vary for a given set of experimental conditions. Hence, if the unknown substance gives the same X-ray pattern as a known substance, the identification is complete. The powder pattern establishes the identity of a substance with the same certainty that fingerprints identify a person. The method is rapid and inexpensive (aside from the initial cost of the equipment), and it requires only a small amount of the sample. The pattern results from the crystal structure (arrangement of the atoms) rather than from the constituent elements of the substance, and if the specimen contains a mixture of several crystalline substances, each produces its own characteristic pattern. The X-ray analysis is made on the substance in its original solid form and is nondestructive with respect to the sample, whereas in chemical or optical spectrographic analysis the substance is dissolved, vaporized, or altered in some manner to determine the constituent elements.

Identification of unknown substances is made by comparing the pattern of the unknown sample with that of a known substance. A file of reference substances is necessary. For this purpose the American Society for Testing Materials, Philadelphia, Pa., publishes a catalogue of X-ray data obtained from the literature. The file now contains data on many thousands of substances including minerals, metals and alloys, inorganic and organic compounds, and is continually being expanded. The data cards are arranged according to the *d*-spacings of the three most intense lines of the pattern to facilitate identification.

An X-ray analysis of a mixture of the ore minerals chalcopyrite ($CuFeS_2$), bornite (Cu_5FeS_4), and pyrite (FeS_2) would identify each of the three minerals, and their relative amounts could be determined. The chemical analysis would give the weight per cent of copper, iron, and sulphur, but could not explain how these elements had been chemically combined; hence the minerals could not be identified. Such a limitation is also encountered in X-ray fluorescence spectroscopy. To cite another example, the chemical analysis of a quartz sand used for making glass might show, in addition to silicon dioxide, impurities of a few per cent of iron and titanium. In order to determine the best method of purification, it is necessary to know if the impurities are present as a thin coating on the quartz grains or as separate admixed crystals of rutile, ilmenite, magnetite, or some other mineral. Microscopic examination combined with X-ray analysis will reveal how these impurities are present and their relative amounts, whereas chemical analysis would show only the bulk composition.

X-ray diffraction studies are used in a great variety of applications. These include analysis and control of raw and finished products as well as research in the fields of ceramics, metallurgy, chemistry, mineralogy, biology, pharmacy, engineering, and electronics. Paint pigments, petroleum products, engine deposits, soils, metals and alloys, pharmaceuticals, catalysts, clays, boiler deposits, minerals and soaps, are but a few of the materials analyzed with X-rays. The X-ray method was used to determine the chemistry of the transuranic elements and their compounds. Many of these substances are highly radioactive with a short half-life so that speed and safety were essential. These facts and the very small amounts of samples available made chemical methods very difficult to apply. Several laboratories use X-rays for the routine analysis of quartz in industrial dusts. A procedure for the quantitative analysis of the minerals in bauxite exploration-samples has been developed in which the X-ray analysis gives results within 1 to 2 per cent of chemical analysis in about 10 man-minutes, thus permitting an enormous saving of time.

Substances with the same crystal structures give similar X-ray patterns with small changes in the spacings and intensities of the lines. The similarities are usually clear enough to be revealed by visual comparison of the patterns. Such information is useful in relating substances which have markedly different chemical compositions. Fig. 5 shows the X-ray patterns of diamond (carbon), silicon, and sphalerite (ZnS).* Each atom in all three substances is surrounded by four other atoms which may be represented as follows:

```
   C          Si          S
 C C C      Si Si Si    S Zn S
   C          Si          S
```

These are said to have a diamond-type structure. Many other basic structure types have been revealed by X-ray analysis. Some substances of the same chemical composition may occur in two or more different atomic arrangements, called polymorphic forms. Since the atomic arrangement is different, the X-ray patterns will be different even though the chemical composition is the same. This is shown by a comparison of the patterns

* Figs. 5 and 6 are schematic drawings. The positions of the lines are those obtained with CuKα X-rays, and the relative intensities are indicated by the heights of the lines.

of sphalerite (the cubic form of ZnS) with wurtzite (the hexagonal form). See Fig. 5. There are many well-known cases of polymorphism: for instance, diamond and graphite, both carbon; glass and quartz, both silicon dioxide. Different heat treatments or slight changes in chemical constitution may cause different forms to occur and their physical properties may be quite different. X-rays are most useful in distinguishing between these forms.

Solid Solutions and Mixtures.—In addition to the gross features discussed above, small changes may occur in the X-ray pattern which reveal important facts, useful for the analysis of matter in the solid state. Consider the simple X-ray patterns of the metals, nickel and copper (Fig. 6). Since both have the same structure, they give similar X-ray patterns which differ only in the spacings of the lines. The radius of the nickel atom is somewhat smaller than that of the copper atom (1.25 Å and 1.28 Å, respectively). The atomic planes of nickel are closer together and the d-spacings are smaller. The X-ray patterns show the nickel lines occurring at larger 2θ angles corresponding to smaller d values. Note that the lines occurring at high 2θ angles are shifted by relatively larger amounts than the lines at small 2θ angles. The reason for this is predicted by the Bragg equation which, after differentiation, may be written

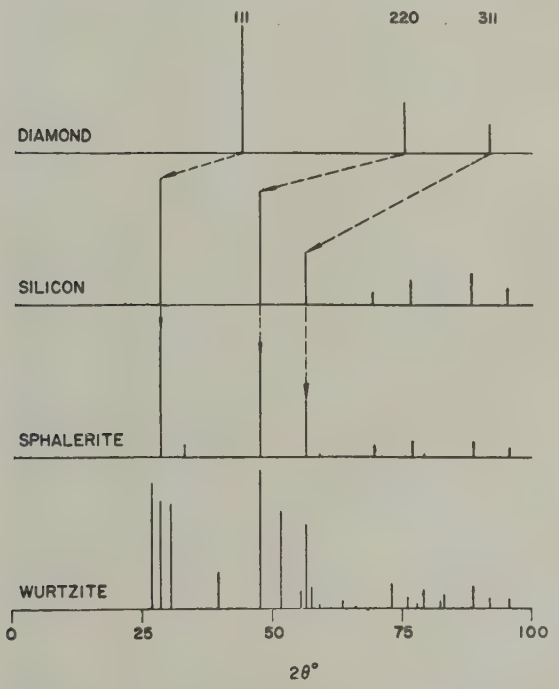


Fig. 5. Powder patterns of isostructural and polymorphic substances.

$$\Delta\theta/\Delta d = -\tan\theta/d. \qquad (2)$$

This equation shows that the shift in line position, $\Delta\theta$, due to a change of lattice spacing, Δd, increases as the tangent of the angle and reaches a maximum at $\theta = 90°$ and $2\theta = 180°$ where $\tan\theta = \infty$. The high-angle lines occurring in the so-called back-reflection region of the pattern are most useful in determining changes in the lattice spacings.

Between the patterns of the pure metals presented in Fig. 6 is a pattern labelled $Ni_{50}Cu_{50}$

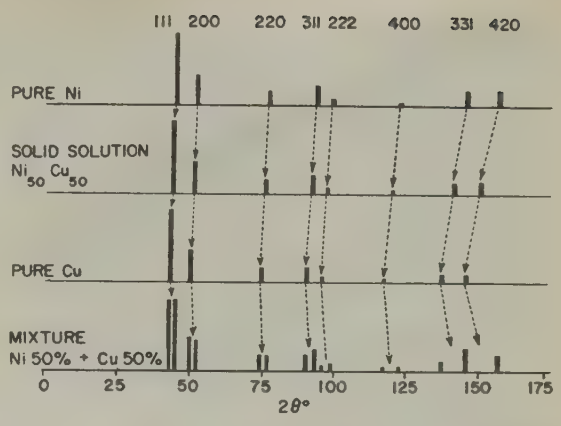


Fig. 6. Powder patterns illustrating the difference between a solid solution and a mixture.

which represents a solid solution of 50 atomic per cent of both nickel and copper. If the atomic arrangements of the pure metals in two dimensions are indicated as

Ni Ni Ni Ni	Cu Cu Cu Cu
Ni Ni Ni	Cu Cu Cu
Ni Ni Ni Ni	Cu Cu Cu Cu
Ni Ni Ni	Cu Cu Cu

the solid solution could be represented as

Ni Cu Ni Ni
Ni Cu Ni
Ni Cu Cu Cu
Cu Ni Cu

This is called a substitutional solid solution because the nickel and copper atoms may substitute one for the other and occupy the same relative positions as in the pure metals, although they are randomly mixed. The d-spacings, therefore, are between those of the two pure metals. The lines are shifted in the X-ray pattern by an amount which is dependent upon the composition of the solid solution. A smooth, nearly linear relation exists between the dimensions of the lattice and the chemical composition. The X-ray patterns of simple cases of the type illustrated here permit easy and rapid calculation of the intermediate members.

A single basic structure, called a phase, may extend over wide ranges of chemical composition. In the case described above, the same phase exists for pure nickel, pure copper, and all intermediate compositions. The atomic arrangement is the same for the entire series. Usually, however, only a limited solid solution can take place because the substituting atoms are very different in size or for other reasons, and the phase will have a limited range of chemical composition. The X-ray method has great practical importance in the determination of phase-composition-temperature diagrams. Such diagrams form the basis for the production of many complicated metals and alloys. If a phase change occurs through heating or change of composition, it is revealed by the X-ray pattern. When the composition of a given phase is altered, the lattice dimensions also change and hence the boundaries in the phase diagram may be determined. This application of X-rays is widely used in the study of binary and ternary alloys, systems of oxides, carbonates, and the like. The application has also been used to detect small amounts of solid solution, for example in the manufacture of the fluo-

rescent material zinc orthosilicate, in which 1 per cent manganese substitutes for zinc.

Interstitial solid solutions occur when very small atoms fit into unoccupied interstices of the lattice instead of substituting for atoms in the lattice. Obviously the lattice parameter remains nearly the same. A good example is the addition of carbon to iron to produce steel. Accurate measurements of the density, in addition to X-ray data, are used to study the process. Density increases with the addition of interstitial atoms, and X-ray data show if specific compounds are formed at certain critical compositions.

X-rays often afford the only practical means of following the course of a chemical reaction. For example, if an alloy of copper and nickel is desired, the required amounts of each element will be weighed, mixed, and heated. If the heat is insufficient for the elements to alloy, the X-ray pattern will be a mixture of the two patterns, as shown on the bottom of Fig. 6. Heating at a temperature sufficient to allow a complete reaction will give the X-ray pattern depicting a solid solution. No other method has proven as useful in following complicated reactions. For example, in the manufacture of ceramic magnetic materials, various substances such as the oxides of iron, zinc, and manganese are mixed together in their proper proportions and fired. A reaction occurs forming a useful magnetic spinel phase which has a totally different structure than the original individual oxides. If some of the oxides remain unreacted, the properties of the magnetic material will be altered. X-rays are used to study the course of the reactions and to work out the proper firing conditions. Chemical analyses are of little aid in such reaction studies since the end product has the same chemical composition as the original materials.

The X-ray patterns of amorphous materials, such as glasses, resins, and liquids, are distinctly different from those of crystalline substances. The atoms in an amorphous material do not have the symmetrical repeating arrangement so characteristic of crystalline materials. The X-ray patterns of amorphous materials appear as one or two weak broad bands at small 2θ angles superimposed upon a continuous background. X-rays are therefore not useful in distinguishing between amorphous substances but are ideally suited to show if a substance is crystalline or amorphous. This test is useful in many practical applications. The X-ray diffractometer patterns of Fig. 7 show the progress of the devitrification (crystallization) of a silica glass. At the left is the broad diffuse band characteristic of glasses. The middle pattern shows the beginning of crystallization by the appearance of lines of cristobalite, a high temperature form of silicon dioxide, superimposed upon the amorphous band. The final pattern shows an increase in the intensity of the lines and further reduction of the band as the devitrification continues.

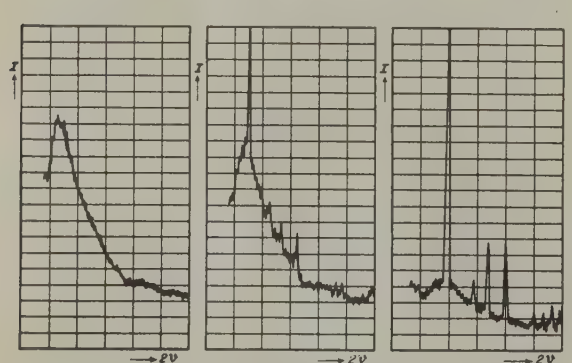


Fig. 7. Diffractometer patterns showing devitrification of silica glass to cristobalite.

Diffraction Applications.—The discussion in the previous section has been confined to substances in their ideal crystalline state. If the substance is ground to colloidal-crystal size, strained beyond its elastic limit, cold- or hot-worked, rolled, or the like, the resultant lattice deformation has a marked effect on the X-ray pattern. X-rays are of great practical importance in studying these phenomena and a few examples will be presented to show the general nature of these applications.

When a crystalline substance is ground into particles a few microns in size (the beginning of the colloidal range), the resultant X-ray powder lines broaden, the amount of broadening increasing with decreasing size. Although such X-ray patterns will not reveal absolute particle sizes, the technique is most useful for determining relative sizes and for distinguishing between clusters of particles and true crystallite sizes. The equation

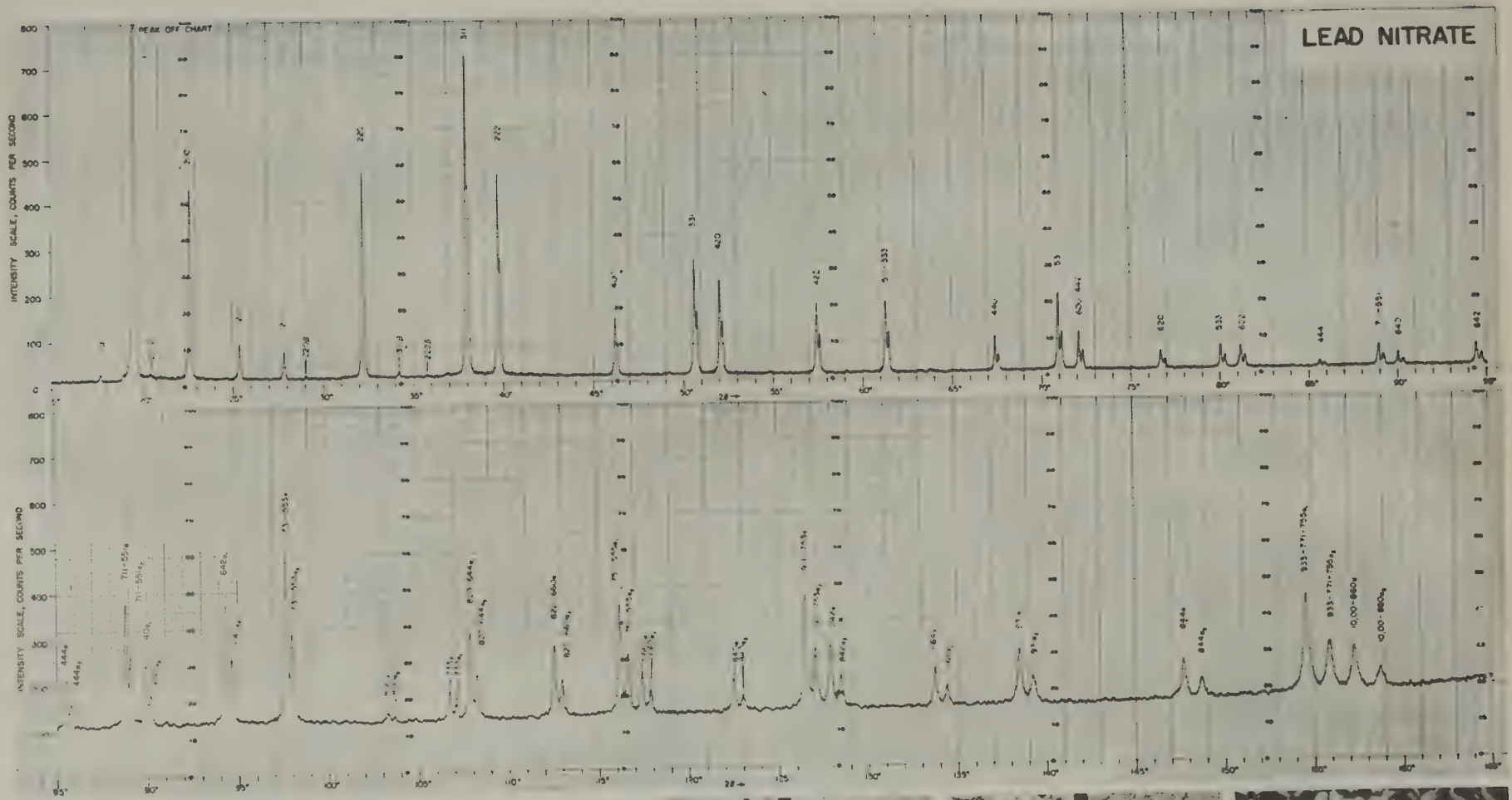
$$t = k\lambda/(b - b_o)\cos\theta \qquad (3)$$

gives the basis for the measurement. The crystallite thickness, t, is the dimension perpendicular to the reflecting atomic planes; k is a constant usually taken as 1; b is the measured width of the diffraction line of the small particle specimen; and b_o is the width of the line obtained with particles large enough not to cause line broadening, both b and b_o being measured under exactly the same experimental conditions. If the powder consists of small particles whose sizes embrace a large range, the X-ray measurement represents an average value since it is not possible to separate the overlapping broadenings. One application of the method has been the testing of the quality of catalysts. A good catalyst has a large surface area and hence small particle size. If the X-ray pattern is sharp, it is good evidence the particles are too large.

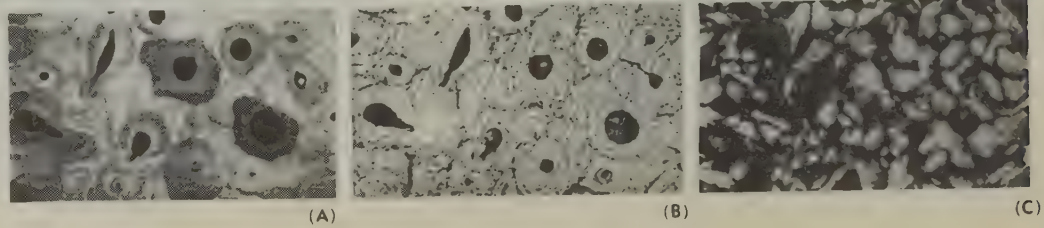
When a substance is strained, the X-ray lines, particularly those at high angles, become broad and poorly defined. When the strain is removed by appropriate heat treatment (annealing), the lines return to their original sharpness. This is a simple procedure to determine the correct annealing temperature. The method is also used to determine the effect of various types of mechanical treatment on the material.

In the previous discussion the assumption has been that the crystallites used for the X-ray specimen are randomly arranged so that all possible sets of atomic planes have an equal probability of reflecting. If this is not the case and if the crystallites assume certain special orientations, then the relative intensities of the lines of the X-ray pattern will be changed from their correct values; or, in extreme cases, some reflections may disappear. The ability of X-ray patterns to elucidate such behavior provides a powerful tool for the study of many practical problems dealing with the orientation of crystallites in fibers, wires, sheets, and foils.

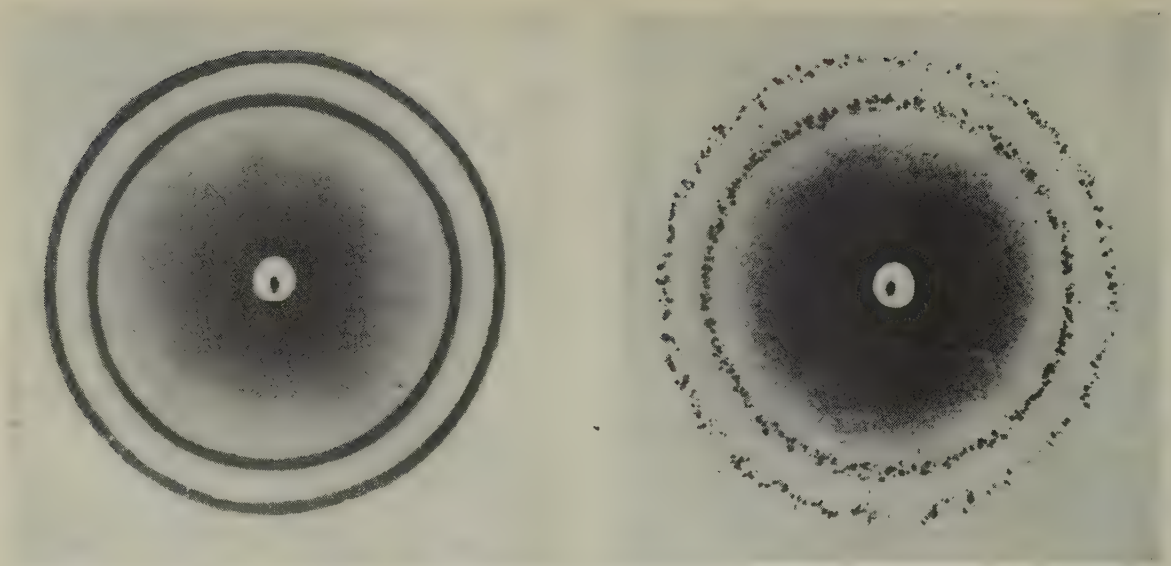
Many electrodeposited metals tend to orient themselves in a preferred manner. For example, when selenium is plated on steel under certain conditions, it shows a marked preference for



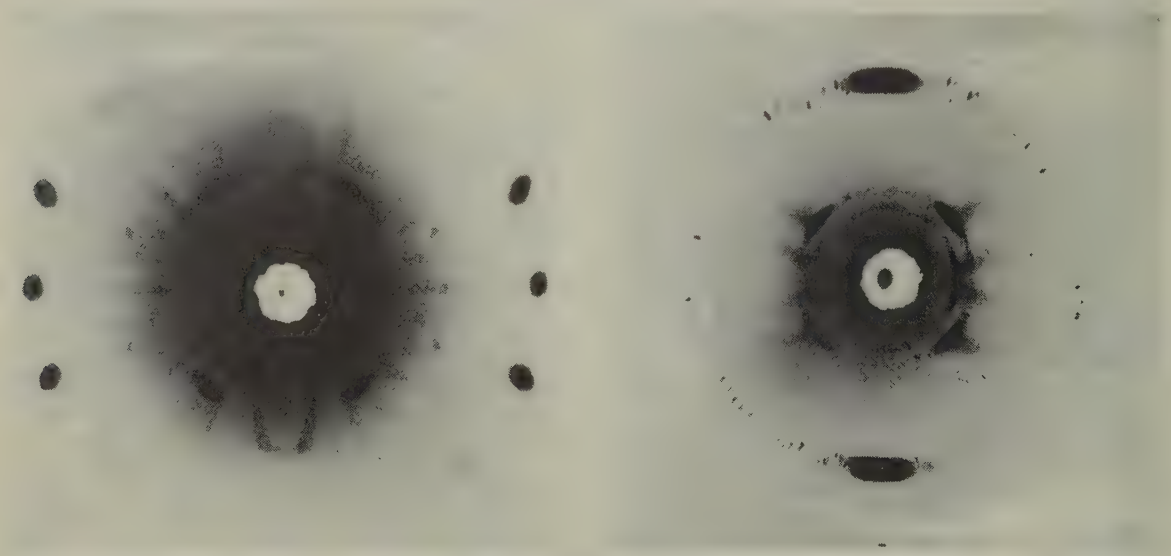
Above: X-ray diffractometer chart of lead nitrate, automatically recorded. Compare with film on accompanying plate.



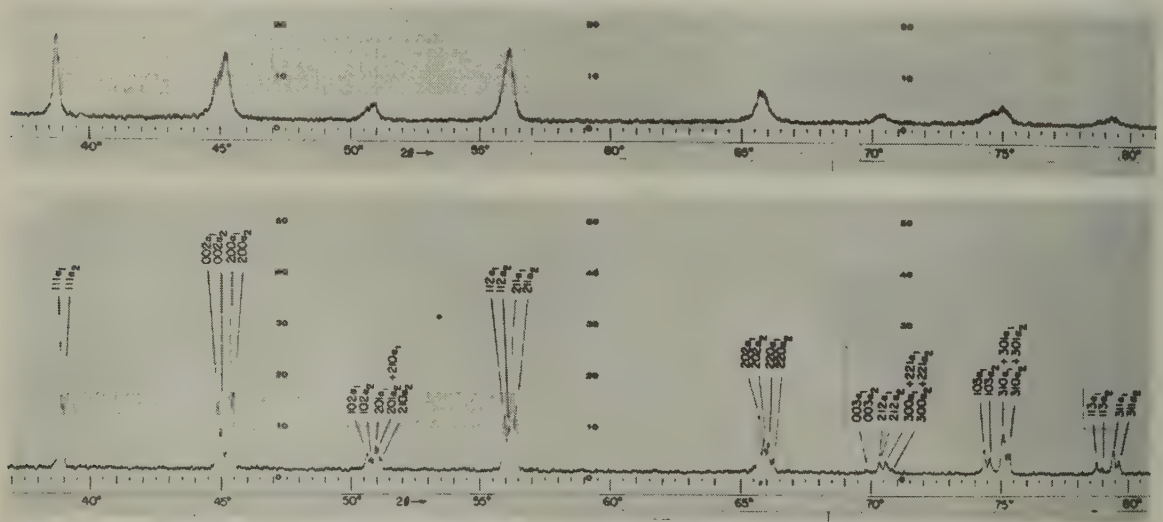
Right: (A) enlarged X-ray microradiograph of thin section of bone. (B) microscope view of same section in ordinary light. (C) microscope view of same section in polarized light. (From R. Amprino and A. Engström, "Acta Anatomica." vol. 15, page 7. S. Karger, A. G., Basel, Switzerland, 1952)



Pin-hole transmission patterns of nickel oxide obtained with stationary specimen on flat film. *Left:* Particle size 3 microns. *Right:* Particle size 25 microns. (From H. P. Rooksby, "Physical Society Progress Reports," vol. 10, page 83, 1946)



X-ray patterns showing preferred orientation of crystals in metal plates with rolling direction vertical. *Left:* Molybdenum. *Right:* Aluminum. (From H. P. Rooksby, "Physical Society Progress Reports," vol. 10, page 83, 1946)



X-ray diffractometer patterns of barium titanate. Powdered single crystal (above) and ceramic (below).

growing with its *c*-axis, the axis along the selenium chain of atoms, perpendicular to the steel surface; but the *a*-axes, perpendicular to the chain, are more or less randomly oriented. X-ray diffractometer patterns show a large increase in intensities of reflections from the atomic planes perpendicular to the *c*-axis relative to those of planes parallel to the *c*-axis. The latter are less likely to be in a position to reflect X-rays and may even disappear from the pattern. Electrical conductivity is much larger in the direction along the chain than perpendicular to the chain. The X-ray method affords an ideal way of following the plating conditions required to develop the best selenium electrical elements. Similarly, the magnetic properties of certain ceramic materials are enhanced by placing the powder in a magnetic field prior to firing so that the crystallites are oriented, resulting in the greatest magnetic susceptibility for the material. X-rays are used to study this process, which can not be followed with a microscope.

In the manufacture of drawn wire the metal crystals tend to become oriented with respect to the drawing direction but are randomly oriented around the wire axis. An X-ray powder photograph of a wire, therefore, shows discontinuities and marked variations of intensity around the circumference of the X-ray reflection, as shown in the accompanying illustrations. X-rays are also used to follow the effect of various treatments on the molecular orientation of natural and synthetic fibers such as ramie and nylon. The improved mechanical strength of the fibers and their physical properties can be correlated with the particular alignment of the molecules caused by extrusion and drawing.

The preferred orientation of crystals in rolled metal sheets may be influenced by the manufacturing method. The crystals tend to align with a certain rolling axis and in a particular orientation with respect to the rolling plane. The preferred orientation has a marked effect on deep drawing and similar operations. Careful control of the rolling process by X-ray analysis can produce special orientations, for example, in iron-silicon sheets used in transformer cores. The direction of easiest magnetization of iron-silicon crystals is parallel to the cube axes, and when these crystals coincide with the rolling direction, the sheet has a high permeability.

During World War II it was necessary to manufacture millions of quartz oscillator plates for use in frequency control of military communications. These crystals had been made in small quantities, but the sudden unprecedented requirements made it necessary to develop mass production methods. The desired crystals required precision cut angles with respect to the crystallographic axes. After an approximate orientation of the raw quartz crystal, a test slice was cut with a diamond saw, its precise orientation measured with X-rays, and the sawing angle corrected accordingly. Special X-ray machines with counter tube detectors were developed which permitted unskilled personnel to make accurate measurements in about 15 seconds. This process was the first use of X-rays as an integral part of a manufacturing process.

X-Ray Spectroscopy.—This field has its origin in the work of Henry Gwyn-Jeffreys Moseley, who, in 1913, published the basis of X-ray spectroscopy. He measured the X-ray spectra of a number of elements and found that the square root of the frequency of the various X-ray lines and the atomic number of the element emitting these lines exhibited a linear relationship. This fundamental law showed that each element had a characteristic X-ray spectrum and that the wavelengths varied in a regular fashion from one element to another. In addition to pure metals, he obtained the spectrum of a piece of brass which showed strong copper and weaker zinc lines, and this was the first X-ray chemical analysis. Moseley's work also played a most important role in the early conception of atomic structure and the acceptance of Niels Bohr's model of the atom.

It was stated in the section on X-ray diffraction that each element produced a simple, characteristic X-ray line spectrum when that element was made the target of an X-ray tube. Therefore, the element can be identified by measuring the X-ray wavelengths. Obviously, the practical difficulties of preparing specimens as X-ray targets would be a serious disadvantage in routine chemical analysis. Instead, the specimen may be irradiated by an X-ray beam which causes the specimen to produce secondary or fluorescence X-rays. These fluorescence X-rays have the same characteristic line spectrum, wavelengths, and relative intensities as the X-rays produced by direct electron excitation in an X-ray tube. The total intensities of the secondary X-rays are much lower than the X-rays produced directly in an X-ray tube; nevertheless, the fluorescence is sufficiently strong to be of practical value. The specimen is mounted outside and close to the X-ray tube window since the primary X-ray intensity diminishes as the square of the distance between the target and specimen. For instance, at a distance of one inch the intensity is 25 times greater per unit area than at a five-inch distance. Each element exhibits a sharp change in its X-ray absorption properties at a wavelength slightly less than the shortest emission wavelength characteristic of the element as indicated by the dotted line of Fig. 1. This is called the absorption edge of the element. An element produces the strongest fluorescence when irradiated by primary X-rays of wavelengths slightly shorter than its absorption edge. Thus, the copper lines, $\lambda = 1.54$ Å and 1.39 Å, produce strong secondary X-rays in cobalt, whose absorption edge is at 1.61 Å, but no fluorescence in zinc, whose edge is at 1.28 Å. Instead of using the characteristic lines of the X-ray target material, which would excite strong fluorescence in only a few elements, the continuous "white" radiation may be used to cause a whole series of elements to fluoresce. A tungsten-target X-ray tube operating at 50,000 volts or more produces a large amount of continuous radiation and is generally used for this purpose.

A schematic diagram of the arrangement used in a modern X-ray spectrograph is shown in Fig. 8. Here a relatively large X-ray source is used since no focusing is involved in this particular instrument and a high total intensity is desirable. Radiation from the X-ray tube causes the specimen to fluoresce in all directions, as indicated by the dotted lines. Only those rays traveling in a certain direction pass through the parallel-slit assembly whose thin, highly-absorbing metal foils collimate the X-rays. The single-crystal plate, oriented to reflect from only a single *d*-spacing, reflects one wavelength at a given angle in accordance with Bragg's law

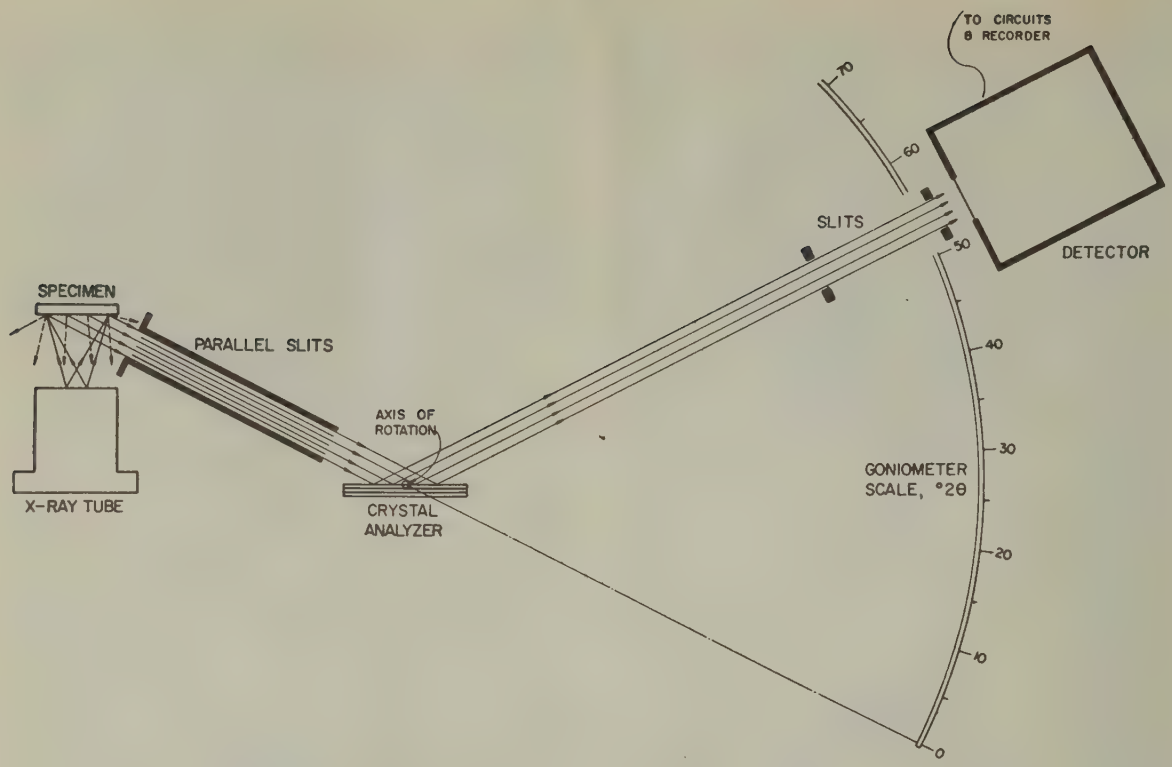


Fig. 8. Principle of the X-ray spectrograph.

(equation 1 above). By slowly rotating the crystal at one half of the angular speed of the detector, the various wavelengths from the parallel beam of X-rays are reflected one by one as the crystal makes the proper θ-angle for each wavelength. The intensity of each wavelength is then measured with a high-sensitivity scintillation counter or similar detector and automatically recorded. Calibration curves relating concentration to intensity are established for each element of interest. The angle at which the various wavelengths are reflected, and the angular separation (dispersion) of the wavelengths, are dependent upon the d-spacing of the reflecting atomic planes of the crystal analyzer, as shown in Fig. 9. Three

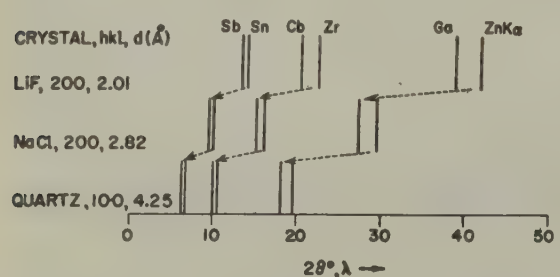


Fig. 9. Effect of crystal analyzer on positions of lines.

common crystals are depicted as analyzing the Kα reflections of three sets of adjacent pairs of elements. When the value of d decreases, the reflections occur at larger angles and have a greater separation. The crystal analyzer cannot reflect a wavelength larger than $2d$ as shown by the Bragg equation.

An interesting comparison can be made between X-ray fluorescence and optical emission spectroscopy. In the latter method the specimen is burned in an electric arc, a lens is used as a collimator, and a prism or diffraction grating disperses the spectrum, while a film is commonly used to record it. The optical spectrum is a complexity consisting of hundreds of closely spaced lines for each element, whereas the X-ray spectrum has only a few lines. Hence the X-ray method is comparatively simple and more direct.

The specimen used for X-ray spectroscopy may be an amorphous or crystalline powder, a polished and etched metallographic specimen, or even a liquid. There is a simple relationship between the fluorescent X-ray intensity as measured and the amount of element in the sample. The increase in intensity with concentration is seldom linear, however, because of the absorption of the fluorescent X-rays by the specimen itself. Since the composition of the specimen may vary over wide ranges, the measured intensities show a marked dependence upon the absorption. As a consequence, empirical calibration curves made with a small number of standard specimens are required when a quantitative analysis is to be made.

In many cases the X-ray method is more rapid than the optical method and the calibrations required for quantitative analysis are usually simpler. The X-ray method is superior for analyses involving amounts from 5 to 100 per cent, wherein an accuracy of about 1 per cent can be achieved; the procedure requires about one minute of actual measurement. In general the optical method is more reliable for trace-element analyses. Good results have been reported for the X-ray method for concentrations as small as 0.1 to 0.01 per cent, but the accuracy is lower and the time required is longer. The X-ray method is usually as accurate as a quantitative chemical analysis and has the important advantages of requiring far less time and of being a nondestructive, recording method. The analyses can be performed equally as well on the rare earth elements as on the transition elements: However, experimental difficulties are encountered with ele-

ments of low atomic number. With increasing wavelengths (decreasing atomic number) air absorption of the X-rays also increases. Vacuum techniques are required for elements of atomic number below 22, starting with titanium, for which $K\alpha = 2.75$ Å. About 90 per cent of X-rays of this wavelength are absorbed in an air path 13 inches long.

The results of a fluorescence analysis of nickel and copper with a rock salt crystal analyzer are shown in Fig. 10. The upper two charts show the simple spectrum of pure nickel and pure copper. The third chart shows the spectrum of a mixture of equal parts of nickel and copper. Unlike X-ray diffraction, a solid solution and a mixture give the same spectrum. The CuKβ line is relatively lower than it was in the case of pure copper because of the self-absorption of the nickel. The bottom chart for 10 per cent nickel and 90 per cent copper shows how the relative intensities are dependent upon the concentration of the elements in the specimen.

This method has been used in many types of analyses, such as the determination of nickel, chromium, and other elements in high-temperature steels; the measurement of lead and bromine in gasoline, sulphur in oil, and uranium in aqueous solutions; and the analysis of ores, minerals, alloys, and the hemoglobin (iron) content

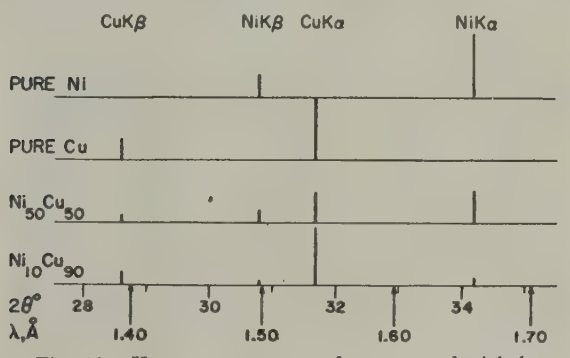


Fig. 10. X-ray spectrogram of copper and nickel.

of blood. Another unique application has been in the measurement of the thickness of tin plating on steel. The iron in the steel is irradiated to produce fluorescence, and the reduction of this fluorescent intensity as it passes through the tin plate is a measure of the thickness of the plate.

Summary.—X-ray techniques are being widely used in a great variety of applications. X-ray methods are fast, reliable, nondestructive, and direct-recording. Information that cannot be obtained by other methods of analysis can often be obtained by the X-ray method. There are many applications of chemical analysis by X-ray methods, the powder diffraction method being used to identify compounds and the X-ray spectrograph to identify the constituent elements. Since no two chemically distinct crystalline substances give the same X-ray powder diffraction pattern, the identification made by comparison with a known standard is unique. X-rays are used to follow the course of chemical reaction, to distinguish between mechanical mixtures of substances, solid solutions, and polymorphic forms. They are used in the study of phase-composition-temperature diagrams, and similar problems. Other applications of the diffraction technique are in the determination of particle sizes, proper annealing temperatures, the special orientation of crystals, stress and strain of materials, and the like. The modern X-ray spectrograph, using the secondary or fluorescence X-rays, has become an important tool in quantitative chemical analysis of the elements. It has been applied in many chemical problems and gives promise of becoming an invaluable analytical instrument.

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XY COMPANY, the popular name of the New North West Company formed in 1798 by a union of Montreal, Canada, fur firms and discontented North West Company men. The new company marked its goods with the letters XY. After a keen competitive struggle the XY Company was absorbed by the North West Company in 1805.

X Y Z CORRESPONDENCE, in United States history, the name given to the reports made to President John Adams by a United States commission sent to France to negotiate a treaty of commerce and amity in 1797–1798. War between France and England had begun in 1793; and when in the following year the United States settled its outstanding differences with England in Jay's Treaty (q.v.), the French regarded it as a breach of the commitments made to them by the United States during the American Revolution. As a result, they began to harass United States shipping, and in October 1797 Adams sent Charles Cotesworth Pinckney, John Marshall, and Elbridge Gerry to Paris to try to reach an understanding. The Directory refused to recognize them, but Talleyrand, the French foreign minister, delegated three agents to conduct negotiations unofficially. As the price of agreement, the French agents demanded a sizable personal bribe and a large official loan to the French government. These terms were promptly rejected, and the United States commission left France. To justify his action, Adams submitted the commission's reports to Congress in April 1798 and distributed thousands of copies to the public, substituting X, Y, and Z for the names of the French agents. One of the products of the ensuing excitement was the patriotic hymn *Hail Columbia,* written by Joseph Hopkinson to the tune of the *President's March.* Another was the popular slogan, "Millions for defense but not one cent for tribute," attributed to Pinckney, who always, however, denied coining it. For the next two years, an undeclared naval war between France and the United States was waged in the Caribbean Sea.

Consult *American State Papers, Foreign Relations,* vol. 2 (Washington 1832) for the text of the correspondence.

XANTHIAN MARBLES, zăn'thĭ-ăn, a large collection of marble sculptures of various ages (from 545 B.C. onward) discovered in 1838 near the site of the ancient Lycian city of Xanthus (now Günük, Turkey).

XANTHINE, an organic base, $C_5H_4N_4O_2$, occurring in small amounts in many animal secretions, in the blood, urine, liver, in some urinary calculi, and in tea extract. It may be readily made by the action of nitrous acid on guanine. A white amorphous powder slightly soluble in water, and forming crystalline compounds with both acids and bases. It is closely related to theobromine and caffeine, the alkaloids found in cocoa and coffee respectively. Caffeine may be considered as xanthine in which three hydrogen atoms have been replaced by three methyl (CH_3) groups.

XANTHIPPE, zăn-tĭp′ē, 5th century B.C., wife of the Greek philosopher Socrates. Her name has become proverbial for a nagging wife, (*v.* Shakespeare, *Taming of the Shrew,* i. 2). Speaking of her, Socrates said: "My aim in life is to get on well with people; I chose Xanthippe because I knew if I could get on with her I could with anyone."

XANTHIPPUS, zăn-tĭp′ŭs, early 5th century B.C., father of Pericles. A prominent figure in Athenian public life. He was one of the commanders of the Greek fleet which defeated the remnant of Xerxes' navy at Mycale in 479 B.C.

XANTHOCONITE. A silver ore $3Ag_2S.As_2S_5$, containing 61.4 per cent of silver. Formerly mined in Santa Fé County, N. Mex.

XANTHUS, zănth′ŭs (Gr. "golden yellow"), (1) Chief city of ancient Lycia in Asia Minor, located on the west bank of the Xanthus River. Destroyed in 545 B.C. by the inhabitants who refused to surrender it to the besieging Persians. Again so destroyed in 42 B.C. when the Romans invested it. Many of the ruins are well preserved. The better marbles were transported to the British Museum by the archaeologist Sir C. Fellows in the mid-19th century. (2) The Xanthus River (modern Kucuk Menderes River) also called Scamander. According to Homer, during the fighting between the Trojans and Achilles, the Xanthus, choked with bodies, rose to drown Achilles who escaped through the intervention of Apollo. (3) Achilles' famous horse. When rebuked by his master for abandoning Patroclus on the field, Xanthus turned his head and told Achilles that he too would soon be dead, not by his horse's fault but by the inexorable decree of fate. (*Iliad,* xix.)

XAVIER, Saint Francis. See FRANCIS XAVIER, SAINT.

XEBEC, zē-bĕk, a small three-masted vessel, employed in the Mediterranean, distinguished from other European vessels by the great projection of the prow and stern beyond the cutwater and stern-post. In this respect it resembles the felucca, from which it differs only in having the fore-mast square-rigged.

XENIA, zē′nĭ-a, city, Ohio, Greene County seat; altitude 925 feet; 14 miles east-southeast of Dayton; on the Pennsylvania, and the Baltimore and Ohio railroads. It is in the valley of the Little Miami River, on a broad elevated area. A trading center for stock raising and farm products of the surrounding agricultural area, its chief manufactures are rope and twine, furniture, shoes, electrical equipment, and foundry products. It is the seat of the Ohio Soldiers' and Sailors' Orphans' Home, a federal government institution founded in 1869. Three miles distant is Wilberforce University (q.v.). Laid out in 1803, many of its early settlers were Germans. Government is by commission and city manager. Pop. (1950) 12,877.

XENOCLES, zĕn′ō-klēz, Greek tragedian, b. Athens 4th century B.C. He won a prize for four plays: *Oedipus, Lycaon, The Bacchanarian Women* and *Athamas.*

XENOCRATES, zē-nŏk′rå-tēz, Greek philosopher: b. Calchedon, 396 B.C.; d. 314 B.C. He went to Athens in early youth; became a pupil of Aeschines, studied Socratic philosophy, joined Plato in 361 and accompanied him to Syracuse where he remained until Plato's death in 347. In 339 B.C. he succeeded Speusippus in the Platonic School, presiding over the Academy until his death. An exponent of Plato's philosophy, he further developed the Pythagorean theories of the master, but Xenocrates was a brilliant teacher rather than an original thinker. His integrity won him the respect of his contemporaries. Epicurus was one of his pupils.

XENOLITHS, inclusions of the wall rock caught in an intrusion, as in a dyke or batholith (qq.v.); and there frozen into the igneous mass as it cools. See MAGMATIC STOPING.

XENON, zē′nŏn, a heavy noble gas and element (atomic number 54; atomic weight 131.3) named by Ramsay and Travers, its discoverers (1898), from the Greek ξενος, strange. Consisting of nine isotopes, traces occur in the atmosphere (5/100,000%). Colorless, it is insoluble in water. The symbol is X or Xe.

XENOPHANES, zē-nŏf′å-nēz, Greek philosopher and satirical poet; founder of the Eleatic school of philosophy; b. Colophon, Asia Minor, c.570; d. about 480 B.C. Banished from his native city he settled, c.536 B.C., at Elea in southern Italy. He believed all things to be made of earth and water, and in one God, unlike men in form and thought, who "swayeth all things by the force of his mind." He wrote with scorn of the Homeric Gods and their human vices, and ridiculed the Pythagorean doctrine of transmigration: "Pythagoras was passing by when a dog was being ill-treated. 'Don't beat it!' he cried. 'It is the soul of a friend; I recognize his voice.'" In matters of theology Xenophanes held that "there is nowhere anything but guessing." He was a critical thinker rather than a creative philosopher.

XENOPHON, zĕn′ō-fŭn, Greek historian and general: b. Athens, c.430 B.C.; d. Corinth, c.355 B.C. The first three decades of Xenophon's life were spent in an atmosphere of war. The struggle for world supremacy between Athens and Sparta ended in the destruction of the Athenian Empire and the overthrow of democracy in 404, when Xenophon was about 26. It seems evident that to Xenophon, aristocratic by birth, handsome in appearance, reserved, unimaginative and a little smug in temperament, the

confusion of Athenian politics, which he did not understand, was less congenial than Spartan discipline and order. There was little future for a young man of Xenophon's attainments in Athens at the end of the 5th century, and all over Greece many disillusioned young men were turning to a career of military adventure as an escape. Thus he willingly accepted the offer of his friend Proxenus, a commander of Greek auxiliaries in the army of the Persian prince Cyrus, to join those forces about to launch on a campaign to wrest the throne of Persia from Cyrus' elder brother Artaxerxes (401 B.C.). A pupil of Socrates, Xenophon was deeply religious, and on his master's advice consulted the Delphic oracle before leaving Athens to which he was never to return. A full and vivid record of the campaign in Asia Minor is contained in Xenophon's most famous work, the *Anabasis* (q.v.).

On joining, Xenophon served as a subordinate officer, but with his capacity for observation and love of discipline, he soon distinguished himself as a soldier and acquired a reputation for reliability. After Cyrus fell in battle, and the Greek commanders were treacherously murdered by Artaxerxes' lieutenant, Tissaphernes, Xenophon was selected to cammand the retreat of some 13,000 Greeks, through 1,500 miles of mountainous country inhabited by hostile tribes. This prodigious feat he accomplished by a combination of physical courage, tenacity, cheerfulness, firmness and diplomacy, all qualities of leadership. He developed the greatest tactical ability in extricating his troops from the perils of a retreat through rugged territory. Military historians such as Theodore Ayrault Dodge and George Fielding Eliot mention Xenophon as the inventor of retreat tactics still valid in modern mountain warfare.

At the end of the campaign, Xenophon joined the forces of Sparta, then waging war on the Persian satraps Pharnabazus and Tissaphernes, after which he returned to Greece with Agesilaus, king of Sparta, and in 394 fought in the Spartan army against the Athenians at Coronea. The latter, not unnaturally, found him guilty of treason and condemned him to exile. Though this sentence was later rescinded he seems never to have returned to his native city with which he was completely out of sympathy. Agesilaus made him a gift of an estate in the beautiful hunting country near Scillus in Elea—a good place for retirement, since it was very close to Olympia which every one of consequence visited sooner or later, and where the whole of Greece gathered every four years for the Olympic Games. Here he could indulge his natural inclinations, which were those of a country squire with literary tastes. Politics he loathed and despised. In fact he had all the characteristics of an 18th century English gentleman of leisure, including the love of foreign adventure which he had already satisfied on his campaigns.

With the spoils won in Asia Minor, Xenophon built a small but magnificent replica of the temple of Artemis at Ephesus, on his estate, and settled down to a life of farming, hunting and writing. At Scillus he probably wrote most of his books. Next to the *Anabasis,* the *Memorabilia Socratis* (*Reminiscences of Socrates*) is his most interesting work, in that it gives us an interpretation of the great philosopher by a contemporary writer other than Plato. While we cannot accept what Xenophon says about Socrates if it involves any difficult point in philosophy which he was not qualified to understand, many of his reminiscences are very convincing. He is accurate and interesting when he gives an anecdotal, discursive account of Socrates' activities, showing him to be a teacher of pithy common sense giving his young followers practical advice on how to manage their affairs, or telling how Socrates was continually occupied with the problem of getting competent men into power. In his *Symposium,* or *Table Talk,* Xenophon does not make Socrates and his companions indulge in deep philosophical argument, but presents a very human and humorous Socrates amusing the company by arguing that a snub nose is far better than a straight one, and telling them he danced every morning in order to reduce. This presentation of Socrates does not conflict with the more serious and profound philosophical presentation by Plato; rather, it complements it. The Socrates whom Xenophon shows his readers is the familiar figure known to his contemporaries at large, the Socrates Xenophon himself was qualified to understand and admire. The Socrates interpreted by Plato was beyond Xenophon's comprehension.

The *Hellenica* by Xenophon is a valuable history of contemporary Greek affairs from 411 B.C. through the first forty years of the 4th century; it is written with political bias but without distortion of facts. His *Cyropaedia,* or *Education of Cyrus* (the Elder), is a pleasant and fanciful account of Persian life, and his *Oeconomica,* or *Home Management,* is a delightful account in dialogue form of a Greek country gentleman's idea of the good life. He describes the place of the wife in the home, the duties of the servants, the duties of the master to the servants, the best arrangement of the house with forethought and without extravagance: the innermost room, being the most secure, to contain the most valuable furniture and rugs; the coolest cellar to be used for storing wine; the driest room for storing wheat; the best lit room for displaying works of art. Xenophon insists at length upon tidiness. Clothes, shoes, even saucepans look beautiful when they are arranged neatly. He was inclined to be fussy in the home.

Xenophon's style is clear, limpid, straightforward and elegant. It was greatly admired by the Greeks who called him the "Attic Bee." After seventeen years at Scillus Xenophon removed to Corinth where he died. He was reputed to have been extremely handsome even in old age.

ANDRÉ MICHALOPOULOS.

XENOPHON OF EPHESUS (Xenophon the Younger), Greek writer who flourished in the 2nd century A.D. One work of his has been preserved, a story in five books called *Ephesiaca; or the Loves of Abrocomas and Anthia.* It is written in a simple and elegant style. There is an English translation by Rooke.

ANDRÉ MICHALOPOULOS.

XENOS, zē'nŏs, **Stefanos Theodoros,** Greek author. From 1855 he was a merchant and general broker in London, and in 1858 was naturalized as a British citizen. He published *The Devil in Turkey* (1850), a three-volume English translation from the author's unpublished Greek manuscript; in Greek, *The Heroine of the Greek Revolution* (1861), trans-

lated as 'Andronike' (1897); 'East and West: A Diplomatic History of the Annexation of the Ionian Islands to the Kingdom of Greece' (1865); and 'Depredations: or Overend, Gurney and CoC. and the Greek and Oriental Steam Navigation Company' (1869).

XENOTIME, a tetragonal mineral occurring in crystals of the same forms as zircon. It is essentially an yttrium phosphate, YPO_4, but much erbium is frequently present, and also sometimes the cerium metals, and small quantities of thorium and silicon. It is usually found in minute crystals of resinous or vitreous lustre, yellow or brown color and having a hardness of 4 to 5 and specific gravity of about 4.5. It occurs as an accessory constituent in many granites (see Derby in *American Journal of Science* 41, 308, 1891), in large crystals in the granitic rocks of Norway, in the auriferous gravels of North Carolina and Georgia, and in choice crystals in the gneiss of New York City. When obtainable in sufficient quantities it will be an important ore of yttria and erbia.

XERES, hā'rās, or **XEREZ,** or **JERES, Francisco de,** Spanish historian: b. Seville, about 1500; date of death unknown. He accompanied Pizarro, as his secretary, to Peru, about 1530, returned to Spain with the first shipment of gold taken from Atahualpa. At the direction of Pizarro he wrote a detailed history of the expedition and the conquest down to the death of Atahualpa, entitled 'A True Account of the Conquest of Peru' (1547). The work was translated into Italian by Ramusio, and into French by Ternaux-Compans and is still valued as a source of information.

XERES DE LA FRONTERA. See JEREZ DE LA FRONTERA.

XEROPHYTES, zĕr'ō-fīts, plants which have guarded themselves by structural means against excessive transpiration. The term was originally applied to plants living in dry and sandy soil, or on rocks, and to those inhabiting deserts; but it is now extended to plants existing in localities where, for one reason or another, they cannot readily obtain water, as in the case of the vegetation in salt marshes, arid bogs and moors and of cold regions where water is present but not available for the use of the plants, which have consequently adapted themselves to prevent the waste of the moisture which they have. This result is obtained in various ways. In some, the transpiring surface is greatly reduced, and the foliage is nearly or wholly dispensed with, the stems themselves taking its place, as in switch plants and cacti; and this habit is frequently combined with the storage of water in succulent tissues. Other plants, like the eucalyptus trees predominating in the dry forests of Australia, by a vertical arrangement of their foliage, or a similar disposition of the branches themselves, when foliage is wanting, as it is in the casuarinas, avoid presenting broad surfaces to the sun and hot winds. Some erophytic plants close their leaves just before the dry season; the whole existence of others begins and ends during the continuance of a rainy season; and in the bulbous and tuberous plants we see still another common arrangement for passing the dreaded dry months, the plants growing vigorously and completing their above-ground existence, while the weather is still favorable, and storing up food in their roots or rootstocks, so that they may rest uninjured in the ground during the heated term, and be ready to spring into activity as soon as the rains begin. An extensive development of ligneous tissue is characteristic of xerophytes and so also are such modifications of tissue as the matted hairs, mineral, waxy and varnish-like encrustations on the epidermis, the closing or concealing of stomata, etc.

XERXES I, zĕrk'sēz, king of Persia: b. about 519 B.C.; d. 465 B.C. He was a younger son of Darius, the son of Hystaspes, and began to reign in 485. He was preferred to his elder half-brothers, born before his father was raised to the throne; Xerxes was born after that event, and was the son of Atossa, daughter of Cyrus. After having suppressed a revolt in Egypt in a single campaign, he thought himself able to execute the plan of conquering Greece, already conceived by his father, and collected for this purpose an immense army, estimated by the historians as containing 1,000,000 men. In all probability the Greeks greatly exaggerated the number of their enemies; and the train of women and slaves who followed the army made at least half of its numerical amount; still the numbers of the Persians were beyond all comparison superior to those of the Greeks. By means of a bridge of boats Xerxes crossed the Hellespont (480) while the Greeks awaited him on the frontier of their country, in the pass of Thermopylæ. After the heroic Leonidas had fallen with his Spartans (see LEONIDAS), Xerxes burned Athens, which had been forsaken by its inhabitants. The first naval battle between the two powers at Artemisium had been indecisive; but it inspired the Greeks with new confidence; and the second naval action at Salamis, in which, if we believe the Greek historians, 2,000 Persian vessels were engaged against 380 Greek, terminated in the defeat of the Persians (28 Sept. 480). Xerxes now quitted Greece, leaving behind him his best general, Mardonius, who, not long after, was routed at Platæa. Xerxes now gave himself up to debauchery; his conduct offended his subjects and Artabanus, the captain of his guards, conspired against him, and murdered him in his bed. The personal accomplishments of Xerxes have been commended by ancient authors; and Herodotus observes that there was not one man among the millions of his army that was equal to the monarch in comeliness or stature, or as worthy to preside over great and extensive empire. He was succeeded by his son Artaxerxes I.

XIMENA, hē-mā'nä, in Spanish legendary history, the wife of the Cid (q.v.).

XIMENA, or The Heroic Daughter, an English adaptation of Corneille's 'Cid,' by Colley Cibber, first played in London in 1712 and printed in 1718.

XIMENEZ DE CISNEROS, Francisco. See JIMÉNEZ DE CISNEROS, FRANCISCO.

XIMENEZ DE QUESADA, Gonzalo. See JIMÉNEZ DE QUESADA, GONZALO.

XIMENEZ DE RADA, Rodrigo. See JIMÉNEZ DE RADA, RODRIGO.

XIMENIA, zī-mē'nĭ-ȧ, a genus of plants of the family Olacaceae, represented by large shrubs or small trees, often spiny. Leaves entire, leathery; calyx very small, petals four, hairy inside; stamens eight; ovary with four one-seeded cells. *X. americana,* the false sandalwood, is a straggling shrub, or low spreading tree producing dull-white fragrant flowers, smelling like cloves, succeeded by small, oval, red or yellow pulpy fruits, an inch long, aromatic, but somewhat astringent. They contain a white globose nut with a kernel which tastes like a filbert. Its wood is very tough and heavy. This shrub is known in Florida as the hog plum or wild lime, and in the West Indies as mountain or seaside plum.

XINGU shĕNng-gōō', river, Brazil, one of the chief tributaries of the Amazon. It is formed by the junction of several headstreams which rise near latitude 15° S., longitude 55° W. Chief of these is the Tamitatoaba, which flows from a small lake about 75 miles in circumference. After flowing north for 1,200 miles through a densely forested and little explored region, the Xingú forms a large lake which is connected with the Amazon estuary by a number of deltaic channels 240 miles west of Belem (Pará). Steamers ascend the river to the Cataract and Fall of Itamaracá. The river was unexplored until 1884–1887, when it was descended from Cuyabá by Karl von den Steinen; but much of its course, interrupted by falls and rapids, is still unexplored.

XIPHODONTIDAE, zĭf-ō-dŏn'tĭ-dē, a family of primitive forerunners of the ruminants, whose remains occur in the Upper Eocene rocks of western Europe. Some of them are the largest and most slender artiodactyls of their age, and the only feet hitherto discovered are two-toed, with mere rudiments of the lateral digits.

XIPHOSURA. See MEROSTOMATA.

XOCHIMILCO, sō-chē-mēl'kō, town, Mexico; in the Federal District; 10 miles south of Mexico City. It is situated on the western shore of Lake Xochimilco and is a picturesque suburb of the capital. Pop. (1940) 14,370.

Floating Gardens.—Before the Spanish conquest the Indians here raised flowers, vegetables, and fruits on rafts (chinampas) made of interwoven twigs and reeds and covered with mud. Their produce was marketed in the Aztec capital of Tenochtitlán, now Mexico City. In the course of time the roots of the plants became attached to the bottom of the shallow lake and fixed the rafts to the bottom. The modern appearance of the "floating gardens," therefore, is that of a raised meadow intersected by canals lined with poplars, flowers, and other plants. Boating on the canals is a popular diversion, especially on Sundays, when they are crowded with flower-decorated boats propelled by boatmen with long staves. Other boats are manned by those selling food and beverages to the holiday-makers; still others by small bands which serenade for a fee.

XUARES, hōō-ä'rās, **Gaspar,** Paraguayan botanist, historian and biographer: b. Santiago del Estero, Paraguay, 1731; d. Rome, Italy, 1804. Entering the order of Jesuits, he devoted himself to teaching philosophy and theology; and after the suppression of his order he moved to Italy, where he occupied himself with botanical researches.

He wrote *History of Buenos Ayres,* and *Dissertations,* which remain in manuscript; and a *Life of Saint Francis Xavier.*

XUREL. See JUREL.

XYLANDER, ksü-län'dĕr, **Wilhelm** (real surname HOLTZMANN, hôlts'män), German scholar: b. Augsburg, Aug. 20, 1532; d. Heidelberg, Feb. 10, 1576. Educated at Tubingen and Basel, in 1558 he was appointed professor of Greek at Heidelberg. His numerous Latin translations from the Greek have been of much service to later students. Xylander is noted as having been the first to translate Euclid into German, in 1562. An introduction to Aristotelian philosophy was one of his many original works.

XYLENE, zī'lēn, or **DIMETHYL BENZENE,** in chemistry. Three isomeric hydrocarbons are known by this general name, orthoxylene, metaxylene, and paraxylene. They all have the composition $C_6H_4(CH_3)_2$ and are dimethyl derivatives of benzene. Commercial xylene or xylol, found in coal tar, is a mixture of the above three. It is a colorless, oily liquid, boiling above 140°C., not soluble in water, and used as a solvent in various chemical operations.

XYLOGRAPHY. See WOOD ENGRAVING.

XYLOIDIN, zī-loi'dĭn, or **XYLIDINE,** in chemistry, an explosive probably of the composition $C_8H_9NO_2O_5$, known also as pyroxylin and nitrostarch. Discovered by Henri Braconnot in 1833 and prepared by dissolving one part of potato starch in eight parts of fuming nitric acid and then pouring this solution, well cooled, into 16 parts of concentrated sulphuric acid. It is a white hydroscopic powder, insoluble in water and alcohol, but soluble in ether. It is not used to any considerable extent.

XYLOPHONE, zī'lō-fōn, a musical instrument of percussion consisting of bars of wood or glass graduated in length and resting on belts. The notes are produced by striking on the bars with small hammers and have a range of two or three octaves.

XYLOPIA, zī-lō'pĭ-ȧ, a genus of anonaceous trees or shrubs, natives of tropical regions, with coriaceous leaves, commonly two-ranked, and flowers in axillary clusters or solitary. The corollas have six petals, the outer three elongated, boat-shaped, curving over and partially enclosing the other three. The receptacle is conical, with the stamens outside and the carpels in its excavated interior. The fruits are elongated berries. *X. sericea,* the pindaïba of Rio Janeiro, bears a highly aromatic fruit, which may be used as pepper, with which it agrees in flavor. Good cordage is made from the fibers of its bark. The wood, bark and berries of *X. glabra,* the "bitter

wood" of the West Indies, taste like orange seeds, and impart a similar flavor to the wild pigeons which feed on them. It is said to be useful in colic and for creating an appetite. Martius believes the fruit of *X. grandiflora* to constitute a valuable febrifuge used by the South American Indians. The dry, black and quill-like fruits of *X. aromatica* form the *Piper aethiopicum* of commerce, used as pepper by the West African Negroes. They are sold in the native market as a stimulant and condiment. *X. polycarpa* is the yellow dye tree of tropical Africa, with a bitter bark, that contains berberine and which yields a yellow dye, of extensive use.

Y the 25th letter of the English alphabet, derived from the Greek through the Latin, is both vowel and consonant. It came into Latin in Cicero's time in spelling words borrowed from the Greek; for the Latin language has no sound like that of the Greek Υ (upsilon); the *y* found in some Latin words, as *lacryma, satyra, sylva,* is due to an error of modern editors; those words were in ancient Latin always written *lacrima, satira, silva.* The modern Italian alphabet has no *y,* and the *y* of Greek words adapted into Italian is changed to *i: sinfonia, symphony, sindico, syndic.* In Dutch, *y* stands for *ij,* and represents the diphthongal long *i* of English as in *time.* In English, *y* is a superfluous letter, so far as it stands for a vowel sound; as such, it can always be represented by the vowel *i.* The sound of Υ, *v,* in Greek, was that of French *u* and German *ü.* This sound does not exist in English: it is heard when, with lips and tongue in the positions for pronouncing the vowel sound *oo,* one tries to give the English vowel sound of *e* in *he.* In early English or Anglo-Saxon, *y* represented this peculiar vowel sound; but it has so far dropped out of English speech that a person whose only speech is English cannot pronounce it untaught. At the time of the Norman Conquest *i* had taken the place of this *y,* and soon both the sound and the letter went out of English use. But when Norman words came to be used by the English the French *u* sound was retained in many words, as *muse, lute, duke,* and they were pronounced with the French *u;* this sound gradually developed into *iu,* but the spelling remained unchanged: this *iu* represents the sound of *u* in *muse, duke* as now pronounced. In the beginning of syllables and when followed by a vowel, *y* is a palatal consonant formed by bringing the middle of the tongue in contact with the palate, nearly in the position for *g* hard; hence Old-English *g* hard has often been softened into *y,* as in *day* from Old-English *dag. Y* also often stands for the sound pronounced in the same manner but written *j* in the other Germanic tongues. Until comparatively recent times it was customary to write *the* y^{e} and *that* y^{t}, and those forms were repeated in typography. In those cases the character resembling *y* or identical with it, stood, not for *y* but for the Old-English letter þ; it is a mere ignorantism to read "y^{e} year," *ye year* as though *y* here stood for the consonant *y,* and not for the digraph *th.* As an abbreviation *Y* stands for yttrium. *Y* is used in mathematics for the second of two unknown quantities or the ordinate of a point in Cartesian co-ordinates. See ALPHABET.

YACHTS AND YACHTING. Broadly speaking, a yacht is any boat, vessel or ship privately owned and used for pleasure, although small, undecked sailing, motor and rowing boats are seldom referred to by the term. The term "yacht" covers an infinite range of sizes and types of craft, from the small open boats through half-decked day-sailing and racing boats; small cabin cruisers propelled by sail, power, or both; larger seagoing power and sailing vessels; up to the lofty America's Cup class racing sloops and great luxury ships 200 or more feet in length and costing many hundred thousand dollars, which were common up to World War II but which have been little in evidence since then. Sailing yachts may be of various rigs—the single-sailed catboat; the single-masted sloop or cutter with from two to five sails; the two-masted yawl or ketch with three or more sails; and the schooner, with two or more masts and three to a dozen or more sails. There are various less widely-used rigs, but the square-rigged yacht, once common, is practically extinct. "Yachting," likewise, is a term that includes a multitude of activities—afternoon sailing, small-boat racing, leisurely coastwise cruising in sail and power craft, round-the-world voyages, international racing on a formal and expensive scale, and entertaining aboard some palatial Diesel yacht, to mention but a few.

Early History of Yachting.—Yachting may be traced back into the dawn of history, in the state vessels and pleasure barges of the Egyptians, Greeks and Romans. In English-speaking countries, it was introduced by King Charles II, who had become a devotee of the sport during his exile in the Channel Islands and Holland, and brought it home with him in the Restoration in 1660. Indeed the word "yacht" stems from the Dutch *jaght* or *jaght schip,* with connotations of hunting, sport and speed. Races were held and pleasure sailing was popular on the Thames and elsewhere in British waters intermittently from that time on. The earliest recorded yacht club was the Water Club of Cork Harbor, in existence in 1720. In 1775 the Cumberland Fleet, which became the present Royal Thames Yacht Club, was formed in London and in 1815 The Yacht Club, later to become the Royal Yacht Squadron, at Cowes, England, was formed in London.

In America the sport goes far back into colonial times. An engraving of New York Harbor in 1717 identifies "Col. Morris's yacht *Fancy,*" and histories of that time indicate that there were many craft in use for pleasure though "racing was not much in fashion." While there was no organized yachting, as such, the use of craft for pleasure continued through colonial and federalist times. A noted early American yacht was the lavishly equipped and decorated 83-foot hermaphrodite-brig-rigged *Cleopatra's Barge* built in Salem, Mass., in 1816, for George Crowninshield, wealthy merchant-ship owner, who cruised to the Mediterranean in her. Early attempts at starting yacht clubs were the Knickerbocker Boat Club in New York in 1811 and the

Boston Yacht Club in 1835, but neither lasted more than a couple of years. The first permanent yacht club in America was the New York Yacht Club, founded in 1844. It held its first annual cruise that year and its first annual regatta in 1845, events which, save for interruptions by wars, have been annual fixtures ever since. The Royal Bermuda Yacht Club was also formed in 1844. Other early yacht clubs in America were the Southern (New Orleans), 1859; Carolina, 1854; Hoboken, 1856; and Brooklyn, 1857. In the New England area the Boston Y. C. was formed in 1865 and the Eastern in 1870. Other old clubs in different parts of the country are Oshkosh (Wisconsin) 1870; San Francisco, 1867; Savannah (Ga.) 1867; Portland (Maine) 1869; and St. Augustine (Fla.), 1872. Today there are many hundreds of clubs in the United States devoted to the sport of yachting, many of them on inland rivers and artificial lakes where yachting was never thought of until a few years before World War II. Some are elaborate, socially important and expensive institutions; many are simple and unpretentious clubs with dues of a few dollars a year, filling the needs of the small-boat owners of modest means.

International Yacht Racing.—The America's Cup has always been regarded as the blue ribbon of international yacht racing. The schooner yacht *America* was built by George Steers, in New York, in 1851 for a group of members of the New York Yacht Club headed by Commodore John C. Stevens. She was 101 feet long on deck, a typical American schooner of the fast, seaworthy type then used by the New York pilots. She was sailed to England, where she proved much faster than any of the British yachts, and while there won a trophy of the Royal Yacht Squadron called the Hundred-Guinea Cup, in a race around the Isle of Wight against 17 British yachts. The *America* was sold in England; subsequently was a Confederate blockade runner and then a federal naval dispatch boat during the American Civil War; later she became a yacht again, and in 1921 was presented by a group of yachtsmen to the United States Naval Academy, at Annapolis, where she finally succumbed to neglect and was broken up in 1946.

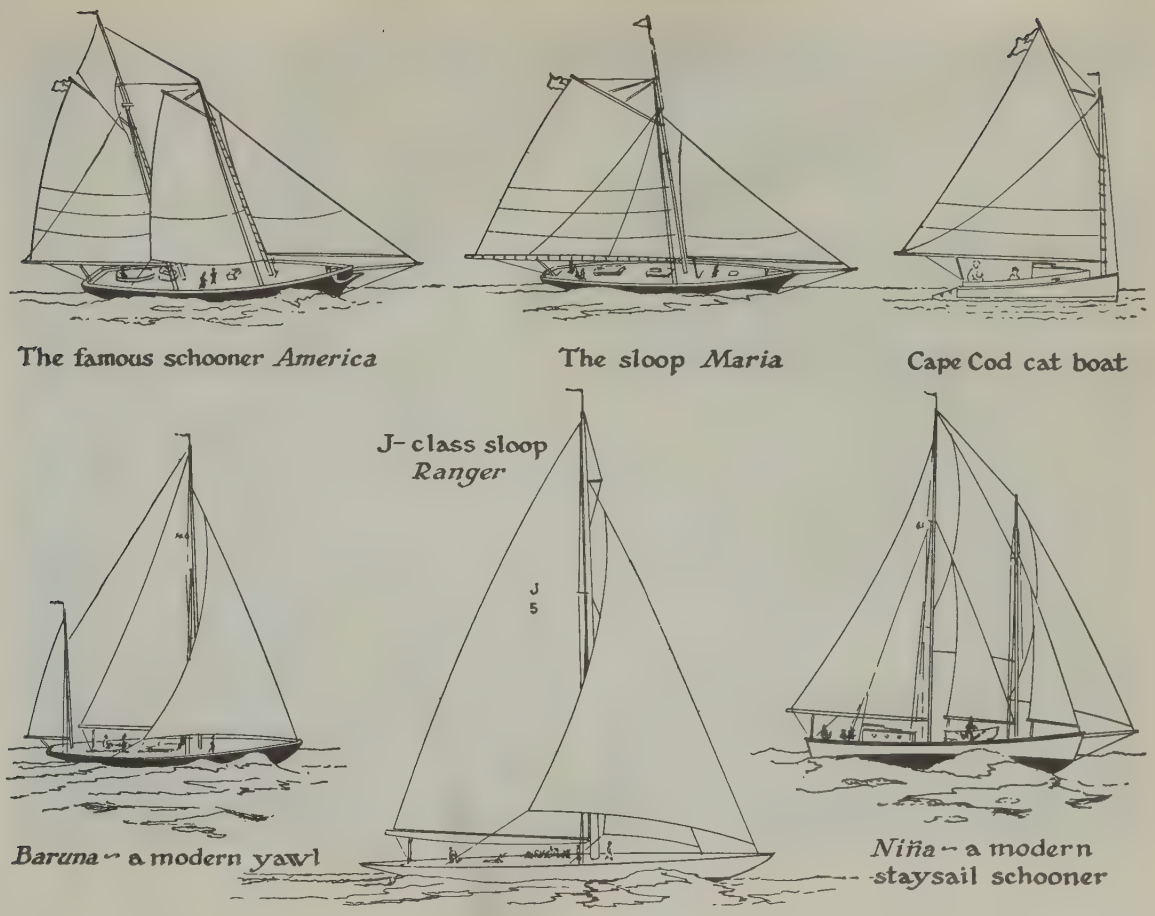
The trophy became known as the America's Cup after it was deeded to the New York Yacht Club by the yacht's original owners in 1857, to be an international challenge trophy. A requirement of the deed of gift, inserted to insure that only really seaworthy yachts would compete for the cup, requires a challenger to cross the ocean under sail on her own bottom. The cup has always been raced for in yachts of the largest active racing classes in point of size. From 1870 through 1937, sixteen attempts to take this cup have been made, two by Canadian and the others by British challengers, but the New York Yacht Club has always managed to make good the defense. In 1870 and 1871 the British schooners *Cambria* and *Livonia* were beaten by several American yachts. Since then all contests have been true match races, one boat to a side. The Canadian *Countess of Dufferin* and *Atalanta* were beaten by *Madeleine* and *Mischief* (the first sloop to defend the cup) in 1876 and 1881. General Charles J. Paine's *Puritan, Mayflower,* and *Volunteer,* all designed by Edward Burgess, defeated the British *Genesta, Galatea,* and *Thistle* in 1885, 1886, 1887.

The era of Herreshoff-designed and -built defenders started with *Vigilant* and *Defender,* club syndicate-owned sloops that beat Lord Dunraven's *Valkyries II* and *III* in 1893 and 1895. Sir Thomas Lipton entered the field in 1899 with the first of his five *Shamrocks* which were successively defeated by syndicate-owned yachts of the New York Yacht Club, *Columbia* in 1899 and 1901; *Reliance* in 1903; *Resolute* in 1920, and *Enterprise* in 1930. *Enterprise* was the first of three defenders sailed by Harold S. Vanderbilt and designed by W. Starling Burgess. *Rainbow,* which defeated Thomas O. M. Sopwith's *Endeavour* in 1934, was the second and *Ranger* of which Vanderbilt was sole owner and the firm of Sparkman and Stephens was co-designer with Burgess, the third, beating Sopwith's *Endeavour II.*

In smaller craft, American yachtsmen have never enjoyed the monopoly of victory that they have in America's Cup yachts, though they have always won their share and more. International racing has been held in many different types of craft, ranging in size down to 12- and 14-foot sailing dinghies. One of the best known is the six-meter class in which a dozen nations have competed for the Scandinavian Gold Cup, British-American Trophy, Seawanhaka Cup and other prizes. The most widely representative is the Star Class, which started in America but now sails in more than a score of countries throughout the world. The Stars are small one-design sloops, 23 feet over all and of inexpensive construction, in which several international events are held annually, including a world championship in which, up to 1946, only one nation, Germany, had ever taken top honors from American sailors.

Ocean Racing.—Though the first transatlantic yacht race was sailed in December 1866, by the big schooners *Henrietta, Fleetwing* and *Vesta,* this branch of the sport really began to attain its present popularity early in the 20th century, among owners of relatively small but seaworthy cruising yachts. The best known ocean races, all biennial fixtures, are the race from the east coast of the United States to Bermuda and that from the west coast to Honolulu, both of which date back to 1906, and the British Fastnet race from southern England to the Irish Coast and back. Transatlantic races are occasionally held, and many coastwise races, a greater or lesser part of which are in the open ocean. The popularity of this type of racing has grown very rapidly since about 1920, and has not only provided competition of the highest caliber, attracting many of the ablest yachtsmen in the sport, but also has been instrumental in developing a type of yacht which, with only slightly less speed than the extreme racing type, combines excellent cruising accommodations and the ability to go to sea and take the weather as it comes, as was proved in World War II when many of these ocean racing yachts were used by the Coast Guard, winter and summer, in a protective antisubmarine patrol along the coast. The modern ocean racing yachts are relatively small, ranging approximately from 35 to 75 feet in length over all, and are manned almost entirely by amateur crews.

Yacht Racing Classes.—The number and variety of yacht racing classes are legion, many being strictly local and consisting of only a few boats while others are national and even international in extent and run into thousands of



boats. In a general way, however, they may be grouped into (a) one-design classes (b) rating classes and (c) handicap classes. One-design classes are, as the name implies, boats all as nearly alike as they can be made in hull, rig and equipment, success in racing being entirely dependent on the skill of skipper and crew in keeping their boat and gear in top-notch condition and in sailing her. Such classes range from small open dinghies costing only two or three hundred dollars to big yachts of 50-foot waterline length. Rating classes are those in which all yachts compete without time allowance, but in which considerable latitude is possible in design, construction and rig. They are rated according to measurement formulas. Such classes are the six- and twelve-meter, R, Q, M, and 30-square meter classes and the modern America's Cup sloops of the J or 76-rating class. In handicap classes, boats are rated either according to one of many rating formulas or on past performance, and each one except the fastest receives a time allowance which is subtracted from her elapsed time in a race to determine her corrected time, prizes being distributed according to corrected time. Ocean, long-distance and port-to-port races are usually run on this basis.

Yacht Racing and Rating Rules.—A code of Yacht Racing Rules, governing competition among sailing yachts, has been adopted as standard in all yachting countries through the efforts of the North American Yacht Racing Union and corresponding yachting bodies in other countries. It is a lengthy document but its most important and often-invoked sections are those dealing with right of way. These are based on the Rules of the Road at Sea, but are more detailed and complicated because the Rules of the Road are designed to keep ships from approaching within risk of collision of each other, while the Racing Rules assume that competing yachts will be in close quarters most of the time and are designed to prevent actual collision.

Yacht Rating Rules.—Rating rules are those by which yachts are measured to determine in what racing classes each shall compete, or what time allowance each will receive in handicap racing. Originally simple rules, many of them have become extremely complicated in efforts to prevent designers from turning out freak boats which, while fast, are undesirable in other respects such as seaworthiness, cost, etc. They are based on different combinations of many factors such as length, beam, draft, tonnage, displacement, girth, sail area, weight of ballast, etc., and contain many limiting factors covering construction, equipment, rigging, etc. A naval architect, in racing yacht design, tries to produce the fastest boat of a given rating for a certain class, or a boat that will be fast yet have a low rating when handicapped under a given rule. There are many such rules, some still simple and applied only to one or two individual races while others are internationally used and applied to many races. Among the latter are the Universal Rule, under which the America's Cup boats and many American racing classes have been built; the International Rule, used both in Europe and America, particularly in the 6-, 8-, 10- and 12-meter classes; the Cruising Club Rule under which many important ocean races are handicapped, and the Square Meter or Sail Area Rule,

governing such classes as the 22- and 30-square-meter boats.

Yacht Speeds.—In displacement type hulls (i.e., those that go through the water and do not lift out and "plane") potential speed is a function of the square root of the waterline length. Thus a 36-foot waterline yacht that will make 8.4 knots under ideal conditions has speed-length ratio of 1.4, which is unusually high, whereas a 100-foot waterline yatcht making only 10 knots has a ratio of 1.0, which is poor. This, of course, applies to theoretical maximum speed, which is seldom reached by any yacht. Actual speed depends not only on the design, sails and rigging of the yacht but on the way she is sailed, the smoothness of her bottom, the wind, sea, tide and many other conditions.

This speed-length ratio theory does not apply to planing hulls, which include light, fast motor craft and a few light sailing types like the inland scows, since in those boats most of the hull is actually lifted out of the water by their motor or sail power and resistance correspondingly reduced. Hence speeds of 20, 30, or 40 knots may be made in boats 20, 30, or 40 feet long, and even much greater speeds in racing motorboats.

Sailing yacht speed records are of little significance as so much depends on conditions that are seldom twice the same. The best time ever made around a 30-mile triangular race course was by the America's Cup class sloop *Yankee* in a trial race in 1930, of 2 hours 47 minutes 59 seconds, or an average speed of about 10.7 knots. Her fastest 10-mile leg in that race was made at 13.3 knots. The transatlantic sailing record, made by the 134-foot waterline schooner *Atlantic* in 1905, is 12 days 4 hours 1 minute from Sandy Hook Lightship to The Lizzard, an average of 10.32 knots. The Bermuda race record, by the 50 foot waterline sloop *Highland Light* in 1932, is 71 hours 35 minutes 45 seconds for 628 miles.

Yacht Design and Construction.—The early yachts were replicas of commercial, naval and fishing vessels of their era and locality, modeled and built by the same men. The British revenue cutters, the fast able Sandy Hook pilot schooners and the fishing vessels of New England all had their influence on pleasure craft. In fact some were sold to become yachts, and vice versa, many yachts being converted to pilot vessels, fishermen and packets.

Before the middle of the 19th century practically every yacht was built to lines taken from a small model whittled and scraped to shape by an expert from a block of pine. The modern practice of designing a yacht on paper according to scientific principles came in, in America, after the Civil War when such men as A. Cary Smith, Edward Burgess and Nathaniel G. Herreshoff showed the way to the modern science of naval architecture which drafts and calculates each line and element of a yacht before building is started.

Concurrent with scientific designing came the gradual evolution of distinct yacht types, though the influence of commercial types is evident in many yachts even today, such as that of the Gloucester fishing schooners on seagoing cruising yachts. There is no one single "yacht type" but there are many types of yachts, each designed for the waters in which they are to be used, the type of use to which they will be put, and the requirements of their owners as to speed, comfort, seaworthiness, etc.

Yacht construction has likewise gradually diverged from commercial practice. Yachts are built of lighter materials, on construction principles which provide strength with relatively light weight (though often relatively heavy cost), especially in racing craft. Wooden frame-and-plank construction has always been standard yacht construction, though iron and steel hulls began to appear in large steam and sailing yachts in the latter part of the 19th century. World War II, aggravating the shortage of high-grade yacht building lumber, accelerated experiments in the use of substitutes, and the postwar revival of yacht building made increasing use of steel, in smaller yachts than hitherto, and of aluminum, molded plywood, sheet plywood and plastics.

Until well into the 20th century almost every yacht built, sail or power, was an individual creation of the designer and the builder to the order of the owner, and this remains the ideal with most yachtsmen. However, considerable economies in engineering and building are possible in turning out a large number of identical boats, and by the beginning of World War II the stock boat (i.e., one designed and built on the initiative of the builder and offered to buyers as a completed unit) has been widely accepted.

Power Yachts.—Steam power was applied to yachts during the latter part of the 19th century and in the early 1900's the ownership of a magnificent and luxurious steam yacht, used more often for social entertaining and ostentatious display than for satisfying any real taste for the sea, was a part of the equipage of many multi-millionaires. By the 1930's steam had been almost wholly superseded, in these large yachts, by the Diesel engine. The naphtha launch had a brief vogue in the late 1800's and early in the 20th century the internal combustion gasoline engine began to be fitted to pleasure craft, both as the prime motive power and as auxiliary power in sailing yachts. The refinement and increasing cheapness and reliability of gasoline engines rapidly brought power yachting within the reach of those of modest means, and motorboating paralleled the development of the automobile, from a luxury and curiosity status to an everyday vehicle used by many thousands of people for pleasure, small motorboats costing but a few hundred dollars being obtainable by 1940. Speeds increased as gasoline engines became lighter and more powerful, until by 1940 "runabout" type pleasure craft making up to 30 and 40 miles per hour and small cruising boats making 12 or 15 knots were not unusual. Following World War II a great increase in the popularity of power as well as sailing craft, on inland lakes and rivers as well as on salt water, was noticeable. Motorboating requires less skill and experience than sailing, and consequently appeals to many who might hesitate to take their first taste of boating under sail. The Diesel engine, operating on cheaper and safer fuel, is newer than the gasoline engine; it has not only replaced steam in big yachts but also replaced gasoline engines in many of the slower motor cruisers from 35 feet up in length, although the Diesel is heavier per horsepower and more costly to install than gasoline power.

To the work of yacht designers and builders and engine manufacturers in the developing of fast, able and dependable motor yachts the world

Bermuda News Bureau

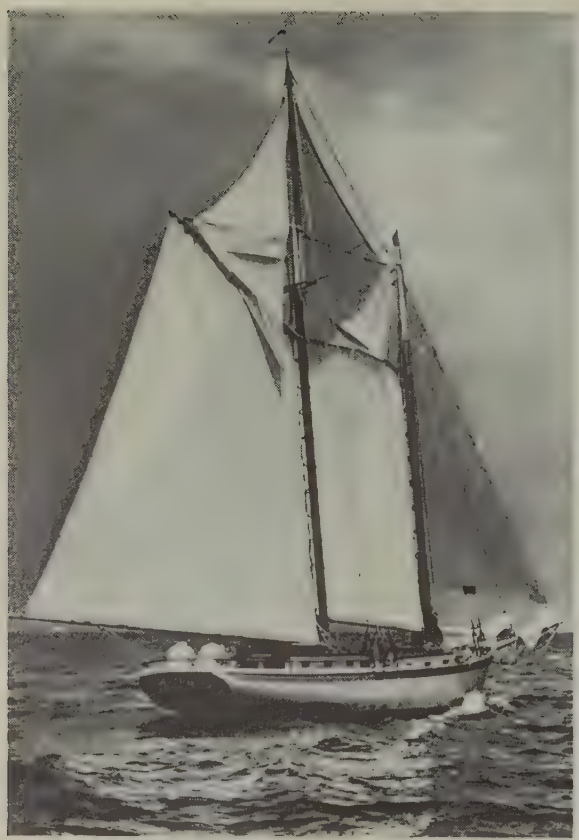
International 14-foot dinghy in a Bermuda yacht race.

Above is a Luders 16 speeding to victory.

Morris Rosenfeld

Aries, International One Design Class sloop, built in Norway.

Alar, New York Yacht Club Class 32-foot sloop.



Coaster, a 36-foot coastal schooner.

Morris Rosenfeld

Abenaki, a 50-foot auxiliary schooner, Maine-built.

Bolero, a 73-foot auxiliary yawl, built in New York.

Morris Rosenfeld

Mercury V, a 99-foot auxiliary ketch, built at Stamford, Connecticut.

owes many of the smaller naval craft that helped win World War II—the motor torpedo boats, submarine chasers, and other military craft, the principles of whose design, building and powering were based largely on yacht practice.

Yachts in War.—From the earliest times, yachts have served their countries in times of war. British and Dutch naval histories as far back as the 17th century include many mentions of yachts as a part of the fighting fleets. In the United States, a number of yachts were converted into privateers when the War of 1812 started and brought in some of the first prizes. In the Civil War, yachts, among them the *America,* served as dispatch and blockading vessels. Steam yachts formed a part of the fleet that won the Battle of Santiago in the Spanish War. In World War I several steam yachts served with distinction. In World War II practically all the larger Diesel yachts were taken over by the Navy for escort, patrol, antisubmarine and other duties; smaller Diesel and gasoline yachts formed an important part of the coastal defense fleet, and many sailing yachts were formed into a coastal observation and listening patrol. The Navy and Coast Guard found the yachtsmen of the country a fertile source of experienced seagoing personnel during wartime.

WILLIAM H. TAYLOR,
Associate Editor, "Yachting."

YADKIN, yăd'kĭn, a river in North Carolina about 202 miles long; it flows east and south and joins the Uharie River to form the Pee Dee River. Yadkin is also a county in North Carolina.

YADRINTSEF, yăd-rĭn'zĕf, **Nikolai Michailovitch,** Russian author: b. Siberia, 1842; d. Barnaul, Altai Mountains, June 29, 1894. Accused in youth of conspiring for the independence of Siberia, he was exiled to Archangel, but later was permitted to return and was appointed on the staff of Governor-General Kaznakof. Between 1865 and 1875 he traveled extensively in Siberia, publishing the results of his explorations and in 1882 founded at Petrograd (later removing to Irkutsk), the *Eastern Review,* a strong popular weekly devoted to the interests of Asiatic Russia. In 1891–1892 he made careful explorations in Mongolia, discovering the ruins of the ancient capital of the Tatar khans and forming archaeological collections of great value. In 1893 he visited the United States. He was the founder of the Siberian University and a promoter of universal education. Among his works are *The Russian Commune in Prison and in Exile; Siberia as a Colony* (1882).

YAGUARONDI, yä-gwä-rŭn'de. See JAGUARONDI.

YAHOO, yä-hōō', a name given by Swift in his *Gulliver's Travels* to a race of brutes, described as having human forms and degraded propensities. They were subject to the Houyhnhnms, or horses endowed with human reason. Hence, the term is applied to a rough, low, boorish, or uneducated person.

YAHWIST. See ELOHIST.

YAJUR VEDA, yă'jōōr vā'dà. See VEDIC LITERATURE.

YAK, yăk, the native name for the wild ox (*Bos grunniens*) of the mountainous regions of Tibet. There are two races: the wild yak, generally black, which is found near the snow line, descending into the valleys in winter, and a domesticated race, usually half-breeds, of various colors, black and white being most common. The yak is about the size of the common ox, to which it has a general resemblance, but it is covered with a thick coat of long, silky hair, hanging down like the fleece of a sheep, completely investing the tail, and forming a lengthy fringe along the shoulders, flanks and thighs. This fringe, which exists in both races, was apparently developed as a protection to the animal in its alpine haunts, as the long hair forms a sort of mat which defends the body from the effects of the cold when the animal is reposing in the snow.

The domesticated race is of great importance to the natives of Tibet. The yak is employed as a beast of burden, but never for tillage or draft; the milk is very rich and yields excellent butter; the flesh is of the finest quality, and that of the calves far superior to ordinary veal. The hair is spun into ropes and made into coverings for tents, and the soft fur of the hump and withers is woven into a fine strong cloth. The tails, often dyed red, are made into the chowries or fly-flappers, used in India. Yaks are often seen in zoological gardens and menageries, and have repeatedly been bred in Europe. It is probable that they might be advantageously introduced into the northern parts of the continents of America and Europe. They have, however, the disadvantages of not eating corn and not being able to live at a low elevation.

YAKIMA, yăk'ĭ-mô. See SHAHAPTIAN INDIANS.

YAKIMA, a river of the State of Washington, rising in the Cascade Mountains and after a southeastward course of about 175 miles, flowing into the Columbia about six miles west of Pasco and Kennewick, and 10 miles above the confluence of the Snake River. It flows through an important coal-mining region and its valley and those of its numerous short tributaries are among the most fertile in the state. The Northern Pacific Railway traverses the whole length of the valley of the Yakima, almost to its source. The chief tributary is the Naches River which joins the Yakima at the city of Yakima (q.v.).

YAKIMA, Wash., city and Yakima County seat; on the Yakima River; altitude 1,069 feet; 160 miles southeast of Tacoma; on the Northern Pacific and Union Pacific railroads; has a county airport, with airline service. Food processing and packing is its leading industry. Incorporated in 1886, it has commission government. Pop. (1940) 27,221; (1950 est.) 38,375.

YAKOBA, yä-kō'bä, now **BAUCHI,** bouchē', West Africa, a town in northern Nigeria, in the Province of Bauchi, finely situated on a plateau partly surrounded by mountains, 140 miles southeast of Kano, and on a caravan route. It is walled and the interior is finely diversified with gardens and ponds. The climate is healthful. Pop. province (1931) 1,025,310; town about 11,000.

YAKONAN (from *yakwina,* «spirit»). A linguistic stock of North American Indians, consisting of the Alsea, Yakwina, Kuich and Siuslaw divisions. They were physically of the type of the Northwest Coast Indians and were the southernmost tribe practising artificial deformation of the head. Their mythology and traditions were chiefly of the North but were somewhat modified by contact with the Indians of the California coast. Slavery existed among them until they came under the control of the United States. The home of the Yakwina was along Yaquina River, Oregon, from the site of Elk City to the sea; they were formerly numerous, occupying 56 villages in early days, but the tribal distinction of the Yakwina, as well as of the other Yakonan divisions, was gradually broken down through their preference for marriage outside the tribe; there are only a few Yakwina left and these reside on Siletz reservation, but their number is unknown. The Alsea formerly dwelt in villages along both sides of Alsea River, Oregon, and on the adjacent coast; they are now on Siletz reservation, and perhaps a few are on Grande Ronda reservation. The Siuslaw were also village dwellers, inhabiting Siuslaw River as late as 1857; they are probably extinct. The Kuich or Lower Umpqua, villages were on both sides of Umpqua River from its mouth upward for 30 miles; a few survivors still reside on Siletz reservation. The entire population of the Yakonan Indians probably does not exceed 400.

YAKUB BEG, yä-koob′ bēg, surnamed Attalik Ghazi («leader of the champions of the faith»), amir of Kashgar: b. Russian Turkestan early in the 19th century; d. 31 May 1877; He distinguished himself in the defense of Khokan against the Russians. But he first rose to great eminence after the recovery of Kashgar from the Chinese in 1864, when he acted as lieutenant to Buzurg Khan, whom he soon supplanted. For 12 years this remarkable man conferred on a large part of Central Asia the benefits of a settled though rigorous government. He drilled and disciplined a large civil staff, while his army contained the best native soldiers in Central Asia. In his foreign policy he was strongly anti-Russian, and ultimately friendly to Great Britain. China, however, set out to recover its lost Mohammedan provinces and had gained some victories when Yakub died — by assassination, some said. His realm at once fell in pieces. The Chinese armies overran the country (1878), and Kashgar again came under Chinese rule.

YAKUB KHAN, khän, ex-amir of Afghanistan: b. 1849. He was a son of the amir Shere Sli; was appointed governor of Herat by his father and became extremely popular, but in 1870 broke into open revolt, and in 1874 was imprisoned at Kabul. On the death of Shere Ali he was proclaimed amir (1879) and concluded a treaty of peace with the British at Gandamak. By the terms of this treaty he was to receive a British resident, and on his side to obtain from the British government a subsidy and aid in case of foreign attack. The murder of Sir Louis Cavagnari, the resident, with staff and suite, occurred in the following September. Yakub was suspected of complicity. Lord Roberts (then Sir Frederick) defeated the Afghan force 6 October and seized Kabul on the 12th. Yakub abdicated and fled to the British camp. In December he was sent to India as a deposed ruler. Died, 15 Nov. 1923.

YAKUTSK, yä kootsk′, Asiatic Russia. (1) capital of the Yakutian Autonomous Soviet Socialist Republic, on a plain surrounded by lofty heights, on the left bank of the Lena. The streets present a singular aspect, being composed of about 400 houses of European structure, standing apart, while the intervening spaces are occupied by winter *yurts* or huts of the northern nomads, with walls of cow-dung, earthen roofs, and doors covered with hairy hides. The principal buildings of the town are a large stone cathedral, other churches, a synagogue, a market-house and several educational institutions. Inundations are frequent and the town is consequently unhealthful. The trade is important, Yakutsk being the chief commercial emporium for the whole of Eastern Siberia. The principal articles of native produce are furs and fossil ivory, which are exchanged for European produce. Important fairs are held. Pop. about 10,000. (2) The Yakutian S. S. Republic has an area of 1,533,397 ('Century Dict.' and 'Encyc. Brit.' give 1,530,253; other authorities, 'Standard Dict,' Lippincott, Longman, agree with International') square miles, or about two-fifths of that of Europe. The surface is generally low in the north, but rises toward the interior, and in the south and east is covered by the Yablonoi or Stanovoi Mountains and their offshoots. A noteworthy feature of the country is the *tundras,* immense boggy plains, which stretch along the north. Farther south there are good pastures, and wheat and rye are successfully cultivated, even where the ground is frozen to a depth of 600 feet, the summer heat being strong enough to thaw it sufficiently deep for cultivation. There are a number of large rivers teeming with fish, the principal being the Lena. There are valuable forests in the south, frequented by numerous fur-bearing and other animals. Gold and salt are mined but other mineral wealth, including coal, is practically untouched. Caravans with Chinese and European goods collect the produce of the whole line of coast on the Polar Sea between the parallels of 70° and 74°, from the mouth of the river Lena to the farthest point inhabited by the Tchukchis. The towns are chiefly inhabited by Turks and Cossacks, but the great body of the people are nomads, consisting of Yakuts, Tunguses, etc. Frosts of 79.5° F. are recorded and the period free from frost is only about 37 days. The climate is the coldest in Siberia. Pop. about 325,000.

YALE, Elihu, English philanthropist; b. in or near Boston, Mass., 5 April 1648; d. London, England, 8 July 1721. His father was Thomas Yale, one of the original settlers in New Haven, Conn., in 1638, but who removed to Boston soon afterward and to England in 1651, followed by his family the next year. The son was educated in England, engaged in trade in India in 1672, and in 1687–92 was governor of the East India Company's fort at Madras. He returned to England in 1692 and, although he never revisited New England, he displayed his interests in the Collegiate School founded at Saybrook in 1700 by sending gifts of money and books to the amount of some £600 in 1715, 1718

and 1721. The largest gift, that in 1718, followed a suggestion from the college authorities that the college building then being erected in New Haven might be named for him. In 1745 the whole institution received the name of Yale College in his honor. Yale's latest years were passed at Wrexham, Denbighshire, North Wales, and his body is buried in the magnificent parish church there.

YALE, Linus, American inventor: b. Salisbury, N. Y., 4 April 1821; d. New York, 24 Dec. 1868. He was the son of Thomas Yale, an inventor, who was credited with having constructed a number of farm machines. His father also invented a bank lock in 1840, and manufactured it for a time in Newport, N. Y. Young Linus became interested in his father's work, and by 1851 had patented a safety lock. For the rest of his life he was a recognized authority on all matters pertaining to locks and safes. Becoming convinced of the necessity of abandoning the use of a keyhole as affording an easy means of introduction to the lock mechanism, he was led to the adoption of the permanent dial and shaft as used in the combination locks, and subsequently to the perfection of what is known as the «clock» lock. His most notable invention was the double lock, which comprised two locks within a single case, and was operated by the same or different combinations. He received gold, silver and bronze medals as first awards at various expositions.

YALE UNIVERSITY, New Haven, Conn. The idea of a college in Connecticut originated in the Oxford-bred mind of the Rev. John Davenport, who with his Puritan associates established the first settlement of the New Haven Colony in 1638. In 1648 the General Court convened and gave power to a committee «to consider and reserve what lot they shall see meet and most commodious for a college.» In 1701, according to tradition, ten Connecticut clergymen met in the house of the Rev. Samuel Russel at Branford and made a gift of books for «the founding of a College in this colony.» On 9 Oct. 1701, the General Court passed «An Act for Liberty to erect a Collegiate School» wherein «Youth may be instructed in the Arts & Sciences who thorough the blessing of Almighty God may be fitted for Publick employment both in Church & Civil State.» The original seat of the college was at Killingworth (Clinton) in the residence of the Rev. Abraham Pierson, first rector. The Bachelor of Arts degree was first conferred for work in course in 1703. In 1707 the college moved to Saybrook and in 1716 to New Haven. The first building was begun in 1717 and completed in 1718. The new building was named Yale College in honor of Elihu Yale, a retired East India merchant of New England ancestry then living in London, who had made a substantial gift to the Collegiate School. An amendment to the charter in 1745 gave the institution its present corporate form, «The President and Fellows of Yale College in New-Haven.» Connecticut Hall, Yale's first brick building, was completed in 1752 and is still standing. With its statue of Nathan Hale, 1773, it is perhaps the most striking reminder of the Yale of the 18th century. In 1792 the governor, lieutenant-governor, and «six senior assistants in the Council of this State» (later the six senior senators) were made members *ex officiis* of the Corporation. Yale had ceased to be a provincial New England institution and was drawing many students from the South and West.

The next step was transition from college to university. The School of Medicine was chartered in 1810 and began instruction in 1813. The Divinity School was organized in 1822 and the Law School was affiliated with Yale College in 1825. In 1831 Yale acquired the collection of historical paintings by John Trumbull, and the first Art Gallery connected with a college in America was erected in 1832 for their exhibition. The School of the Fine Arts was not established until 1865. Graduate courses in philosophy and the arts were organized in 1846. In 1854 the School of Applied Chemistry (1847) and the School of Engineering (1852) united in Yale Scientific School. This new school took the name of its benefactor, Joseph Earl Sheffield, and became the Sheffield Scientific School in 1861.

Ten years later (1871) an act of the General Assembly provided for the substitution of graduates in place of the six State senators on the Corporation. The General Assembly authorized the name Yale University in 1887. Later were established the School of Music (1894) and the School of Forestry (1900). Yale-in-China was founded by Yale graduates at Changsha in 1906. During the World War (1917–18) Yale's dormitories were turned into quarters for a Reserve Officers' Training Corps and a Naval Training Unit. The year 1920 marked the beginning of the administration of the Freshman Year under its own dean and faculty. After the war the School of Nursing (1923) and the Institute of Human Relations (1929) were established by the gifts of several foundations. The School of Engineering (since 1861 part of the Sheffield Scientific School) was reëstablished in 1932. An Undergraduate Residential College Plan was inaugurated in 1933.

Since the founding of the Collegiate School in 1701 the following have been Rectors or Presidents of Yale. (The change from Rector to President occurred during the administration of Thomas Clap, 1740–66): Abraham Pierson, 1701–07; Samuel Andrew, 1707–19; Timothy Cutler, 1719–22; Elisha Williams, 1726–39; Thomas Clap, 1740–66; Naphtali Daggett, 1766–77; Ezra Stiles, 1778–95; Timothy Dwight, 1795–1817; Jeremiah Day, 1817–46; Theodore Dwight Woolsey, 1846–71; Noah Porter, 1871–86; Timothy Dwight, 1886–99; Arthur Twining Hadley, 1899–1921; James Rowland Angell, 1921–37; Charles Seymour, 1937–

The final authority in the «Government, Care, and Management» of the university is the Corporation, a body of 19 trustees, consisting of the President of the university, the Governor and Lieutenant-Governor of the State *ex officiis*, 10 Fellows who are the «Successors of the Original Trustees,» and six Alumni Fellows, elected one every year by the graduates to serve for six years. The Council of Masters, composed of the Masters of the residential colleges, serves as a committee of control in matters affecting the colleges. An Alumni Board, composed of representatives of all Yale alumni associations of one hundred or more members, serves to maintain mutual understanding between the university and its alumni. The Library, the Peabody Museum of Natural History,

the Observatory, and the Gymnasium are organized independently of the several schools.

The courses of study are offered in twelve schools. Each school has a faculty, a board of permanent officers, and a dean. All undergraduate students enter Freshman Year which prepares them for their three upper-class years in Yale College, or the Sheffield Scientific School, or the School of Engineering. Freshmen live together on the Old Campus and take their meals together in the University Dining Hall. Yale College, historically the progenitor of the university, offers courses of study in the liberal arts leading to the degree of Bachelor of Arts (B.A.). The Sheffield Scientific School offers courses leading to the degree of Bachelor of Science (B.S.) in the following fields: Chemistry (including physiological chemistry or bio-chemistry), physics, biological science (including pre-medical studies), plant science (including pre-forestry studies), psychology, mathematics; and in certain basic technical and economic studies which prepare for careers in industry and commerce and are designated as Industrial Administration and Applied Economics, respectively. The School of Engineering provides courses leading to the degree of Bachelor of Engineering (B.E.) as follows: chemical engineering, civil engineering, electrical engineering, mechanical engineering and metallurgy.

Besides the four undergraduate schools there are eight graduate and professional schools: Graduate School, School of Medicine, Divinity School, School of Law, School of the Fine Arts, School of Music, School of Forestry, and School of Nursing. The Graduate School offers training in a great variety of fields, either for teaching (generally in colleges and universities) or for research. It confers the degrees of M.A., M.S. and Ph.D. For those who do not desire highly specialized training with emphasis on research, there is a Division of General Studies not leading to a degree. In the School of Medicine the courses of study leading to the degree of Doctor of Medicine are divided into two periods, of about two years each. The first period is devoted to basic courses which are required of all students; the second is devoted to work in Clinical Medicine. Graduate courses leading to the degree of Master of Public Health and Doctor of Public Health are also given. The New Haven Hospital (550 beds) and the New Haven Dispensary (110,000 visits annually), allied with the school, serve as centres of clinical instruction. The Divinity School is undenominational and gives instruction in the history, doctrine, and polity of all the leading Protestant churches. Degrees conferred are Bachelor of Divinity and Master of Sacred Theology. The School of Law offers a three-year course leading to the degree of Bachelor of Laws; additional courses of one or two years each lead to the degrees of Master of Laws, Doctor of Civil Law, or Doctor of the Science of Law. Students in the regular curriculum receive preparation for the practice of law in any State. The School of the Fine Arts offers professional courses in architecture, drama, painting, and sculpture, and its general courses are open to the student body of the university at large. The School of Music offers a three-year course leading to the certificate, a five-year course for the degree of Bachelor of Music, and graduate courses for the degree of Master of Music. Closely associated with the School of Music is the New Haven Symphony Orchestra. The School of Forestry (1900) was one of the first institutions in the United States to give professional training in forestry for those who expect to enter public service or forest industries. The summer session is conducted in the Yale Forest at Union, Conn. Field instruction and practice are also involved in the Eli Whitney Forest of 22,000 acres near New Haven and on large private tracts in Louisiana and Arkansas. The School of Nursing, through the generosity of the Rockefeller Foundation, was founded in 1923 on the 50th anniversary of the Connecticut Training School for Nurses, the institution which it succeeded. The curriculum of 32 months includes public health and community work as well as hospital service, leading to the degree of Master of Nursing.

The Institute of Human Relations (1929) promotes co-operative research in the sciences concerned with individual and social behavior. The Institute of International Studies was organized in 1935. The Bureau for Street Traffic Research (1938) provides training in techniques for the safe and efficient control of street and highway traffic.

Yale's buildings number more than 100. Across College Street from the New Haven Green is the Old Campus with its traditional Yale fence, and Connecticut Hall. Around it are dormitories, recitation halls, and two chapels. To the west is the Memorial Quadrangle with the Harkness Tower, gift of Mrs. Stephen V. Harkness in memory of her son, Charle W. Harkness, B.A. 1883. This quadrangle designed by James Gamble Rogers, B.A. 1889, was first occupied in 1920. In 1933 the southern portion of the Memorial Quadrangle became Branford College, the northern portion became Saybrook College; funds for the remodeling were the gift of Mrs. Harkness' son, Edward S. Harkness, B.A. 1897.

The Bicentennial Buildings (College and Grove Streets), designed by Carrère and Hastings, were erected in 1901 and 1902 by the alumni to commemorate the founding of the university. One wing contains the University Dining Hall; the other, Woolsey Hall, an auditorium seating 2,800. Portraits of distinguished graduates and others are hung in the Dining Hall. The Newberry Organ in Woolsey Hall is a memorial to John Stoughton Newberry, the gift of his family. In Memorial Hall, a circular building which joins Woolsey and the Dining Halls, are tablets commemorating individual Yale men and those who died in the Revolutionary, Civil, Spanish-American, and World Wars. The Alumni War Memorial forms a colonnade on the south side of University Hall and was erected in 1927–28 as a tribute to Yale men who died in the World War.

The Sterling Memorial Library, designed by James Gamble Rogers, B.A. 1889, completed in 1931, was one of the many buildings erected from funds provided by the trustees of the estate of John W. Sterling, B.A. 1864. All public rooms are on the first floor, including Linonia and Brothers Library, Rare Book Room, and Yale Memorabilia Room. On upper floors are the «Yale Library in 1742» and special collections which include the library of the

American Oriental Society, the Babylonian Collection, the Speck Collection of Goetheana, the Mason-Franklin Collection, and the Yale Collection of American Literature and many others. The total number of volumes in the several libraries of the university is about 2,850,000; the Sterling Memorial Library contains approximately 2,151,000.

The first wing of the present Gallery of Fine Arts was completed in 1928. The building contains the administrative offices of the School of the Fine Arts and of the Gallery, classrooms, studios, a lecture hall, and galleries in which are exhibited the Jarves Collection of late Mediæval and early Renaissance Italian Paintings, the Mabel Brady Garvan Collections of American Arts and Crafts, Achelis Collection of Prints, Hobart Moore Memorial Collection of Textiles, Antiquities from Greece, Rome and Europe in the Middle Ages, and many others. The Peabody Museum of Natural History was completed in 1925. The exhibition halls contain collections in Mineralogy, Paleontology, Zoology, Anthropology, and the Bingham Oceanographic Collection.

The Sterling Divinity Quadrangle, William Adams Delano, B.A. 1895, architect, is Georgian Colonial in style. It is about a mile north of the campus on Prospect Street. Funds for its construction came from the estate of John W. Sterling. The quadrangle contains Marquand Chapel, libraries, offices, and classrooms, together with a refectory and dormitory accommodations for 180 men students.

The buildings of the School of Medicine, the New Haven Hospital and the New Haven Dispensary occupy two blocks about half a mile south of the Old Campus. The principal buildings are the Sterling Hall of Medicine, the Anthony N. Brady Memorial Laboratory, the Clinic Building (centre of the Hospital group), the Raleigh Fitkin Memorial Pavilion, the Farnam Memorial Building, the Sarah Wey Tompkins Pavilion. The building of the Institute of Human Relations, which is continuous with the Sterling Hall of Medicine, contains the offices, laboratories, and clinic of the Department of Psychiatry and Mental Hygiene, and the Clinic of Child Development.

Yale has recognized the social and educational values inherent in small groups by establishing residential colleges for the students in the undergraduate schools. Nine have been completed: Berkeley, Branford, Calhoun, Davenport, Timothy Dwight, Jonathan Edwards, Pierson, Saybrook, and Trumbull; a tenth college, Silliman was completed in 1940. The college plan was made possible through gifts from Edward S. Harkness, B.A. 1897. Each college has its own library, dining hall, kitchen, common rooms, squash courts, and accommodations for about 200 students. At its head is the Master who lives in the college. Associated with him as active Fellows are about 15 members of the faculty, some of whom reside in the college, and all of whom have studies there in which to meet students. Attached to each college is a group of Associate Fellows who share in its life. Sophomores, Juniors, and Seniors of the undergraduate Schools (Yale College, Sheffield Scientific School, and the School of Engineering) live in the colleges.

About 90 per cent of Yale undergraduates participate in some kind of sport or exercise under university auspices. The Walter Camp Memorial Gateway, designed by John W. Cross, B.A. 1900, forms the Derby Avenue entrance to the Yale Bowl and Field. The Yale Bowl has a seating capacity of 75,000. Yale Field of 145 acres is devoted to various athletic sports. West of the Walter Camp Gateway lies the Ray Tompkins Memorial tract of some 700 acres where there are bridle paths, cross-country courses, and a golf course. Crew quarters are provided in the Adee Boat House on New Haven Harbor, the Bob Cook Boat House on the Housatonic River, and the Gales Ferry Boat House on the Thames. The Payne Whitney Gymnasium on Tower Parkway is a memorial to Payne Whitney, B.A. 1898, the gift of his wife and children, Mrs. Charles Shipman Payson and John Hay Whitney, B.A. 1926. The building designed by John Russell Pope, was completed in 1932 and is a great indoor playground with facilities for all kinds of games and exercise.

The Church of Christ in Yale University (non-sectarian) has an unbroken history going back to 1757. Under the direction of the University Chaplain, and a board of deacons, composed of students and members of the faculty, the Chapel invites the attendance and membership of all members of the university of whatever creed.

The university awards numerous scholarships, fellowships and prizes. In 1939–40, 732 undergraduates received scholarship and beneficiary aid totaling $311,489. Additional awards to graduate and professional school students, together with supplementary employment made available by the Bureau of Appointments, raised the 1939–40 total to more than $1,300,000. Prominent among the university's public lecture courses are the Silliman Memorial Lectures on Science; the Francis Bergen Memorial Lectures on English literature or drama; the Lyman Beecher Lectures on Preaching; the Bromley Lectures on journalism, literature, or public affairs; the Dwight H. Terry Lectures on religion in the light of science and philosophy; the William L. Storrs Lectures on problems of law and jurisprudence; the Trowbridge Memorial Lectures and the Ryerson Memorial Lectures in the School of the Fine Arts.

As of 1 Nov. 1939, Yale's student enrolment was 5,747. Every State in the Union was represented as well as the District of Columbia, Alaska, Hawaii, the Philippine Islands, Puerto Rico, and 36 foreign countries. On full-time teaching appointment in 1939–40 were 163 professors, 78 associate professors, 139 assistant professors, and 190 instructors. The total faculty numbered 1,024. Yale's total endowment in 1938–39 was $100,448,707; income $7,584,772.43, and gifts received amounted to $1,189,200.78.

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YALTA, yôl'tà, city, USSR, located in the Crimea, RSFSR, on the Black Sea, 30 miles east of Sevastopol. Because of its mild climate, it has been a popular resort since the mid-19th century. The surrounding area produces tobacco, grapes for wine, and other fruit. At nearby Livadiya, site of the former winter palace of the czars, a Big Three conference was held in February 1945 (see PACTS AND CONFERENCES: WORLD WAR II—*Crimea Conference* [*Yalta*]). Pop. (1926) 28,838.

YALU, yä'lo͞o' (Korean AMNOK; Jap. ORYOKKO), river, Asia, forming the northwestern boundary between Manchuria and Korea. Rising from the southern slope of the Chang Pai Shan (Paektu-san), it flows south for some 60 miles and then turns westward near Hyesanjin. After receiving two tributaries, the Hochun and the Changjin, it bends north and then southwest, becoming very wide with the influx of many more tributaries, and eventually empties into Korea Bay, an arm of the Yellow Sea. Flowing in a winding channel through gently rolling hills and steep-walled valleys, the Yalu takes 491 miles to cover a distance less than half that as the crow flies, and its basin extends over an area of 24,185 square miles. The chief tributaries are the Hun on the Manchurian side, and the Chasong, Tongno, and Chongman on the Korean side. The river is navigable for about 420 miles by small boats, and timber is floated in rafts from the upper reaches. The entire estuary is an important industrial center for light metals, chemicals, and wood products. Sinuiju, opposite Antung, Manchuria, is the chief city on the Yalu; a major sawmilling and industrial center, it was heavily bombed in the Korean War. At the mouth of the river is the flourishing port of Yongampo.

The Yalu was the scene of fighting in the Sino-Japanese and Russo-Japanese wars. In October 1950, during the Korean War, United Nations forces reached the Yalu at Hyesanjin, only to be forced back by the invading Chinese Communist troops. In June 1952, the huge power plant of the Supung Reservoir was almost destroyed by United Nations planes.

YAM, the popular name for various plants of the genus *Dioscorea* of the family Dioscoreaceae, and loosely applied in the southern United States to certain varieties of the sweet potato. The true yams belong to a genus consisting of more than 150 species widely distributed through the tropics. They have herbaceous twining or creeping stems, broad leaves, and small dioecious flowers, followed by three-angled capsular fruits containing winged seeds. The fleshy roots of some species are widely eaten in tropical countries. The tubers of *D. alata,* one of the best-known species, usually attain a length of three feet and a weight of 30 pounds, but specimens three times as large are not uncommon. They are black or brownish outside and pink within, and are rich in starch. Among other edible species are *D. sativa, D. aculeata, D. rubella,* and *D. globosa.* The air potato (*D. bulbifera*) is an Asian species cultivated to some extent in the United States. The cinnamon vine (*D. batatas*), also known as the Chinese yam or Chinese potato, is often cultivated as an ornamental plant. It bears cinnamon-scented white blossoms.

YAMA, yŭm'à, in Vedic mythology, the first man, who became the ruler of the blessed dead. In Hinduism he was transformed into the judge of the dead, whom he sends, according to their actions, to the celestial or the infernal regions. He is offered oblations of water.

YAMADA. See UJIYAMADA.

YAMAGATA, yä-mä-gä-tä, PRINCE **Aritomo,** Japanese soldier and statesman: b. Choshu Province, Japan, April 22, 1838; d. Odawara, Japan, Feb. 1, 1922. Educated by the patriot Shoin Yoshida, he was active in the overthrow of the shogunate, and in 1869 he was sent by the new imperial government to study the military systems of France and Germany. In 1873 he became minister of war, and in 1877 he directed the government's operations against the Satsuma rebels. In the following year he became chief of general staff, and in 1884 received the title of count. He was minister of home affairs in 1885. Appointed prime minister in 1889, he held this office until 1891, when he became minister of justice. He proved himself a skillful strategist in the Sino-Japanese War, and was made a marquis at the close of the war in 1895. From 1898 to 1900 he served once more as prime minister, and during the Russo-Japanese War was chief of general staff. In 1905 he became president of the Privy Council, and in 1907 was raised to the rank of prince. Yamagata was the spokesman of the military faction of the ruling oligarchy, and as such was the principal opponent of Prince Hirobumi Ito (q.v.). He originated the policy of having only active army or navy officers serve as army and navy ministers—a policy which did much to further the rise of militarism in the 1930's.

YAMAGATA, city, Japan, capital of the prefecture of the same name, situated in Honshu, on the Mogami River, 30 miles west of Sendai and 180 miles north-northeast of Tokyo. It is a silk center and has metalworking establishments. Among its notable buildings are an ancient Shinto shrine and a castle of the feudal period. Pop. (1947) 98,632.

YAMAGUCHI, yä-mä-go͝o-chē, city, Japan, capital of the prefecture of the same name, situated in Honshu, on the Fushino River, 35 miles north of Shimonoseki. It has popular hot springs and considerable commerce and industry.

From the 12th century on, Yamaguchi was the seat of the Ouchi family, and by the early 16th century it had become a flourishing cultural center. In 1551 the city was visited by St. Francis Xavier, who established a Christian mission there (like the other early missions, it was destroyed in the 17th century). Subsequently the Ouchi declined in power, and their place was taken by the Mori, who remained as feudal lords until 1868. Pop. (1947) 97,975.

YAMAMAI, yŭm'à-mī, a large Japanese silkworm (*Antherea yamamai*) which feeds on the oak and produces green-tinted silk, known by the same name, which is extensively used in Japan and to a lesser extent elsewhere.

YAMANOUCHI GUN. See ORDNANCE.

YAMASKA, yä-mäs'ka, Quebec, Canada; (1) a village and railway junction of Yamaska County, on the Yamaska River, 31 miles north of Saint Hyacinthe. The river affords power for several mills. Pop. about 900. (2) A county bordering on Lake Saint Peter; area, 183,705 acres. Capital, Saint François du Lac. It is drained by the Yamaska, Nicolet and Saint Francis rivers. Pop. 16,204. (3) A river flowing from Brome Lake, Brome County, west, then north, and after a course of about 100 miles through a fertile country, draining into the Saint Lawrence River at Lake Saint Peter.

YAMBO, yäm'bō, **YANBU,** yän'boo, or **YEMBO-EL-BAHR,** yĕm'bō-ĕl-bär, Arabia, a seaport town on the Red Sea, in the kingdom of Hejaz, 115 miles west of Medina, of which it is the harbor. Marking the end of the third quarter of the caravan journey from Cairo to Mecca, the town bears the title "Gate of the Holy City." The town consists of a long row of white houses built of limestone and coralline, standing on the edge of an arid plain. It has considerable imports and transit trade between Suez, Jidda and Medina. Pop. about 6,000.

YAMEO (also **LLAMEO, LAMA, LAMISTA** or **LHAMEOS),** South American Indian tribe of northeastern Peru, living along the Marathon (Upper Amazon), the lower Huallaga and Javery rivers, and formerly between the Tigre and Napo rivers. Physically they are smaller than the other tribes of the region. They have a distinct language, and while formerly warlike are now in the main peaceable agriculturists and weavers. The portion of the tribe living farthest to the east maintains its primitive customs, but the larger part of the tribe has become merged in the general country population. Franciscan missionaries brought most of the tribe under the influence of civilization. Consult Brinton, D. G., 'The American Race' (New York 1891).

YANA ("people"), a small tribe, forming the Yanan (or Noje, or Nozi) linguistic stock of North American Indians, whose former habitat was bounded on the east by a mountain range a little west of Lassen Butte, and terminating near Pit River, in northern California; on the north by a line running northeast to southwest, passing near the northern side of Round Mountain, three miles from Pit River; on the west by a line extending from Redding southward on an average 10 miles to the eastward from Sacramento River; north of Redding it approximates twice that distance. They were massacred by the miners of the neighboring country in August 1864, all but 50 being killed. The tribe and stock were represented in 1884 by 35 individuals divided into two groups — one at Redding, the other in their original country at Round Mountain and in 1902 but six remained. They have a tradition to the effect that they came from the East and it is said that in physical traits they differ markedly from all the northern California Indians.

YANA, yä'nä, or **JANA,** Eastern Siberia, a river which rises in the Verkhoyanskii Mountains, and after a northerly course of about 750 miles enters the Arctic Ocean through Yana Bay, near Ustjansk, by seven large and many small mouths.

YANCEY, William Lowndes: American political leader and orator: b. Ogeechee Shoals, Ga., 10 Aug. 1814; d. 27 July 1863. He was the son of Benjamin Cudworth Yancey, a political leader of the South, who died at the age of 36. His stepfather was the Reverend Nathan Beman of New York. Yancey studied at Williams College, but lack of funds arrested his course there before he was graduated. He entered the law office of B. F. Perry at Greenville, S. C., was admitted to the bar in 1834, and began to publish the Greenville *Mountaineer,* which was opposed to nullification, and supported the Union. In 1835 he married Miss Earle of Greenville, who was possessed of a considerable fortune in negro slaves. Yancey resolved then to abandon law and undertake cotton planting at Catawba, Ala. However, a local feud resulted in the poisoning of the Yancey wells and the consequent death of the slaves, and he was forced to abandon the plantation. He re-entered his profession, resumed his journalistic efforts, and became a commissioner in bankruptcy. At Wetumpka, near Harrowgate Spring, Yancey owned and edited a weekly newspaper, and established a flourishing law practice. He sat in the Alabama legislature, and was active in reform measures (1841–44). After a vigorous campaign he was elected to Congress for the term 1844–46. After a duel with Representative Clingman of North Carolina, Yancey resigned from service in Congress, disappointed in that body. He moved to Montgomery, Ala., where he entered the firm of Elmore and Yancey, and soon recuperated his lost fortune. He now began a career of unofficial political leadership, peculiar to himself. At the National Democratic Convention at Baltimore Yancey led the movement which resulted in the adoption of the "Alabama Platform." This instructed the delegates not to vote for any candidate opposed to government protection of slavery. In spite of this organized effort, General Cass, the nominee of the Baltimore convention, received the electoral vote of Alabama.

When the question of secession was under consideration in 1851, Yancey favored withdrawal from the Union. When the State refused to summon the legislature to submit the question of convention to the people, he summoned a non-partisan mass State convention which sent representatives independently to the Democratic convention at Cincinnati. Yancey now became the controlling force in the radical politics of the State. He also made a canvass of the North, speaking eloquently in favor of secession and slave owners' rights, after the meetings of the Charleston Democratic Convention. The election of Lincoln was partly due to the split in the Democratic party which Yancey led. After the secession he was sent by the Confederacy to secure the recognition of the various European governments. His efforts at London and Paris were unsuccessful and he returned in 1862, when he was elected senator of the legislature of Alabama. He served in the Confederate Senate until his death. Consult Du Bose, J. W., 'Life and Times of William Lowndes Yancey' (Birmingham 1892).

YANES, yän'ĕz, **Francisco Javier,** Venezuelan diplomat: b. Caracas, Venezuela, 6 May

1861. From 1892 to 1897 he was vice-consul and acting consul-general of Venezuela at New York and in 1901–03 served as Spanish secretary and chief of the translations division of the United States Philippine Commission, Manila. From 1905 to 1910 Señor Yanes was secretary of the governing board of the International Bureau of American Republics and after 1910 served as assistant director and secretary of the governing board of the Pan-American Union, Washington, D. C. At the Jamestown Exposition of 1907 he represented the International Bureau of American Republics and was a member of the jury of awards. He was a member of the American Academy of Political and Social Science, the American Society of International Law, and of many other learned bodies. Señor Yanes wrote on literary and political subjects. Died, Washington, D. C., 25 Feb. 1924.

YANG-BAN (two divisions, civil and military). The name first given to the privileged classes in Korea, during the Korai dynasty (918–1392), when the inhabitants were classified as nobles, commoners and slaves. The nobles, owing allegiance to the king, exercised within their own domains both civil and military authority. In time, these functions and classes were separated, the civil officers being called East Division and the military, West Division, according to their place at court. After 1392, under the new dynasty, when Buddhism fell and Confucian ethics and Chinese ideas prevailed, many able commoners entering politics, the ruling classes numbered five, nobles, local yang-ban, middle-class men, common people and slaves. In this new classification, the noble yang-bans held the chief government offices and were immune from taxation. If not earning a living, they lived off the people. The chief families or clans were the Kim, Chwe, Pak, Li, Chong and An (the Six Families), and later the Min and Cho. The stories of their bitter feuds make up the substance of modern Korean history, culminating in the murder of Kim Ok Kun and Queen Cho. With other clans and their subdivisions, numbering over a score, there were, in 1910, 54,000 yang-ban families, comprising one-fiftieth of the households in Korea; two central provinces having a total of 35,630 families; though the yang-ban are scattered all over the peninsula. Without domains or fixed stipends, the yang-bans, despising labor and looking only to official positions and income — when there are but 17,000 offices of any and all sorts open to Koreans — the condition of 37,000 families in this proud class is that of poverty. In old days, a man in high office would have 200 or 300 hangers-on to look after, the public looking on his supporting so many relatives as a great virtue. When Korea, in 1912, for the third time in its history, was given the name of Chosen, apart from the creation of a new class of nobility pensioned by the Japanese government, all the old class distinctions and privileges — of amazing and curious variety — were abolished. Yet as social ideas, habits and customs die slowly, the yang-ban, like the old samurai of Japan, still enjoy, locally, much of the old-time prestige. The history of Korea, especially in its modern phases, cannot be understood without some understanding of the social influence of the yang-ban and their feuds. Consult Hulbert, 'The Passing of Korea' (1906); Griffis, 'Corea, the Hermit Nation' (1907), the official Annual Reports on Reforms and Progress in Korea (1917–18), and the Eastern Asia Official Guide Book: Vol. I, Manchuria and Chosen.

YANGTZE KIANG, yäng'tsĕ-kĕ-äng, the name generally given to one of the greatest rivers of China throughout its entire course, although this name is only applied in China to the lower course of the river, the entire river being called simply Kiang, or Ta Kiang (river or great river), while in the various provinces it traverses it is generally known by special names. It rises in the Tangla Mountains in mid-Tibet, about lat. 35° N. and long. 89° E., at an altitude of from 16,000 to 19,000 feet, and is first known by the name of Muru-Ussu. In its upper course it is sometimes called the Kincha-kiang. Its upper course through the mountainous region of Tibet extends to about 1,100 miles, during which its windings and falls present numerous striking scenes of natural beauty. It crosses the Chinese frontier in the province of Sze-chuan, then flows southward and eastward through Yunnan and northeast back through Sze-chuan Yunnan. Between the town of Li-kiang in this province and Hui-li in Sze-chuen, for a course of about 250 miles, it flows in an easterly direction through a winding channel or mountain gorge of imposing grandeur. Traversing the whole province of Sze-chuen in a northeasterly direction and passing in southeasterly direction into the province of Hu-peh, it reaches at King-chau the great Chinese plain, and traversing the provinces of Ngan-hui and Kiang-su, and passing the cities of Han-Yang, Han-kau, and Wu-chang, a great seat of the tea exporting trade, Ngan-king, Nanking, and Chin-kiang, it enters the Tung-hai, or Eastern Sea, above Shanghai. Its direct course from its source to its mouth is estimated at 1,800 miles; its course with windings is about or considerably over 3,000. It receives numerous affluents, and is crossed by the Grand Canal, which forms a junction between it and the Hoang-ho. The summer rains combined with the melting snows of the mountains in Tibet cause the river to risĕ at times as much as 40 or 50 feet at Hankow and Chin-kiang, resulting in great loss of life and serious damage to crops and other property. The drainage area is about 650,000 square miles, and it is estimated that the river annually carries away 6,428,000,000 cubic feet of sediment; the volume of water is 770,000 cubic feet a second. Steamers of 5,000 to 6,000 tons burthen easily reach Hankow, 680 miles from the sea, except at low water in winter. The river and the ports of Chin-kiang and Han-kau were opened to foreign navigation in 1860, I-chang (1,000 miles up), and others since. A British squadron sailed up the river in 1861 for more than 800 miles. The last 200 miles of its course is through practically level land, and in the first 1,000 miles the rise of the river is only 130 feet. It constitutes a most important waterway, carrying about one-half of the sea-borne traffic of China; and it is equally valuable commercially as a means of intercommunication throughout the country. The navigation above the confluence of the Tung-ting is interrupted by rapids. The tidal

influence reaches in February to Lake Poyang, 436 miles from the sea.

YANG AND YIN, in Chinese philosophy, terms employed to indicate the two phases, light and darkness, under which the supreme principle of the universe, *Tai-ki,* displays itself in the world of phenomena, Yang and Yin being, in various proportions, blended in all forms of existence.

YANKEE, term used in the United States to designate natives of New England. The name was applied during the Revolutionary War, by the British to the Americans; and in the American Civil War, by the Confederates to the Union soldiers. In Europe the term is sometimes improperly applied to natives of the United States as a whole. The word is of uncertain origin; it may be a corruption of English or Anglais, which was formerly current among the Massachusetts Indians. See NICKNAMES.

YANKEE DOODLE, a popular song of the United States, which for more than a century and a half has enjoyed the status of a national air. The origin of the song is uncertain, but most of the legends concerning it place its beginnings towards the middle of the 18th century, during the French-Indian Wars. The most common legend concerns a certain Dr. Richard Shuckburg, a physician attached to the British Army at Albany, who composed the song to make fun of the provincial Yankee troops. There is little substantiation for this story, but research has established that the song, and many of its verses were probably composed during the 1750's, and that it was used in derision of the Colonials by the British. From then it became very popular and by 1767 many versions were current in the American colonies. The first known appearance of the song in print occurred in 1782, when it appeared in James Aird's *A Selection of Scotch, English, Irish, and Foreign Airs,* which was published in Glasgow. The fact that this collection contains several Virginia airs, and a Negro jig, lends weight to the belief that the tune of *Yankee Doodle* is actually of American origin. Its first known American printing was as part of Benjamin Carr's *Federal Overture,* composed in 1794 and published in Baltimore in 1795.

The use of *Yankee Doodle* as a song to poke fun at the Yankees continued to the early days of the Revolutionary War. It is said that when Lord Hugh Percy's troops marched out of Boston in April of 1775, bound for Lexington and Concord, they kept step to the strains of *Yankee Doodle.* At Concord they were routed by the Colonial troops, and as they beat a disordered retreat to Boston the Yankees followed them, themselves singing *Yankee Doodle.* From that time the song has been considered an American patriotic air. Consult Sonneck, O. G., *Re-*

Consult Sonneck, O. G., *Report on "The Star-Spangled Banner," "Hail Columbia," "America," "Yankee Doodle"* (Washington, D.C., 1909).

JOHN TASKER HOWARD.

YANKEE GANG, a term used in Canadian sawmills for a method adapted for sawing logs 21 inches in diameter and under. It consists of two sets of gang saws, connected by parallel ways. The slabbing gang reduces the log to a balk and slab boards after which the balk is transferred to the stock gang, which rips it into lumber.

YANKTON, city, South Dakota, Yankton County seat, situated on the Missouri River at an altitude of 1,232 feet, 63 miles southwest of Sioux Falls; it is served by the Chicago and North Western, Chicago, Milwaukee, St. Paul and Pacific, and the Great Northern railroads. Grains are grown in the county, and cattle, sheep, hogs, and poultry raised. Chief industries in the city include food packing, the manufacture of egg cases, boxes, industrial alcohol, and the growing and shipping of seeds and nursery stock. Fireworks, cigars, and soft drinks are further products of industry. Yankton is the site of Yankton College and of Mount Marty Junior College (Roman Catholic). The city has a Carnegie library and contains a state mental hospital. There are many memorials of the time when the West was young and turbulent. Yankton was permanently settled by whites about 1855, and from 1861 until 1883 it was the capital of Dakota Territory; the site of the territorial capitol, erected in 1862, is marked. A marker on the courthouse lawn commemorates an Indian massacre of early days. Yankton was incorporated as a town in 1862, and as a city in 1869. It has a commission form of government. Pop. (1950) 7,709.

YAO, you, semilegendary Chinese emperor: supposed to have reigned about 2357–2258 B.C. He was the first of three model emperors extolled in the *Shu-king* (Canons of History), the oldest Chinese source of pre-Confucian history, which was supposed to have been edited by Confucius himself. In the works of Confucius, Yao is celebrated as the embodiment of all the virtues requisite for his high position. In 2296 B.C., during his reign, occurred the great Chinese flood. The year 2277 B.C. marked the beginning of the Chinese Era of Yao. He chose for his successor not his son but a young man named Shun, who was famed for his piety and who became the second of the moral emperors.

YAP, in the Caroline Islands, is in the North Pacific some 500 miles southwest of Guam; the three or four islets constituting Yap are regarded as a single island. The soil is rich, and tropical products are cultivated. Under the Japanese, Yap was the headquarters of an administrative district; there were three government schools, and Roman Catholic missions. Numerous ruins of an ancient civilization have been found. Discovered in 1791, Yap, in common with other islands of Micronesia, was a possession of Spain, who frustrated a German attempt in 1885 to claim it. However, after Germany purchased the whole of Micronesia (with the exception of Guam) in 1899, Yap became an important transpacific cable station, and this was the cause of a dispute between the United States and Japan when the latter, following World War I, was given a mandate for all former German possessions in the North Pacific. A settlement was reached in 1921 and embodied in a treaty, signed Feb. 11, 1922, by which the United States obtained the right of free access to Yap to operate the cables free from Japanese control or censorship; Americans also gained the right of residence and ownership of real and personal property. Pop. (1946) 3,673. See also CAROLINE ISLANDS.

YAPOK or **YAPOCK**, yä-pŏk′ (also called YAPACH and OYAPOCK), a small ratlike marsupial (*Cheironectes variegatus*) of the opossum family (Didelphyidae), which is found in Central and South America. It is rather larger than a common rat, with large, naked ears, and a long, nearly naked tail; fur brown above, with three transverse bright gray bands, interrupted in the middle, white below. It differs from the opossums in having webbed hind feet and being an expert swimmer and diver. Its habits closely resemble those of the otter, and it feeds on fish, crabs and other aquatic animals.

YAQUI, or **YAKI**, yä′kē, a North American Indian tribe of Piman stock and of the Cahita division, living in the state of Sonora, Mexico, along the Yaqui River. They are industrious and are generally engaged in agricultural occupations and in weaving, although there are miners and pearl divers among them. They have the clan system of government and have always been determined enemies of the Mexican government, against which they have waged long and bitter warfare. Repeated wars have reduced the tribe from numbers which once reached 40,000 to about 13,000.

YAQUI, a river, Mexico, in the state of Sonora, with two head streams, both bearing the same name, one rising in New Mexico and one in Chihuahua. The confluence of the two streams occurs about 200 miles from the coast and the river then flows in a southwesterly direction and empties into the Gulf of California. It is about 420 miles long and is navigable at but few points, owing to the rugged, mountainous country and many cañons through which it flows.

YAQUINA BAY, inlet of Pacific Ocean, in Oregon, at the mouth of the Yaquina River. It forms the harbor of Newport.

YAQUINA RIVER, Oregon, northwest of Corvallis, flows 50 miles in a westerly direction past the city of Toledo into Yaquina Bay at Newport.

YARACUY, yä-rä-kwē′, state, in the northwestern part of Venezuela, comprising the Yaracuy Valley. The capital of the state is San Felipe. The climate is tropical; the rainy season extends from June to December. Mineral resources include copper, lead, platinum, iron pyrite, coal, and marble. The fertile land of the valley produces sugar cane, cacao, corn, rice, yucca, cotton, tobacco, bananas, and coffee. Area, 2,741 square miles; pop. (1950) 132,790.

YARD, yärd. (1) As a nautical term, a spar slung from a mast and serving to extend a sail. Yards are either square, lateen, or lug sail; those for square sails are suspended across the mast at right angles, and are of a cylindrical form, tapering from the middle, which is termed the "slings," toward the extremities, which are called the "yard arms." (2) A standard measure of length, equal to three feet or 36 inches, the foot in general being made practically the unit. As a cloth measure the yard is divided into four quarters, equaling 16 nails. A square yard contains nine square feet, and a cubic yard 27 cubic feet. It was legalized in England in 1855, the previous legal measure, established in 1760, having been destroyed in the Houses of Parliament fire, Oct. 16, 1834. A legend exists to the effect that the original English yard was established by Henry I, and was the length of his arm. See also WEIGHTS AND MEASURES.

YARKAND, town and oasis, China, in Sinkiang Province, situated on the Yarkand River, about 100 miles southeast of Kashgar, 3,900 feet above sea level. It is enclosed by a ditch, and a thick mud wall with towers at intervals. The streets are intersected by numerous canals. The inhabitants, like those of Kashgar, are very mixed in regard to race. The prevailing religion is Mohammedanism. There are 120 mosques and some caravanseries. During the period in which Eastern Turkestan was severed from China a commercial treaty was concluded at Yarkand in 1874 between Sir Douglas Forsyth, representing Great Britain, and Yakub Beg, who was then the independent ruler of Eastern Turkestan. Commercial intercourse with India sprung up in consequence. The oasis of Yarkand yields gold and precious stones, and is rich agriculturally. Pop. (1947 est.) 60,000; oasis 311,159.

YARMOUTH, yär′mŭth, town, Maine, in Cumberland County; altitude 80 feet; on Casco Bay; 11 miles northeast of Portland; on the Grand Trunk, and Maine Central railroads. Fishing and seafood packing are the principal industries. Yarmouth, settled in 1636, was once a shipbuilding port. North Yarmouth Academy was founded in 1810. Pop. (1950) 2,669.

YARMOUTH, town, Massachusetts, in Barnstable County; extending from Cape Cod Bay on the north to Nantucket Sound on the south; about six miles east of the town of Barnstable, on the New York, New Haven and Hartford Railroad. It was once famous for its fishing fleet. Places of interest include Friends' Meeting House (1809), Indian mounds, and an ancient cemetery. The town was settled and incorporated in 1639. It includes the villages of Bass River, South Yarmouth, West Yarmouth, and Yarmouth Port. Pop. (1950) 3,297.

YARMOUTH, city and port of entry, Nova Scotia, Canada, in Yarmouth County, on the Bay of Fundy, the Atlantic Ocean, and the Canadian National and Canadian Pacific railways. It is popular as a summer resort. Fishing, lumbering, iron founding, and the manufacture of cotton duck are the chief industries. It ships Irish moss and strawberries. At the head of its educational institutions is Yarmouth Academy. Pop. (1951) 7,790.

YARMOUTH, Great, or **YARMOUTH**, county borough, England, in the county of Norfolk, 22 miles east of Norwich, and 110 miles northeast of London, on a narrow slip of land between the Yare and the sea. It is connected by a bridge over the Yare with Little Yarmouth, or South Town, in Suffolk, and is on the Great Eastern and the Midland and Northern railroads. The older part, near the river, is remarkable for its 145 narrow lanes at right angles to the main streets, known as the "rows" in which the houses were once the homes of the wealthy burgesses. Between the older part of the town and the sea is the modern part, with a marine

parade and other attractions. The parish church, founded in 1101, is the largest parish church in England, being 230 by 112 feet; and the market-place is also of great size. There is an excellent town-hall, a large custom-house, an ample library and museum, a borough jail, a lofty Nelson monument, the royal hospital and royal naval lunatic asylum, the aquarium, two good piers and an ancient jetty. The North and South Quays stretch along the river for nearly two miles. The harbor is in the Yare, and is accessible by vessels drawing 18 or 19 feet. Immediately off Yarmouth, and parallel to the shore, is a great range of sand-banks, between which and the land is the safe anchorage of Yarmouth Roads. Yarmouth is the great seat of the English herring-fishery, in which about 300 vessels and 3,000 hands belonging to the port are employed; many are likewise engaged in the mackerel fishery, and in that for cod and other whitefish. Most of the fish are cured, the herrings known as «Yarmouth bloaters» being highly esteemed. There are malting-houses, boat-building yards, rope-works, silk-crape factories, trawl-net works, etc. Yarmouth has risen into considerable importance as a watering-place. It suffered from both air and sea raids during the European War. Area, 3,568 acres. Pop. (1931) 56,771.

YARN, any textile before woven into cloth. Cotton yarn is numbered according to the number of «hanks» contained in a pound of 7,000 grains. Each hank, or skein, measures 840 yards. Worsted yarn has 560 yards to the skein; woolen yarn has 1,600 yards to the skein or run. Linen yarn is wound upon reels, and made up into leas, hanks and bundles. Flax and jute yarn is numbered according to the number of leas of 300 yards per pound.

YAROSLAVL, yä-rō-slăv', or **JAROSLAV,** Russia, (1) a city, capital of the province of Yaroslavl at the confluence of the Kotorosli and Volga rivers, 173 miles northeast of Moscow. It is the see of an archbishop. The Uspenskij Cathedral was begun in 1215, and there are numerous other old churches, several monasteries, schools, gymnasia, a theological seminary, and a lyceum with a law faculty. The left bank of the Volga is the suburban and residential portion of the city and contains many beautiful dwellings. The city is chiefly engaged in manufacturing and commerce, the right bank of the Volga being lined for two miles with quays. There are numerous cotton and linen mills, silk factories and bell foundries The city was founded about 1024 and was the chief town of a municipality in 1218–1471, then coming under the rule of Moscow. The village of Velikoje Selo, included in the city, was the centre of the linen manufacture of Russia, and had an annual output valued at $3,000,000. Pop. about 112,000. (2) The province has an area of 13,751 square miles, and is bounded by the provinces of Cherepovets, Vologda, Kostroma, Vladimir and Tver. It was one of the smallest but most thickly populated provinces in Russia. The surface is level and well watered by the Volga and its tributaries, the Mologa and Sheksma. The western portion has numerous ponds and marshes, the largest being Lake Nero, near Rostov, from which the Weska flows. The Volga is connected with the Neva by two canals, through which considerable commerce is carried on. Market gardening, timber cutting, mining, flax, livestock and poultry raising and manufacturing are the chief occupations. There are extensive linen and cotton mills, and factories for the manufacture of chemicals, machinery, metal ware, flour, tobacco and spirits, making Yaroslavl one of the principal manufacturing provinces of Russia. Considerable commerce is carried on by the two railway lines, the Rybinsk-Petrograd and the Yaroslavl-Moscow-Vologda. Its principal commercial cities are Rybinsk and Yaroslavl; while Rostov, Mologa, Danilov and Poszetchon are important trade centres. Pop. about 1,364,500.

YARRA-YARRA, yä'rą-yä'rą, or **RIVER YARRA,** Australia, (1) river of Victoria on which Melbourne (q.v.) stands. It is about 100 miles long, but is not navigable above Melbourne, owing to its falls. (2) A lake of Western Australia, east of Darling Range and 150 miles north of Perth.

YARRELL, yăr'ĕl, **William,** English naturalist: b. London, 3 June 1784; d. Yarmouth, Norfolk, 1 Sept. 1856. Led to note carefully the habits of birds and fishes in 1825 he sent his first contribution to the *Zoological Journal,* a notice of some rare British birds observed in the years 1823–25. The same year he became a Fellow of the Linnæan Society, to whose *Transactions* he repeatedly contributed interesting papers on the subject of birds, and in 1849 became its vice-president. His chief work is his 'History of British Birds' (2 vols., 1839–43; 4th revised edition 1881–85). He also published 'The History of British Fishes' (2 vols., 1835–36).

YARROW, Harry Crecy, American physician: b. Philadelphia, Pa., 19 Nov. 1840. He was educated in the schools of his native city and at Geneva, Switzerland, and in 1861 was graduated from the Medical Department of the University of Pennsylvania. His first service in connection with the Union Army was as examining surgeon for the Pennsylvania reserve corps. On 18 July 1861, he was regularly mustered in as assistant surgeon of the Fifth Pennsylvania cavalry, known as the «Cameron Dragoons.» He was in action at Dranesville, Va., in December 1861, and several minor engagements, and the following month resigned to accept a position of acting assistant surgeon and executive officer in the United States army general hospital at Philadelphia, where he remained late in the year 1864, when he was detailed, with other surgeons, for service at Hilton Head, S. C., in anticipation of the fall of Fort Sumter. In July 1872 he resumed service with the Engineer Corps as surgeon and naturalist with the expedition for explorations west of the 100th meridian. In 1876 Dr. Yarrow was ordered to the Centennial Army Hospital at Philadelphia and in 1878 was assigned to duty, in the Army Medical Museum at Washington, where he remained until 1887. He was then attached to the Army Dispensary in Washington and was connected with that institution until 1898, when he resigned. In the meantime he was for 15 years honorary curator of the Department of Herpetology in the National Museum at Washington. He has been a member

of the medical faculty of the George Washington University for over 20 years, and was a trustee of that organization. Dr. Yarrow is a member of various medical and scientific associations. He is the author of 'Study of Mortuary Customs among the North American Indians,' and has written a number of valuable papers on biological, medical and ethnological subjects.

YARROW, or **YARROW WATER,** Scotland, a celebrated pastoral stream in Selkirkshire, which rises at Yarrow Cleugh, and, running east a few miles, forms a beautiful lake, called the Loch of the Lowes, which discharges its water into Saint Mary's Loch. Issuing from the latter, the river, after a course of 16 miles through the district of Ettrick Forest, flows into the Ettrick, a tributary of the Tweed, near Selkirk, its total length being about 25 miles. It is famous in Scottish song, and has been celebrated in poems by Scott, Wordsworth and others.

YARROW, an erect, hairy composite herb (*Achillea millefolium*), sometimes called milfoil. The terminal corymbs of small white, or occasionally rose-colored flowers, are large, compound and fastigiate. The leaves are from two to four inches long, and are cut into numerous fine segments, which are very pubescent. Yarrow is a common plant of roadsides, and has been introduced from Europe. It has been used for a long time as a tonic and astringent, and enters into an ointment for dressing wounds. Several species of *Achillea* are garden plants. Sprigs of yarrow plucked from a young man's grave, by lovesick maidens, who repeat meantime a mystic formula, are expected to invoke the images of their lovers, in dreams.

YARUMAL, yä-roo-mäl, Colombia, a town in the department of Antioquia, on the Nechi, 50 miles northeast of Medellin. Gold mining and stock raising are the chief industries. Pop. about 21,250.

YATAGHAN, yăt'ą-găn, the Turkish name for a sort of dagger-like sabre with double-curved blade, about two feet long, the handle without a cross-guard, much worn in Mohammedan countries.

YATES, David Gilbert, American physician: b. New Jersey, 1870. He was graduated M.D. at New York University in 1898 and specialized thereafter in affections of the eye, ear and throat. He was senior assistant surgeon at the New York Eye and Ear Infirmary; was aural surgeon to the New York City Children's Hospital and Schools, and assistant surgeon at the Manhattan Eye, Ear and Throat Hospital. He is a contributing editor of the *Medical Critic* and author of numerous medical papers. D. 9 May 1918.

YATES, Edmund Hodgson, English journalist and author: b. Edinburgh, 3 July 1831; d. London, 20 May 1894. After a secondary education he obtained a post in the secretary's department of the general post office in 1847, and in 1862 became head of the missing-letter department. Meanwhile he was also active in various literary works — writing dramatic critiques for the *Court Journal* and the *Daily News,* contributing to numerous periodicals, editing short-lived humorous journals, *Comic Times* and *The Train,* and doing some successful farces. In 1855 he instituted a gossipy personal news column in the *Illustrated Times,* the first of the sort, and elaborated the idea when in 1858 he became editor of *Town Talk,* in which he soon made an attack on Thackeray which resulted in his expulsion from the Garrick Club; in 1860 he became acting editor of *Temple Bar,* of which he was editor-in-chief in 1863–67; and for a time he was also editor of *Tinsley's Magazine.* Among his subsequent ventures were *Time: A Monthly Miscellany* (1879–84), and *The World.* He served seven weeks' imprisonment in 1885 for a libel against the Earl of Lonsdale, published in *The World* in 1883. He lectured in the United States in 1872, and in that year withdrew from the post-office department. In 1873–74 he was special correspondent for the New York *Herald.* The best of his works in fiction are probably 'Broken to Harness' (1864), originally published in *Temple Bar,* and 'Black Sheep' (1867). His 'Edmund Yates: His Recollections and Experience' (1884; 4th ed. 1885) contains much interesting material.

YATES, Lorenzo Gordin, American naturalist: b. England, 8 Jan. 1837; d. 1909. He came to the United States in 1853, and after teaching in Wisconsin, he later studied medicine and dentistry. He served in the geological survey of California under Prof. J. D. Whitney (q.v.), and had charge of the scientific department of the Froebel Institute, Los Angeles, Cal. He has published 'California Digest of Masonic Law' (1867); 'Charm Stones' (1886); 'The Ferns of Ceylon' (1887); 'Notes on Hawaiian Ferns' (1887); 'The Channel Islands' (1890); 'The Mollusca of Santa Barbara County and New Shells from the Santa Barbara Channel' (1890); 'All Known Ferns'; 'Aboriginal Weapons of California' (1900); 'Prehistoric California' (1903).

YATES, Richard, American politician: b. Warsaw, Ky., 18 Jan. 1818; d. Saint Louis, Mo., 27 Nov. 1873. He was graduated at Illinois College, Jacksonville, in 1838; practised law at Springfield, Ill., sat in the State legislature 1842–49, and was sent to Congress as a Whig in 1850. In 1860 he was elected governor of Illinois and was re-elected in 1862, becoming one of the notable «war-governors.» He was a strong opponent of slavery, and an ardent supporter of the government during the Civil War, taking an active part in the organization of volunteer regiments. He was United States Senator in 1865–71, and afterward United States railroad commissioner.

YATES, Richard, American politician, son of the preceding: b. Jacksonville, Ill., 12 Dec. 1860. He was graduated from Illinois College in 1880 and from the law department of the University of Michigan in 1884. After being city attorney of his native place, 1885–91, he was judge of Morgan County, Ill., 1894–97, and United States collector of internal revenue at Springfield, Ill. (1897–1900). In 1901 he was elected governor on the Republican ticket of Illinois for the term ending 1905. In 1913 he was appointed by the governor of Illinois a member of the State railroad commission and 1914–16 a member of the new Illinois State public utilities commission. He was a member of Congress 1919–32. D. 11 Apr. 1936.

YATES, Robert, American statesman and jurist: b. Schenectady, N. Y., Jan. 27, 1738; d. Albany, N. Y., Sept. 9, 1801. Educated in New York City, he settled in Albany after his admission to the bar in 1760. At the outbreak of the American Revolution he was a member of the Albany committee of safety, and represented his city at several provincial congresses and at the state constitutional convention. In 1777 he was appointed to the Supreme Court of New York, becoming chief justice in 1790.

During the 1780's Yates was a leading anti-federalist. A delegate to the Constitutional Convention of 1787, he left it on the ground that the Convention had been called to revise the Articles of Confederation, and was exceeding its powers in drafting a new instrument of government. He campaigned against ratification and voted against it in the Poughkeepsie convention which ratified the federal Constitution for New York. His notes of the secret proceedings and debates of the Constitutional Convention were published in 1821.

He was twice defeated in campaigns for the governorship of New York. He resigned from the state supreme court in 1798, and concluded his career by serving on the commission which settled title to lands disputed between New York, Massachusetts, and Connecticut.

YATES, William, English Baptist missionary: b. Loughborough, Leicestershire, Dec. 15, 1792; d. at sea, July 3, 1845. Ordained a Baptist minister 1814, he accepted an appointment with the Baptist Missionary Society and sailed for Calcutta the next year. He settled at Serampore, then returned to Calcutta, where the greater part of his time was spent translating the Bible into eastern languages. For the English he composed dictionaries, grammars and manuals of Hindustani, Arabic, Sanskrit, Bengalee. He was awarded an M.A. (1831) and D.D. (1839) by Brown University in the United States.

YATES CENTER, city, Kansas, Woodson County seat; altitude 1,099 feet; 20 miles northwest of Chanute; on the Missouri Pacific Railroad. It is in a productive farming region of which the principal crops are corn, wheat and oats. Nearby are oil and natural gas wells and limestone and sandstone quarries. Pop. (1950) 2,178.

YAWL, yôl, a small ship's boat, propelled by four or six oars. Also applied to a jolly boat, a small fishing boat, and to a sailing boat similar to a cutter, but having a small sail at the stern.

YAWNING, yôn'ĭng, or **GAPING,** an involuntary and wide opening of the mouth and inhalation of breath, generally produced by weariness, intense absorption causing an involuntary interruption of full breathing, or by an inclination to sleep; sometimes by hunger, sympathy, etc. It often precedes the fit in some intermittent fevers, hysteria and spasmodic asthma, and in some instances, by the frequency of its recurrence, becomes a real disease. Persons suffering from heart disease may be liable to yawning fits. It is supposed by some to be determined by an interruption of the pulmonary circulation. Yawning is performed by expanding the chest, by extending the lungs, by drawing in, gradually and slowly, a large quantity of air, and gradually and slowly exhaling it after it has been retained for some time, the muscles of the chest being restored to their natural state. Its effect upon the muscles brought into play is sometimes very restful. When yawning is troublesome, long, deep respiration, or drawing in the air at long intervals, relieves it. It also occurs in certain animals. It often seems contagious or sympathetic, the sight of another person yawning frequently inducing the act.

YAWS, a disease occurring in Africa, the Caribbean, the East Indies, and other tropical regions. It is characterized by cutaneous yellowish tumors, numerous and successive, gradually increasing from specks to the size of a raspberry, one at length growing larger than the rest; core a fungous excrescence; fever slight, and probably irritative merely, and less noticeable in adults than in children. It is contagious, but cannot be communicated except by the actual contact of yaw matter to some abraded surface, or by inoculation, which is sometimes effected by flies. It is also called framboesia, from the French *framboise,* a raspberry. Some authorities regard it as a form of syphilis.

YAZD. See YEZD.

YAZOO (an Indian word meaning "River of Death"), a river in Mississippi, formed by the junction of the Yalobusha, Tallahatchie rivers, and several bayous thrown out by the Mississippi River in the northwestern part of the state. Its general direction is southwest. It is a deep, sluggish stream, the total course being nearly 188 miles, and very irregular. It enters the Mississippi about 11 miles above Vicksburg. It is navigable all the year. The Tallahatchie River receives part of its waters from the Mississippi; so that small boats from the Mississippi can enter the Yazoo at its source and re-enter the Mississippi not far from Vicksburg. The Yazoo flows through one of the richest cotton-raising regions of the South, growing long-staple cotton.

YAZOO CITY, Miss., city and Yazoo County seat; altitude 120 feet; on the navigable Yazoo River; 42 miles north of Jackson, and on the Illinois Central Railroad. Because of its location on the eastern border of the rich delta region between the Yazoo and Mississippi rivers, it is an important market and shipping center. The chief agricultural products of the region are cotton, farm crops, and lumber. The chief industrial establishments include lumber mills, cottonseed-oil mills, cotton gins, cotton compresses, petroleum refinery, nitrogen fertilizer factory, grain elevator, and machine shops. The principal public buildings are the county courthouse, opera house, and library. Yazoo City was settled in 1824 as Hanan's Bluff and enjoyed a booming river trade for many years. In 1830 it was incorporated as Manchester and in 1839 the name was changed to Yazoo City. During the Civil War two skirmishes were fought in the city, and at low water the hulk of a Federal gunboat, sunk by the Federals in the river, is visible. In 1904 the city suffered heavily from fire; practically all the business portion and many ante-bellum houses were destroyed. Rebuilt, the city has a modern appearance. It is the birthplace of Rear Admiral Thomas Pickett Magruder. Government is vested in a mayor and council. Pop. (1940) 7,258; (1950) 9,746.

YAZOO CITY, Military Operations at and near. Yazoo City was chosen by the Confederates as a site for a navy yard, at which were constructed some formidable iron-clads. Upon General Grant's approach to Vicksburg from the rear, in May 1863, the Confederates abandoned Haynes' Bluff, near the mouth of Yazoo River, upon which Lieut.-Commander John G. Walker, of the United States navy, went up the river with a small gunboat fleet to destroy all the works at Yazoo City. As the expedition approached the city, Lieut. Isaac N. Brown, of the Confederate navy, set fire to and destroyed three powerful rams which he had nearly completed, and upon which the Confederates were placing great dependence. Walker set fire to everything else of a public character, including the navy yard, containing five saw-mills, planing-mills, machine-shops, etc., and the expedition then returned. Early in June, Kimball's Union division was sent up the Yazoo to destroy the railroad bridge over the Big Black near Canton; but upon arriving at Mechanicsburg, Kimball found a large Confederate force in his front at Yazoo City and Liverpool, and as the river, on which he depended for supplies, was rapidly falling, he returned to Haynes' Bluff. After the surrender of Vicksburg, 4 July 1863, a report reached General Grant that Gen. J. E. Johnston was fortifying Yazoo City, and that a number of steamers were at the place, employed in supplying his troops. A naval and military expedition was organized to capture or destroy the steamers and take the place. Four vessels, under Lieut.-Commander Walker and 5,000 men under Gen. F. J. Herron, in transports, went up the Yazoo from Haynes' Bluff 12 July, and approached Yazoo City at noon next day; the Confederates were reported in force, and the iron-clad gunboat *De Kalb* was pushed ahead and opened her guns to ascertain the number and position of the enemy's guns. The Confederates had a battery of six heavy guns and the town was held by the 29th North Carolina infantry. Finding the defenses formidable, Walker dropped back and notified Herron, who at once landed his troops and a combined attack was made. After a slight skirmish on shore the Confederates fled, previously setting fire to four large steamers. Six heavy guns and one steamer fell into Union hands. Herron captured nearly 300 prisoners. While the *De Kalb* was moving slowly along and firing on the enemy, she ran on a torpedo and sank in 15 minutes. All on board were saved. Herron destroyed all public property, captured about 2,000 bales of cotton and returned to Vicksburg 21 July.

On 3 Feb. 1864, in co-operation with General Sherman's Meridian expedition (q.v.), a combined expedition of gunboats and transports with troops was sent up the Yazoo River from Vicksburg, with instructions for the gunboats to explore Yazoo and Sunflower rivers and all their tributaries. The gunboats were five in number, under command of Lieut.-Commander Owen, United States navy. Five transports conveyed the 11th Illinois and 8th Louisiana (colored) infantry and 35 colored cavalry, in all 982 men, under command of Col. James H. Coates, who was instructed to reconnoitre above Yazoo City and to obtain corn and forage on the Sunflower or on the Yazoo, and also to seize at least 1,000 bales of cotton and to destroy all flats or boats used to cross from the east to the west. From its start the expedition was annoyed by Gen. L. S. Ross, who, with a brigade of about 1,200 men, was guarding the Yazoo River and the Mississippi Central Railroad, and who, on 3 February, opened fire with artillery upon one of the gunboats when near Liverpool Heights. Coates landed his men, had an indecisive fight with Ross in which he lost six killed, 21 wounded and eight missing, and at night withdrew to his transports. Next morning the expedition, under fire of Ross' artillery and musketry, passed up the river, the gunboats clearing the way to within four miles of Yazoo City, where it remained until 6 February, when two gunboats, having been ordered to reconnoitre, reported that the place was occupied in force, with five guns in position and another in course of erection. The guns opened, two shots taking effect on one of the gunboats, and the gunboats and transports fell down the river below Satartia, where, on the morning of 7 February, Coates disembarked his entire command, drove back some Confederate skirmishers and at night withdrew to his transports. On 8th February the expedition again pushed up the river, two gunboats passed the city and the transports landed their men within a mile of it. Next day Coates took possession of the city, and on 11 February moved up the river, arriving at Greenwood on 14 February, where he remained until 19 February, gathering cotton, corn and forage. He then received orders to fall back to Yazoo City. On 28 February when within six miles of the place he ordered his small force of cavalry to move in rear of the city and take possession of all roads leading out of it. That afternoon he landed at Yazoo City and took position in some redoubts commanding the roads. Major Cook, with 50 colored cavalry, was sent toward Benton. When nearly six miles out Cook ran into Ross' brigade, by which he was roughly handled and pursued nearly to the city, losing eight killed, 35 wounded and 10 missing. Coates' pickets were much annoyed and on the morning of 5 March were driven in. Ross had been joined by Gen. R. V. Richardson's Tennessee brigade of about 600 men and at 10 o'clock the two brigades, about 1,600 men, making a determined attack, forced portions of the Union line and gained the streets of the town. At the same time they used artillery upon the redoubt, on the Benton road beyond the town, which, with the adjacent rifle-pits, was held by a part of Coates' command and repulsed all Confederate effort to carry. At 2 P.M. Coates, with those who were not in the redoubt, made a charge through the streets and the Confederates withdrew and gave up the attempt upon the redoubt. The Union loss in the engagement was 19 killed, 80 wounded and 18 missing. The Confederate loss was six killed and 51 wounded. On the evening of 6 March Coates started on his return to Vicksburg. He took with him over 1,700 bales of cotton, and much corn and forage. The total loss of the expedition was 31 killed, 121 wounded and 31 missing.

On 19 April 1864 a small detachment of a colored brigade, under command of Col. H. Scofield, marched from Vicksburg for Yazoo City and two gunboats went up the river to co-operate in an attack on the city. Scofield skirmished sharply with a part of Gen. Wirt Adams' brigade and on the night of 20 April bivouacked 15 miles below the city. On 22 April the gunboat *Petrel* in attempting to run past Yazoo City in order to fire upon the works from above, was fired upon by a section of artillery and a detachment of sharpshooters of Adams' brigade. The men were driven from the guns, the crew from the boat, and most of them captured, including Acting Master McElroy. The Confederates seized the boat, removed her eight guns and burned her. Next morning the expedition returned to Vicksburg.

E. A. Carman.

YAZOO FRAUD, The, a name given to the sale of lands in the western part of Georgia by a corrupt legislature, to certain large companies in 1789. This action caused great excitement and bitter controversy until settled by the United States Supreme Court in 1810.

YAZOO PASS AND STEELE'S BAYOU EXPEDITIONS. In the Civil War after the battle of Chickasaw Bayou, 29 Dec. 1862, and the capture of Arkansas Post, 11 Jan. 1863, General Grant ordered the army to Young's Point and Millikin's Bend, where he took command in person 30 January. Work on the projected canal across the peninsula opposite Vicksburg was pushed, but on 4 February Grant questioned its success, and began to look for other routes by which the army could reach the high ground either north or south of Vicksburg. Two projects were considered. One involved cutting away from the Mississippi into Lake Providence from a point 70 miles above Vicksburg. This lake, a former bed of the river, was connected by Bayou Baxter with Bayou Macon, a navigable stream, which led to the Tensas, thence into the Washita, and finally into the Red River. Thus it was hoped the army could be transported to the lower Mississippi to co-operate with Banks against Port Hudson. It is 470 miles by the main river from Lake Providence to the mouth of Red River, and much farther by the winding bayous. Upon the cutting of the levee at Lake Providence the water from the river flowed in rapidly and the six miles of the lake beyond were soon available. But Bayou Baxter was found choked for miles with fallen trees and a thick growth of timber overhanging it. General McPherson's entire corps was engaged for some time in attempting to open this channel and those below it. In March this project was abandoned.

On the east side of the river, a few miles below Helena, was Yazoo Pass. This had formed the old route of river steamers through the Coldwater to the Tallahatchie, and the Yallabusha to Yazoo City, but it had been closed for some years by a strong levee. By reopening this route it was believed to be possible to reach the high ground on the Yazoo bluffs north of Vicksburg. This Yazoo Pass plan promised greater success than the Lake Providence scheme. Under Lieut.-Col. Wilson of the engineers, later Maj.-Gen. James H. Wilson, the levee was cut 2 February, a way was cleared to the Coldwater, and the Pass opened to navigation on 24 February. Brig.-General Ross, with 4,500 men, was ordered into the pass upon light draft transports, and, preceded by gunboats, penetrated by that stream to the Tallahatchie, and thence to the Yallabusha, where the expedition, after an advance of 225 miles, was stopped 11 March by Fort Pemberton, near the juncture of the last-named streams. It was a strong work in a bend which commanded both. The fort was found to be so situated that in this time of high water neither troops nor gunboats could reduce it although the gunboats attacked on 11 and 12 March. As it stood only a few feet above the water, attempts were made to flood it by cutting the levee at Austin above Helena, and widening the cut into Yazoo Pass. These were unsuccessful. The expedition, after several attempts on the fort, withdrew. On the way back a reinforcement under General Quimby was met, 22 March, and this officer ordered a return to Fort Pemberton for further efforts. He soon became satisfied that the fort could not be reached, and ordered final withdrawal. The gunboats could not turn in the narrow channels and were forced to back out over a large part of the route. General McPherson's corps had been ordered into the pass, but was delayed for lack of light draft transports and later the intended movement of the army by that route was abandoned. Meantime the Confederates had gathered a strong land force under W. W. Loring, which became first harassing and soon after most threatening. Sherman, preceded by five gunboats of Admiral Porter's fleet, was dispatched in haste 16 March through Steele's Bayou, by which route it was hoped he could reach the Yazoo, relieve Ross, then supposed to be in danger of capture, and at the same time find a practical way for the army into the Yazoo. Sherman had a winding and difficult route of 150 miles before he could reach that stream. From Steele's Bayou, which he entered at Eagle Bend, he passed to Black Bayou and thence to Deer Creek. This opened into Rolling Fork by which he could enter the Big Sunflower, and by this stream reach the Yazoo. Even with the tremendous energy of his advance Sherman was barely in time to save the gunboats which had been attacked in Deer Creek by land forces, and were so hard pressed that Admiral Porter was considering the blowing up of his fleet and retreating with his crews through the swamps. These several attempts through the bayous east and west of the river had been carried on over hundreds of miles and against the most formidable obstacles of flooded country, dense forests and heavily obstructed streams. They were finally abandoned and the army reassembled at Millikin's Bend and Young's Point. From this position the army subsequently moved in the final campaign against Vicksburg.

H. V. Boynton.

YEAR, the period in which the revolution of the earth round the sun, and the accompanying changes in the order of nature, are completed. The accurate determination of the

length of the year, which required great knowledge of astronomy and exact observations, could only be reached by the successive efforts of many generations. (On this subject see CALENDAR). There are years of various lengths, according to the principle adopted in measuring them. The sidereal year is the interval that elapses while the sun moves from a star to the same star again (of course this motion is only apparent), a period the length of which is slightly affected by nutation, but on the average is equal to 365 days, 6 hours, 9 minutes, 9.6 seconds. The tropical or civil year, sometimes called the solar year, is the time in which the sun moves from the vernal equinox to the vernal equinox again; its mean length is 365 days, 5 hours, 48 minutes, 49.7 seconds. This is the year as commonly understood. On account of the precession of the equinoxes it is rather shorter than the true period of the earth's revolution. A lunar year is the time required for 12 revolutions of the moon, which is 354 days, 8 hours, 48 minutes, 37 seconds. Bisextile, or leap year, is a calendar year to which one day is added, making 366 days instead of 365. February of a leap year has 29 days. A light year is a linear measure used by astronomers to measure the distances of intrestellar space. See also DAY; SIDEREAL TIME; SUN DIAL.

YEARDLEY, yērd'lĭ, or **YARDLEY, Sir George,** American colonial governor: b. England, about 1578; d. 1627. After seeing service in the Netherlands he came to America in command of Sir Thomas Gates' expedition. This was wrecked at the Bermuda Islands, but he reached Virginia in 1610 and was acting governor of the Virginia colony 1616–17. Returning to England the next year he was there knighted and chosen deputy governor of the colony filling the office in 1619–21. By his instructions was summoned the first legislative assembly ever gathered in America, the House of Burgesses. The company was dissatisfied with his administration and he was succeeded by Wyatt. He remained in the colony where he served on the council and in 1626 Charles I again made him deputy governor.

YEAR'S MIND. See MONTH'S MIND.

YEAST, or BARM, is a micro-organism of the vegetable kingdom and belongs in the order of the *Gymnoasceæ* to the family of the *Saccharomycetes,* of which there are three classes, namely, *Monospora, Saccharomyces* and *Schizosaccharomyces.* The main characteristic of the first class, as its name indicates, is that it only develops one spore in the ascus. Thus far only one type, the *Monospora Cuspidata,* which is parasitic in *daphiniadæ* which it destroys, has been determined. There are many representatives of the second class, while only a few of the third have up to the present time been identified. The second class — the *Saccharamyces* — is generally what is understood under the term yeast, not only in the brewery but also in the distillery and the compressed yeast fabrication. Its structure is very simple; it consists of a single cell, which has few distinguishing characteristics. Each cell of the saccharomycetes is more or less globular or ovoid in form and, just as every other vegetable cell, consists of a colorless, viscous substance (protoplasm), a cell-wall (membrane), and also a nucleus. In the protoplasm there are observed, according to the species of the plant cell, different numbers of spaces filled with cell-juice, which are termed vacuoles.

In young yeast cells the cell-wall, or membrane, is very thin — 0.4 to 0.9 μ — and has almost the same refractive power as the protoplasm which it surrounds. The membrane is thickened through external influences, especially when the yeast-cells must develop in or upon a highly nutritious medium. An increase in the thickness of the cell-wall is also accompanied by greater impermeability and a corresponding decrease in the fermentative capability of the cell. Through the action of acids or alkalies upon the yeast cell the layers of the cell-wall can be shown, which are two, and sometimes three, or even more in number. Chemically the membrane of the yeast cell consists of cellulose (erythro and achroo-cellulose), pectinic compounds, and plasmatic components, for which reason it is very nitrogenous. The cell contents consists of protoplasm with more or less glycogen. (According to Laurent there is 32.28 per cent glycogen in the dry substance.) In the young yeast cell the whole interior is filled with protoplasm; in a short while, however, apparently hollow spaces appear, which are filled with the reserve nourishment necessary for the vitality of the cells. The nucleus furnishes the substances necessary for building up the cell, and, according to its chemical composition, belongs to the albuminoids in the class of the *proteids,* and especially to the nucleins. The form of the nucleus varies considerably; in a young cell it is spheroid, flattens out with increasing age to a disc whose periphery is no longer entire, but is lobed; elliptical shapes were also found.

The nucleus is in some instances of a considerable size; its diameter in some cases being one-third of that of the cell. Concerning the inner structure of the nucleus it was observed that the nucleus of the yeast cell has a pellicle as well as a nucleolus, which is spheroid, and is situated in approximately the centre of the nucleus, the space between the pellicle and the nucleolus being filled with nucleus plasma (*Karyoplasma*), this having a netlike structure through which the nucleolus is suspended. One or more vacuoles were observed in several types of yeast in the Karyoplasma under certain conditions, especially when the cells were transferred into fresh nutrient solutions. With the beginning of the propagation of the cell a corresponding development of the nucleus takes place, in either one of two ways, that is, the direct division (Amitosis), or the indirect division (Karyokinesis, Mitosis). The manner in which the nucleus divides itself differs in the various types of yeast. The yeast cell is propagated in one of two ways, either through oxygen spore formation, budding, or through endogen spore formation, the real sporulation.

In the former case a new cell is detached from the parent cell, while in the latter the new cells (spores) are formed inside the parent cell, which it leaves only upon complete maturity. Several recent investigators are inclined to believe in the sexuality of yeast, and close research

with various yeasts, as *Sacch. farinosus, Sacch. Bailii,* etc., has been made.

Two types of yeasts have in the course of time become culture plants in the real sense of the word, through intentional continuous cultivation for certain definite purposes. These types are (1) that known as the bottom yeast in the manufacture of beer, and (2) that which is the cause of the fermentation of the top-fermented beers and of the whisky mash. The former is so called because it settles in a thick, creamy layer upon the bottom of the fermenting vat during the slow fermentation of lager beers in temperatures of 40° to 50° F. (4.5° to 10° C.), while the latter is termed top yeast because in the more rapid fermentation at 54° to 65° F. (12° to 18° C.) (ale, weissbeer, etc.), it is separated as a yellowish brown foam, which is forced to the surface by the escaping carbonic acid gas. It is the last-named species which furnishes almost exclusively the material for the manufacture of that product known as compressed yeast.

As has been said, there are a number of independent species of yeast, which vary not only according to form and size of the cell, but also according to the composition of the nutrient medium in which they live, hence according to chemical and physical properties. Yeast flourishes luxuriantly only then when it finds not only qualitatively but also quantitatively, in the nutrient medium all the substances necessary for its nutrition. The brewer, distiller, etc., therefore endeavors to produce as vigorous a yeast as possible, in order to be enabled to conduct the fermentation in the manner best suiting his purposes. For such normal nourishment, it is essential that diverse substances are at its disposal.

Yeast thrives well when, besides water, carbon in the form of sugar, nitrogen in albuminous compounds or ammoniacal salts and various mineral components, especially sulphate of magnesia and potassium phosphate, are at its disposal. If the necessary nutriment is lacking the vitality of the yeast cell may rest, but the cell does not perish.

Various analytical data are at hand in regard to the composition of the yeast. Dumas found that the yeast contains:

	Per cent
Carbon	50.6
Hydrogen	7.3
Nitrogen	15.0
Oxygen, sulphur and phosphor	27.1

Mitscherlich found top yeast of the following composition:

	Per cent
Carbon	47.0
Hydrogen	6.6
Nitrogen	10.0
Sulphur	0.6
Oxygen	35.8

The differences found between bottom and top yeasts have been very slight. Wagner experimented upon top and bottom yeasts and obtained the following averages:

	Top yeast per cent	Bottom yeast per cent
Carbon	49.8	48.4
Hydrogen	6.8	6.0
Nitrogen	9.2	9.2
Sulphur + oxygen	34.2	35.8

A yeast may have all the necessary organic substances in the proper form and amount, yet it will not flourish if the salts are lacking. The yeast in this case is the same as any other plant organism, which must perish if it is deprived of its mineral nourishment. Hence a knowledge of the requirements of mineral substances for a yeast is of utmost importance, and many examinations were made to secure data on this point. Mitscherlich found in the ash of

	Top yeast per cent	Bottom yeast per cent
Phosphoric acid	53.9	59.9
Potash	39.8	28.3
Soda + magnesia	6.0	6.0
Calcium oxide	1.0	1.0
Silica	traces	0.0

The most essential substances which the yeast requires for its sustenance are, accordingly, phosphate of potassium and phosphate of magnesia. The above data are from elementary analyses. Naegeli later instituted investigations which should show the amount of the various combinations, which are observed in a yeast. According to his observations the yeast, when treated with water until its soluble components are absorbed, gives up to the water 37 per cent of the total weight of the dried yeast. The bodies thus brought in solution consist of compounds closely related to vegetable slime. The amount of moisture in a yeast is exceptionally large, for if it is completely dried it loses 83 per cent of its weight, so that in 100 parts of yeast only 17 parts are solid components. The mucous part of the yeast cell, the protoplasm, contains more water than the membrane which surrounds it, and consists chiefly of albuminoids, and about 2 per cent of peptone. Accordingly the composition of the yeast with 8 per cent nitrogen is:

	Per cent
Cellulose and vegetable slime	37
Common albumin	36
Easily converted glutine (caseinic protein)	9
Peptones (precipitable by lead acetate)	2
Fat	5
Ash	7
Extractive aubstances	4

According to E. C. Hansen of Copenhagen, yeast is divided into two groups, the real Saccharomycetes, which are capable of forming endospores, and the non-saccharomycetes, which never form spores. He subdivides the former into such which separate out sucrase and engender alcoholic fermentation, that is, which vigorously ferment saccharose, dextrose and maltose, as brewer's yeast; and such which ferment saccharose, dextrose, levulose but not maltose, as, for example, *Saccharomyces Ludwigii; Sacch. exiguus,* and into such which do not separate out sucrose and do not excite alcoholic fermentation, as *Saccharomyces membranæfaciens.*

The non-saccharomycetes Hansen divides into three groups; such which ferment solutions of dextrose and invert sugar, as *S. Rouxii, S. apiculatus;* such which separate out no sucrase but ferment saccharose, maltose and dextrose, as *Monilia candida,* and finally such which ferment saccharose, glycose, galactose and lactose, the lactose yeasts. In practice the division into culture and wild yeasts would be appropriate. The yeasts can also be safely divided according to their power of attenuation, that is,

the decrease in the density of the nutrient medium due to fermentation. The attenuation reached by a yeast in a diastase-free beer wort has been agreed upon as the limit, and in accordance therewith the brewers' yeasts are graded, and we have the Frohberg type with high attenuation, and the Saaz with low attenuation. Van Laer has defined a new type, Logos, so that now we have the types Saaz-Frohberg and Frohberg-Logos, with all intermediate grades. The numerous wine yeasts vary according to their resistibility against heat and acids; the amounts of sugar produced by them, and the amount of fruitesters, which they impart to the liquid. The distillers' yeasts, mostly top yeasts, are known by their resistance against acids, and foreign ferments, through their fermentative capability and the amount of alcohol developed.

No one can deny that yeast induces alcoholic fermentation, but how this is accomplished is still a matter of controversy. Liebig and other chemists maintain that fermentation is called forth by a ferment contained in the yeast cell, while Pasteur deems it the necessary consequence of life without oxygen. Naegeli claims it to be a transferring of the motion of molecules of protoplasm of the yeast to the fermenting liquid. Eduard Buchner and Rudolf Rapp of Munich discovered in the yeast cell a fermentation-inciting enzyme — zymase — which, however, can only induce fermentation once after the cell is completely destroyed. This discovery, which is of much scientific import, has not yet been made applicable in practical arts.

Besides the culture yeasts, there are a number of wild yeasts, which can produce great disturbances in the liquids infected by them. In order to avoid such infection by wild yeasts and also by bacteria, Hansen experimented and succeeded in preparing a pure yeast culture, that is, a culture originating from a single cell. Such a culture is not only free from all wild yeasts and bacteria, but also can and does remain unchanged as all cells are of the same nature. A reliable fermentation process can only be obtained by the use of one single type.

Such pure cultures are variously prepared; the oldest and best known method is that of Hansen, which has recently been modified by Dr. Lindner of Berlin as the droplet-culture. Both investigators employ for the further development of the young vigorous cultures the propagation apparatus, which when once supplied with an absolutely pure culture can be used for a long time if proper care is observed. Upon this pure-culture method a new brewing process is based which permits of entirely sterile work from boiling the beer to the putting it on the market. This process, invented by Nathan, has been called by him in honor of Hansen, the senior in the art of pure culture, the Hansena process. Another method to obtain yeast of a high degree of purity is that in which a mixture of yeast is exposed to definite conditions of temperature, aeration, kind of nutrition, action of light, pressure and motion that *one* yeast of definite properties develops more and better than the other yeasts in the mixture. If, further, the corresponding layer is removed from the yeast and propagated under the aforesaid conditions, a pure yeast of a uniform character is finally obtained. This process, founded by Delbrueck of Berlin upon his scientific observations in American breweries, was further elaborated by him. An idea of the importance and value of pure yeast culture can be had from the fact that almost all the larger breweries and distilleries employ apparatus for propagation and endeavor through observing the utmost care to protect their yeast against infection. But yeast is not only of great import to the brewer and distiller, but also to the baker, as the quality of his wares depends upon the quality of the yeast used, and in consequence thereof a special industry, that is, the manufacture of compressed yeast, has been introduced. Compressed yeast is chiefly made from distillers' yeasts; but in some instances also, beer yeasts, which must be purified and disembittered, are utilized. The price of compressed yeast in comparison to beer yeast is considerably high, but the baker has the advantage that by using the former his wares obtain a larger size than when the latter is used. The process of fermentation with compressed yeast develops more slowly than with beer yeast, hence the dough requires more time to ripen. Much progress has been made in the compressed yeast fabrication and diverse methods are employed in its manufacture. Many operations must be carefully and accurately observed in order to obtain a salable product. In the main these operations are: (1) Preparation of a fluid in which the yeast can properly develop, either under simultaneous formation of alcohol or without the formation of much alcohol; (2) preparation of a mass, in which there is a corresponding amount of vigorous seed-yeast, which is added to the above-mentioned fluid (preparation of the mother-yeast); (3) bringing together of the nutrient medium with the stock yeast or "setting"; (4) reproduction of the yeast with or without simultaneous fermentation; (5) separation of the newly formed yeast from the fluid by skimming, etc.; (6) washing the yeast, or removing the last traces of the nutrient medium; (7) pressing of the washed and separated yeast mass; (8) forming the compressed yeast into cakes of suitable size; (9) packing of the cakes for the trade and for shipping.

For some time yeast, especially beer yeast, has been used in medicine, and has been successfully employed partly fresh and partly dried, in tablet form in cases of furunculosis, flemonen, acne, psoriasis, and other skin diseases, dyspepsia and partly in diabetes. See BREWING.

YEATS, William Butler, Irish author: b. Dublin, June 13, 1865; d. France, Jan. 29, 1939. Early years spent in County Sligo deeply influenced his later work. He was educated in England and Ireland, and was for three years a student of art, but turned to literature in 1886. He was a leader in the foundation of the Irish Literary Society and the National Literary Society of Dublin, and a prime mover in the Irish Independent Theatre, thus becoming one of the chief representatives of the Irish Literary Revival (q.v.). Yeats had no superior as a lyric poet in his generation, but he was perhaps best known as a playwright. After a few years spent in the literary circles of London and Paris, he returned to Ireland in 1896 and devoted himself assiduously to literature, drawing largely on Gaelic myth, legend and folklore. In 1903–1904 and again in 1914 and 1920 he lectured in the United

States on subjects connected with this movement. In his early career Yeats produced both simple, ballad-like lyrics, and elaborate poems richly detailed. By 1914, however, he had turned against this last form with *Responsibilities* and his subsequent poetry is noted for its austerity and taut construction. Some of Yeats' most powerful plays are in verse, but the preference of his audience for prose kept him from developing this form more fully. *In Plays for Dancers* (1921) and *The Cat and the Moon* (1924) he turned to fantasy. He received the Nobel Prize in 1923, and was a senator of the Irish Free State, 1922–1928. Among his other works are *The Wanderings of Oisin* (1889), *Countess Kathleen* (1892), *The Wind Among the Reeds* (1899), *The Cutting of an Agate* (1912), *The Wild Swans at Coole* (1917), *Autobiographies* (1926), *The Tower* (1928), *Collected Poems* (1933), and *Collected Plays* (1934). Consult MacNeice, Louis, *The Poetry of W. B. Yeats* (New York 1941) and Hone, Joseph M., *W. B. Yeats (1865–1939)* (New York 1947).

YEDO, yĕd'ō. See Tokio.

YELIZAVETPOL, USSR. See Kirov-Abad.

YELLOW, one of the prismatic colors; the color of that part of the solar spectrum situated between the orange and the green; a bright golden color, the type of which may be found in the field buttercup, which is a pure yellow. United with blue it yields green; with red it produces orange.

YELLOW-BASS, PERCH, etc. See Bass, Perch, etc.

YELLOW BAYOU, Engagement at, and Banks' Retreat from Alexandria. General Banks arrived at Alexandria, La., on his retreat from Sabine Cross Roads April 25, 1864. Three days later General Hunter handed him an order from General Grant to close up the campaign against Shreveport without delay and return A. J. Smith's troops to General Sherman, for operations east of the Mississippi. Hunter returned with a letter from Banks to Grant with the information that Porter's fleet was above the Alexandria Rapids in a critical situation should the army abandon it. As to the further prosecution of the Shreveport and Texas campaign that was not to be thought of, and Banks turned his attention to getting Porter's fleet below the rapids. These falls were a mile in length, filled with rugged rocks, which at the time were nearly bare. As the vessels needed at least seven feet of water to float them, they seemed to be doomed. The plans for their release were suggested and executed by Colonel Joseph Bailey of the Fourth Wisconsin Cavalry. The work began on April 30, nearly the entire army at different times being detailed for the duty; 2,000 to 3,000 lumbermen from Maine and the Northwest cut down trees; others were set to collecting stones, bricks, etc., including whole houses and sugar mills with all their machinery and kettles, and in a week a dam of timber and stone, with sunken barges in the center, had been constructed across the river, 758 feet in width, raising the water from five to seven feet deep on the rapids. The work had been prosecuted day and night, the men working up to their waists and exposed to a hot sun. The water having risen, three gunboats and another vessel ran down the rapids on the afternoon of May 8, and lay to just above the dam. Early in the morning of the 9th two of the barges broke loose, making a gap in the dam 66 feet wide, through which the water rushed in a great torrent, and the four vessels went down safely through the opening. Six gunboats and two tugs were still above the rapids, waiting for a higher rise in the water. The damage to the dam was partially repaired and wing-dams were constructed on the upper falls, which shed the water from either side into the channel between them. They were completed by the 11th, when the water had risen to six and a half feet. Meanwhile the heavier vessels had been lightened by stripping from them their armor plates and landing some of the heavy guns, ammunition, chain cables, anchors and provisions, and on the 12th all the vessels had run down the falls and through the dam into deeper water. Meanwhile the Confederates had gotten in Banks' front, south of Alexandria, and taken position on the river 25 miles below the town, where May 1 they captured and sunk a transport, and on the morning of the 3d captured a transport, on her way up the river with 425 men of the 120th Ohio on board. Some of the men were killed and wounded, all the officers and 270 men were captured. On the evening of the 4th another transport carrying 400 men of the 56th Ohio, while going down the river, convoyed by the gunboats *Signal* and *Covington,* was attacked by artillery and musketry, and the gunboats went to her assistance. About 125 men on the transport were killed and wounded; she was soon disabled; the *Covington,* after losing more than half her men, was abandoned and burned; the *Signal* also was disabled and, with the transport, surrendered. No further attempt was made to run the blockade, and for two weeks Banks' communication with the Mississippi was closed. The fleet having passed below the falls and the river rising insuring a safe passage of all the bars below, the gunboats and transports started on the morning of the 13th of May, and in the afternoon Banks marched out of Alexandria for Simsport. From the start his front, flanks and rear were harassed by cavalry and artillery, and on the 16th he had a severe engagement near Mansura, in which the Confederates were driven from position they had taken across the road to Simsport, which place his advance reached on the evening of the 17th. Here it was found that the pontoon bridge was too short to span the Atchafalaya and Colonel Bailey again improvised a crossing. The transports were ranged side by side across the river, with the planking of the pontoons laid across their bows, making a level road of about 700 yards, over which the main body of the army with its trains and artillery began passing on the 19th. While this bridge was under construction, A. J. Smith's command was drawn up in line at Yellow Bayou, covering the rear of the army and the crossing of the Atchafalaya. Here Smith's troops were attacked on the afternoon of the 18th by General Wharton's cavalry and General Polignac's infantry. Smith's skirmishers were driven in, and at first the Confederates gained some advantage; but General Mower, who was in immediate command of the Union line, made a countercharge with two brigades of infantry and one of cavalry and the Confederate attack was repulsed. In endeavoring to follow up his success Mower was checked by a heavy artillery

fire, and withdrew to a thicket, where he formed a new line and brought up artillery. The Confederates renewed the attack and were repulsed with some loss. The thicket now took fire and made an impassable barrier between the two sides, and Mower withdrew, leaving his dead and wounded on the field. The Union loss was 38 killed, 226 wounded, and three missing; the Confederate loss, 452 killed, wounded and missing, of whom 180 were taken prisoners. The army had all crossed the Atchafalaya on the 20th. Banks yielded the command to General Canby, who had been ordered to relieve him; the navy and transports passed into the Mississippi; and the Red River campaign, one of the most humiliating of the war, had ended. On the return march from Alexandria the Union loss was about 165 killed, 650 wounded, and 450 captured or missing. General Taylor says the Confederate loss in the entire campaign, from Sabine Cross Roads to Yellow Bayou was 3,976. Consult *Official Records,* vol. 34; Taylor, *Destruction and Reconstruction;* Mahan, A. T., *The Gulf and Inland Waters;* Century Company, *Battles and Leaders of the Civil War,* vol. 4 (New York 1887).

YELLOW BOOK, The, an English periodical which was published by Matthews and Lane in London from 1894 to 1897. Henry Harland was literary editor; Aubrey Beardsley, art editor until 1896, provided the most highly discussed caricatures of the era. A quarterly, containing short stories, articles, and poetry as well as drawings, its contributors included such names as George Moore, Max Beerbohm, Ernest Dowson, and Stephen Phillips. *The Yellow Book* was very important to that short literary period which has been called "the yellow '90's."

YELLOW BOOK OF FRANCE, a government publication issued regularly since 1861, designed to furnish historians and others with official information. It is similar to the British Blue Book and the German White Book. Several publications of this type were issued by the belligerents during World War I; many of these were merely propaganda designed to influence public opinion in neutral states.

YELLOW COPPERAS, a name sometimes used for the mineral copiatite. Crystallization, monoclinic, usually in translucent pearly yellow plates; hardness, 2.5; composition, a basic sulphate of iron; specific gravity, 2.1. Found near Copiapo as an incrustation on coquimbite; also in other places in South and North America.

YELLOW-EYED GRASS, the common name of the genus *Xyris,* composed of rush-like plants, with bright yellow flowers produced from the summit of a naked scape, conspicuous in sandy bogs in July and August. They are mostly of tropical distribution about the world. The common yellow-eyed grass (*X. flexuosa*) has a bulbous root; equitant, linear, twisted leaves; an erect, two-edged, twisted scape; roundish, acute heads, supporting a number of small yellow flowers projecting from between the scales, with perianth and other parts of the flowers in threes. Another species with pretty, large petals (*X. caroliniana*), occurs near the sea from Rhode Island southward. *X. fimbriata,* a plant two feet high, the divisions of its calyx conspicuously fringed on the wing-margined keel, and plumose at the summit, is found in the pine barrens of New Jersey and southward. The foliage and roots of *X. indica,* of *X. americana,* and of *X. vaginata,* are used for a remedy for leprosy and the itch, in India, Guiana and Brazil.

YELLOW FEVER (also known as yellow jack; black vomit; Fr. *fievre jaune;* Span. *fiebre amarillo;* Port. *febre amarella;* Ger. *Gelbfieber*), an acute self-limited disease caused by a virus and transmitted to man by means of mosquitoes. The incubation period is short (three to six days) and recovery is followed by durable immunity.

Symptomatology.—A frank attack is characterized by acute onset of severe headache, pains in the back and neck, rapid rise of temperature, prostration, injection of the eyes and mucous membranes; followed by albuminuria, discomfort in the epigastric region, vomiting of blood-streaked and then chocolate-brown to black (coffee grounds) material, fall in pulse rate out of proportion to temperature, and jaundice. In fatal cases death ensues around the sixth or seventh day, preceded by suppression of urine, delirium, and coma.

History.—The first unquestionable description of the disease in the New World was given by Diego López de Cogolludo in describing an epidemic which occurred in Yucatán, Mexico, in 1648, although it is not unlikely that it may have existed prior to this date. Shortly thereafter it was recognized in other colonies in the Caribbean area and later along the east coast of Brazil. With periodic recessions and recrudescences, it was for more than two and one-half centuries a scourge to South American and Caribbean ports, and on occasions made seasonal excursions to northern cities in the United States and southward to Argentina and Chile. It was conveyed principally by boats or ships, which in those days carried fresh water in open casks that constituted favorable breeding places for the mosquito vector. Thus seaports and towns along navigable waterways were particularly affected. Notable epidemics occurred in Baltimore, Philadelphia, and New York. New Orleans and other southern United States ports were repeatedly invaded, and towns along the Mississippi River as far as St. Louis were at times infected. These excursions northward were seasonal in character, occurring during the warmer months of the year and promptly terminating with the advent of cold weather. It has been estimated that 500,000 cases occurred in the United States between 1793 and 1900. The last epidemic in the United States was in New Orleans in 1905.

The history of the disease in Africa is obscure, but it is likely that it existed there long before it was recognized in the Americas. Indeed, it is not improbable that it originated in Africa and was transported to the New World during the early days of the slave traffic. Severe epidemics occurred in Spain and southern Europe during the 18th century.

Evolution of Knowledge.—Prior to 1900 nothing was definitely known concerning the cause or mode of transmission of the disease, although a number of hypotheses had been suggested. Dr. Carlos Finlay (q. v.) of Cuba had advanced the theory that it was transmitted by mosquitoes, but it remained to Dr. Walter Reed (q. v.) and his associates Dr. James Carroll,

Dr. Aristides Agramonte, and Dr. Jesse W. Lazear to furnish conclusive proof. In a series of classic experiments performed upon human volunteers near Havana in 1900 they demonstrated that the agent causing the disease was transmitted from man to man by a mosquito *Aedes aegypti,* of the subspecies *Stegomyia* and formerly known as *Stegomyia fasciata.* They also demonstrated that the agent was so small that it would pass through a filter (Chamberland) which would inhibit the passage of bacteria. This may be considered the first time that a human disease was shown to be caused by a filterable virus.

In addition, they established the incubation and infectious period of the disease in man and presented convincing evidence that it was not transmitted by contact, excreta, or soiled clothing. These observations were of utmost practical significance, as they not only pointed the way to effective control of the disease but condemned as futile many of the practices based upon the assumption that the disease was contagious.

Finlay had previously performed some experiments purporting to show this mosquito to be the vector, but in view of subsequently acquired knowledge of the conditions requisite to transmission, it is doubtful if any of his attempts were successful. Certainly he furnished no convincing proof. Yet, in the words of Walter Reed, "To Dr. Carlos J. Finlay of Habana, must be given, however, full credit for the theory of the propagation of yellow fever by means of the mosquito."

It should also be mentioned that Reed and his associates were aided by the observation of Dr. Henry Rose Carter that when a case of yellow fever is introduced in a community there is a delay of around two weeks before secondary cases develop. In their experiments they thus allowed the mosquitoes to "incubate" for a time after feeding on a person ill with yellow fever before permitting them to bite a normal volunteer. They found that an incubation period of about 12 days is required before the mosquito can transfer the infection.

The application of the discovery of Reed and his associates led to dramatic accomplishments. Through the control of the mosquito vector, yellow fever was eliminated from urban centers where it had long been endemic. The successes of Dr. William Crawford Gorgas (q. v.) in Havana and Oswaldo Cruz in Rio de Janeiro, Brazil, in ridding these cities of the infection stand out as notable examples. Indeed, it was hypothecated that by concerted action the disease could be eradicated from the New World, since it was supposed that man was the only vertebrate host and *A. aegypti* the only insect vector. For a time, it appeared that the campaign which was inaugurated would succeed, but outbreaks began to occur here and there which could not be satisfactorily explained by this hypothesis. Subsequent discoveries revealed the reason.

The next significant contribution was made in 1928 by Dr. Adrian Stokes, Dr. Johannes H. Bauer, and Dr. N. Paul Hudson, members of a commission sent by the Rockefeller Foundation to the west coast of Africa, who succeeded in transmitting the infection to monkeys, thus permitting the study of the disease under controlled laboratory conditions. Dr. Stokes paid for this discovery with his life, for he contracted the disease and died. Before an effective vaccine was developed other laboratory workers became infected and several died but, undaunted, the investigations were pursued and discoveries followed step by step in rapid succession. The infectious agent was definitely proved to be a filterable virus; mice were infected with it by intracerebral inoculation; it was cultivated in flasks with embryonic tissue and in embryonated chicken eggs; an immunity test was developed which made it possible by examining their blood serums to identify persons and animals who had been infected; attenuated strains of the virus were produced by cultivation in tissue culture and by passage through white mice, and these strains were effectively used for vaccinating against the disease; other species of mosquitoes besides *A. aegypti,* some of which occur only in tropical forests, were found capable of transmitting the virus; many species of primates were found to be highly susceptible to infection; it was demonstrated that the virus exists in certain forested areas of tropical South America and Africa and that persons visiting these forests may contract yellow fever.

It may be added that conclusive proof that the disease was a virus infection discredited the claim advanced several years previously by Dr. Hideyo Noguchi (q. v.) that it was caused by a spirochete, named by him *Leptospira icteroides.*

Nature of the Virus.—The virus is among the smaller of the known viruses and measures only 20 millimicrons (.000008 inches) in diameter. As found in nature it is pantropic, in that it attacks the viscera such as the liver and kidneys, and circulates in the blood stream. It produces a rather characteristic mid-zonal necrosis of the liver cells which is useful as a means of diagnosis. But it has neurotropic tendencies, and strains have been developed by brain-to-brain passages in mice which attack primarily the central nervous system.

Diagnosis.—While the severe case of yellow fever presents a rather characteristic picture, it may be closely simulated by other diseases. Moreover, mild or even subclinical infections may occur and entirely escape clinical recognition. Consequently the laboratory offers the only certain means of diagnosis. There are three methods: (1) isolation and identification of the virus by withdrawing blood during the acute stage of the disease and inoculating the fresh serum subcutaneously into monkeys or intracerebrally into white mice; (2) microscopic examination of the liver in fatal cases; and (3) by the protection or neutralization test. For the latter, two samples of blood are required, one taken during the first three or four days of the disease and a second taken 10 or more days later. The serum from each sample is mixed with a predetermined amount of virus, and the mixtures are inoculated intracerebrally into groups of white mice. If the mice inoculated with the first serum-virus mixture die and those inoculated with the second serum-virus mixture survive, a diagnosis of yellow fever is warranted. If there is no difference in the survival of the mice in the two groups, it may be concluded that the disease was not yellow fever.

Mortality.—The mortality in frank cases of yellow fever may be high and death rates of

50 per cent have been reported. But many mild and inapparent infections occur, and death rates based upon the total infected may not exceed 5 per cent.

Treatment.—Beyond keeping the patient quiet, regulating fluids and diet, and handling symptoms as they arise, there is no effective treatment.

Epidemiology.—It will be appropriate first to describe the cycle of the virus through the insect vector and the animal host, as the epidemiology of the disease is conditioned by this cycle. When an infected insect (mosquito) bites a susceptible animal (man or primate) a small amount of the salivary excretion which contains the virus is injected into the animal. The virus proceeds to multiply and after two to four days begins to circulate in the blood stream. It continues to circulate for several days, not usually for more than one week, when it disappears as the result of the development of neutralizing antibodies. If a normal (uninfected) mosquito vector bites the animal host during the period when the virus is circulating, the virus then proceeds to multiply in the body of the mosquito reaching the salivary glands after 10 or more days, and the mosquito is then able to transmit the virus to a second animal host, thus continuing the cycle. The mosquito suffers no ill effect from the virus and remains infective throughout its life, but the virus is not transmitted through the egg to a second generation of mosquitoes.

In animals the disease may be mild or even symptomless, or it may be severe and frequently fatal, depending upon the species of animal. No chronic or carrier stage of infection has ever been observed in animals. Thus, as far as time is concerned, the mosquito is a more permanent reservoir of the virus than animals. Man and primates (monkeys) are by far the most susceptible animals, and only mosquitoes have been incriminated as vectors.

There are two epidemiological patterns of the disease: (1) urban yellow fever, involving only man and domestic mosquitoes; and (2) jungle yellow fever in which the virus is maintained by passage through forest animals and forest mosquitoes, the infection of man being fortuitous and secondary.

The epidemiology of the urban form is simple and well understood. The infection is transmitted from man to man by means of the mosquito. In the Americas the mosquito responsible is *A. aegypti*. In Africa other species of mosquitoes may play a role.

The epidemiology of the jungle form is more complicated and all phases of it may not yet be known. It is known, however, that several species of sylvan mosquitoes are capable of transmitting the virus and most, if not all, of the primates are susceptible to infection. In South America the virus has been found most frequently in mosquitoes of the genus *Haemagogus*. The virus has also been found in captured monkeys (*Callithrix penicillata,* a species of marmoset), and immune monkeys, indicating previous infection, are commonly found in forests harboring the virus. In addition, the virus may be easily maintained in the laboratory by cyclic passage through primates and haemagogus mosquitoes. Some species of marsupials are rather susceptible to infection and under laboratory conditions may serve as the mammalian host in the cyclic passage of certain strains of jungle yellow fever virus, but there is no convincing evidence that they play a part in the propagation of the virus in forests. Likewise, studies in African forests point to primates as the principal, if not the sole, mammalian host. In Africa, however, circumstantial evidence implicates a sylvan species of *Aedes* (*A. africanus*) as the important vector.

In South America, jungle yellow fever is endemic in the forests of the Amazon, Orinoco, and Magdalena watersheds and in humid coastal forests of the State of Baiá, Brazil. Also, it has made periodic excursions southward in the Paraná River system as far as the Argentine border. In Africa, its extent is not well defined, but it is probably present in most of the large tropical forests of equatorial Africa. Jungle yellow fever is an important problem for two reasons: first, because persons entering forests which harbor the virus may be bitten by infected mosquitoes and contract the disease; and second, because it constitutes a reservoir of the virus difficult, if not impossible, to control.

With the suppression of urban yellow fever in South America, nearly all human infections since 1940 have resulted from contact with the forest, and the last few urban outbreaks which occurred resulted from the introduction of a jungle virus into towns where *A. aegypti* still existed. Indeed, if it were not for jungle yellow fever, the goal of eradicating the disease from the Americas would have been achieved.

While the birthplace of yellow fever may never be determined with certainty, it is an interesting subject for speculation. Since the viruses which have been isolated in Africa and South America, both from forest animals and mosquitoes and from urban outbreaks in man, are all virtually identical, it must be inferred that they had a common origin. If the transfer of the virus from one continent to another occurred since the discovery of America, the weight of circumstantial evidence points to the origin of the virus having been in Africa, for the following reasons: (1) *A. aegypti* appears to be an Old World mosquito transplanted to the Americas from Europe or Africa, where its closest relatives are found; (2) the combined incubation and infectious period of the disease is so short as to preclude the virus being transported across the Atlantic by man alone, especially during the time of sailing vessels; (3) if it did cross the Atlantic, it must have been with the aid of an insect vector, probably a domesticated mosquito such as *A. aegypti* which is known to be associated with epidemics aboard ships; (4) since *A. aegypti* has been responsible for urban or man-mosquito-man epidemics in the New World, it is highly improbable that such epidemics occurred prior to the arrival of this mosquito. It is therefore enticing to hypothecate that the virus was at one time brought, along with the mosquito, from Africa and thus place the onus of both of these plagues upon the Dark Continent. According to this hypothesis the forest cycle of the virus in South America would be secondary to its original introduction by man and mosquitoes. Otherwise it would have to be assumed that *A. aegypti* was introduced to South America, became infected with the jungle strain of the virus, initiated urban epidemics, and was then transported back to Africa along with the

virus — a much more complicated chain of events.

It is also a matter of speculation whether the virus originated among forest animals and insects or in man. As there are a number of virus diseases infectious to man, such as Rocky Mountain tick fever and equine encephalomyelitis, which it is almost certain derive from animals or insects, it is not improbable that yellow fever had a similar origin.

Urban Prevention and Control.—Prevention of the urban or man-mosquito-man form of the disease is relatively easy in the New World, since the vector (*A. aegypti*) is a highly domesticated mosquito. It is found only about human habitations, and breeds almost exclusively in artificial containers, such as water barrels, tin cans, earthen vessels, and roof-gutters. By destroying unnecessary water containers, oiling and screening those which must be retained, and controlling the result of the antilarval campaign by search for the mosquitoes in houses, the species may be reduced beyond the danger point, or even eradicated. Indeed, in the long run eradication is more economical and has been accomplished in most of the cities and towns of tropical and subtropical South America. The use of DDT, both as a larvicide and as a house spray, has further facilitated the eradication of this mosquito. The elimination of yellow fever from ports and cities where it was formerly endemic is one of the signal triumphs of preventive medicine.

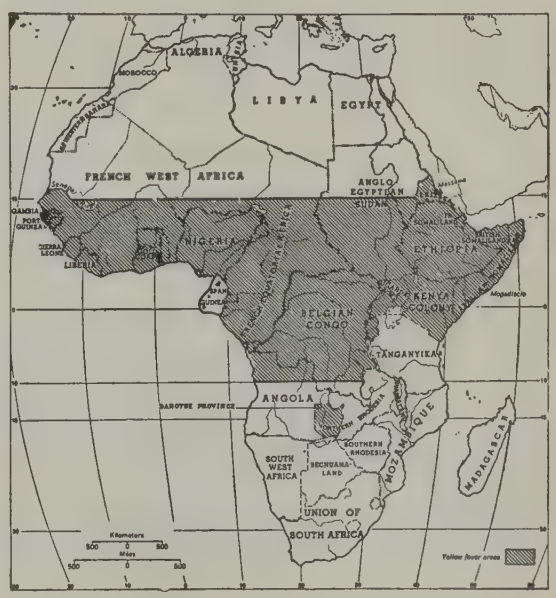
Jungle Yellow Fever.—There is no known feasible method of combating the disease in forest animals and mosquitoes, and considering the enormous extent of the forests harboring the virus, there is little hope of accomplishing anything in this respect. Vaccination, however, is an effective means of protecting exposed persons, and anyone entering forests where the virus may exist should be vaccinated.

Two vaccines are now in use. They differ somewhat in method of preparation and administration, but both consist of living attenuated or modified yellow fever virus. The one more widely used was developed in the United States and is prepared from the so-called 17D strain of virus. This attenuated strain was obtained by repeated passage of a virulent strain of yellow fever virus in tissue culture. In the process of the tissue culture passages the virulence of the original strain was largely lost. This derivative or 17D strain when administered subcutaneously to man produces only a very mild infection with no or insignificant symptoms; yet it has the property of stimulating immunity to fully virulent strains of yellow fever virus. The vaccine is prepared by inoculating embryonated chicken eggs with the 17D strain, incubating the eggs for an additional four days, harvesting the embryos and extracting the juice. The embryo juice is distributed in ampules and desiccated while in the frozen state. Immediately before use the desiccated juice is diluted with physiological saline solution and administered by subcutaneous inoculation. This vaccine was extensively used in the immunization of American armed forces during World War II. Following vaccination with certain lots of the vaccine, inflammation of the liver (hepatitis) and jaundice developed. It was later discovered that the hepatitis was caused by a hitherto unknown virus that was present in the human serum, obtained from supposedly normal persons, which had been used in diluting the vaccine. When the use of human serum was discontinued, the post-vaccination hepatitis ceased.

The second type of vaccine is advocated by the French and has been used in vaccinating large numbers of natives in West Africa. It is prepared from a strain (French neurotropic) which has been modified by serial brain-to-brain passage in mice. This strain is somewhat more virulent than the 17D strain, but the French report only mild reactions and no serious complications from its use. It is made from the brains of infected mice. The brain substance is emulsified in salt solution and frozen and dried. It is administered by the scarification method, similar to that employed for vaccination against smallpox. One administration of either vaccine suffices to produce immunity in about 95 per cent of those vaccinated. The immunity develops in 10 days to two weeks and is known to persist for four to six years, probably longer.

International Control.—Great care should be exercised to avoid the introduction of yellow fever virus into countries where *A. aegypti* exist. The hazard is increased by the extensive development of airplane travel. This mosquito is widely distributed and occurs, for example, throughout the Far East, the Mediterranean area, and the southern United States. The introduction of the virus by humans may be avoided by requiring vaccination of all persons coming from or passing through regions which harbor the virus. Regulations to this effect are now generally in force. Also, airplanes should be sprayed with insecticides to avoid transportation of living mosquitoes.

For purposes of international quarantine control the Expert Commission on Quarantine of the United Nations Relief and Rehabilitation Administration, whose functions have now been taken over by the World Health Organization, has designated the shaded areas shown in the following maps of South America and Africa as endemic yellow fever areas. Persons coming from these areas are subject to quarantine regulations which include vaccination against yellow fever at least ten days prior to entering other



countries. Persons entering these areas should also be vaccinated, particularly if they are likely to come in contact with forests.

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YELLOW-HAMMER, originally, in Great Britain, the common yellow bunting (*Emberiza citrinella*), which is yellow above, varied by dark-brown patches, the under parts being pure yellow, and the wing-feathers dusky black, with brown or yellow edges. The flanks are of a brownish hue. The nest is placed on the ground, and is composed of grasses, moss, roots, etc., and lined with hair. When fat, in the autumn, the birds are much in request for their flesh. They are regarded with superstitious dislike in some districts, and their eggs are broken by boys whenever they are discovered, a foolish saying being current that each egg contains a drop of "devil's blood." The birds are caught and fattened for the table in Italy. In the United States the term is misapplied to the golden-winged woodpecker or highhole. See FLICKER.

YELLOW JACK, a quarantine flag displayed at naval hospitals and from vessels in times of epidemics (see QUARANTINE). Also a common name for yellow fever.

YELLOW JACKET, any species of small American wasp, marked with black and yellow stripes. See WASP.

YELLOW JOURNALISM, a highly colored sensational manner of presenting news. The term, coined in the 1880's, described Joseph Pulitzer's methods of building circulation for the New York *World,* imitated by W. R. Hearst.

YELLOW RATTLE, a scrophulariaceous plant *Rhianthus crista galli,* an annual herb with opposite, lanceolate, sessile leaves and terminal, one-sided, leafy-bracted spikes of yellow flowers. The corollas are two-lipped, with an arched upper lip, and three-lobed lower one. The capsule is orbicular and flat, with several round-winged seeds, which rattle about the pod when shaken, and have given rise to other descriptive names, such as rattle, rattlebox, penny-rattle, etc. In European fields it is very abundant and becomes a pest, since it is parasitic and attaches itself by suckers to the roots of living grasses.

YELLOW RIVER. See HWANG or HOANG-HO.

YELLOW-ROOT, either one of two ranunculaceous plants, one being known as the shrub yellow-root. (*Xanthorrhiza apiifolia*). Its long roots and rootstock, leaves, bark and pith are bright yellow, and the root is extremely bitter and astringent, and is used as a tonic. This yellow-root grows in the southern United States and has pinnate leaves clustered at the top of a short stem, giving the plant a fern-like aspect. The foliage turns to gorgeous scarlet and orange in the autumn. The five-parted flowers are wine-colored. The other yellow-root (*Hydrastis canadensis*) is known also as golden-seal, or yellow puccoon; its root is a tonic drug. The plant has abundant reniform, palmately-lobed, basal leaves, and two cauline ones, the uppermost of these subtending the solitary, greenish-white flower. The puccoon is found in woods in the eastern United States and furnished the Indians with a favorite yellow dye.

YELLOW SEA, or **HWANG-HAI,** hwäng-hī′, a gulf of the Pacific Ocean, extending between the northeast coast of China and the western coast of Chosen or Korea, northward to Manchuria; length about 620 miles; greatest breadth about 400 miles. North and northwest it terminates in the gulfs of Liao-tung and Pe-chi-li, the latter of which receives the waters of numerous large and important rivers. On the east coast are numerous groups of islets, part of them included in the Korean Archipelago. The Yellow Sea is very shallow, having in no part a greater depth than 300 feet, and is so named from the muddy lemon-yellow color of its waters near the land, caused by the large quantity of alluvium continually brought into it by the Hwang-ho or Yellow River, and the Yang-tse Kiang, which gradually tends to decrease its depth. Sand banks are numerous off the Chinese coast, and there are several islands off the Chosen coast.

YELLOW-WEED. See DYER'S ROCKET.

YELLOW-WOOD, a name applied to several timber trees and shrubs, including *Cladrastis lutea.* This is an uncommon leguminous tree, known in cultivation as the virgilia, American or Kentucky yellow-wood, and is indigenous to the United States from Ken-

tucky southwards. The yellow-wood attains to a height of 60 feet, with a trunk some two feet in diameter. It usually divides into two or three limbs not far from the ground, which ramify into slender and somewhat drooping branches, forming a broad, graceful head. In winter the smooth, silvery-gray bark of its main trunk and red-brown of its delicate sprays are very interesting. The limbs, however, are brittle and break easily. The foliage of the yellow-wood consists of light-colored, odd-pinnate leaves, turning to clear yellow in autumn; and fragrant panicles a foot or more long, of flowers, pea-like and milk-white, droop from the ends of the branches. The fruits are linear legumes. A yellow dye was made from the hard golden-tinted wood, which is used for fuel and occasionally for gun-stocks. The yellow-root (q.v.) (*Xanthorrhiza*); the Osage orange (*Toxylon pomiferum*), a favorite hedge plant; fustic, a dyestuff yielded by the wood of *Chlorophora tinctoria,* a West Indian tree with oblong, taper-pointed leaves and an edible fruit; and *Schaefferia frutescens,* the valuable boxwood of the West Indies, are all known as yellow-woods. Australian yellow-woods are the *Acronychia lævis, Hovea longipes* and *Xanthostemon pachysperma;* and the white teak, or Queensland yellow-wood (*Flindersia oxleyana*), also called light yellow-wood, is a tall, slender tree with many branches. Another tree called light yellow-wood is the *Rhus rhodanthema,* bearing large red flowers, and growing to 80 feet in height. It is native to Queensland, and yields a fine cabinet-wood, close-grained, capable of taking a fine polish, sound and durable. Natal yellow-wood is a tree of about the same height (*Podocarpus elongata*), with a close-grained wood which will not bear exposure out of doors, but is extensively used for furniture and interior house-building. The bastard yellow-wood of the same region is *P. pruinosa,* with a tough durable wood, also used in house building; still another species (*P. latifolia*), an evergreen about 80 feet high, having an aromatic wood, is the East Indian yellow-wood. This same name is given to the satin-wood (*Chloroxylon swietenia*). The prickly yellow-wood is *Zanthoxylum caribæum* (q.v.).

YELLOWBIRD, any of several familiar birds prevailingly yellow in plumage. In the United States the name belongs to two small garden-visitors. One is the goldfinch (q.v.), and the other often distinguished as "summer" yellow-bird is a warbler (*Dendroica æstiva*), common in summer throughout all the eastern United States and Canada. It is greenish yellow, brightest on the breast, where it is diversified by salmon-colored streaks. The song is a melodious trill, often heard among the roses and lilacs of the garden, where the bird is likely to fix its deep nest of hempen shreds in an upright fork. The eggs are pink, with reddish and purplish dots. This nest is one of the receptacles most often chosen by the cow-bird for its surreptitious egg; but the yellowbird frequently defeats the intruder's object, by building a new nest on top of the first one, burying the strange egg.

YELLOWHEAD. a yellow-headed blackbird. See BLACKBIRD.

YELLOWLEGS, a genus (*Totanus*) of birds of the family *Scolopacidæ,* large snipe-like species with cross-barred tail-feathers, well-marked gape, long, slender non-sensitive bill and greenish yellow legs, from which they take their common names of yellowlegs, greenshanks, etc., while, because of their constant noisy calling, they are known to gunners as tattlers or tell-tale snipe. The greater yellowlegs (*T. melanoleucus*) inhabits during some part of the year nearly the entire American continent and breeds chiefly north of the United States, in which it is well known as a coastwise migrant. It is 13 to 14 inches long, with a spread of wings of two feet. Above the color is a mixed dark ashy, varying with the age and season, below white streaked and barred with ashy black. Although chiefly a maritime bird, this species also migrates through the Mississippi Valley and is found about the lakes of the interior; and even along the coast it is fond of frequenting the fresh and brackish pools on the meadows, where it finds an abundance of food in the small fishes, mollusks, shrimps and crabs. It also eats worms, insects and the spawn of fishes, which it catches with great facility. During the migrations, which occur in April and from late August to October through the greater part of the United States, it is commonly seen in small parties of six or eight, often consorting with other species of tattlers, willets and godwits. The flight is swift and often elevated, and in alighting in pools in which they wade leg-deep they keep the wings raised until well settled. They are extremely alert and noisy and thus provoke the indignation of gunners. The nest is a grass-lined depression on the ground and the four, pyriform, greenish yellow, brown and gray blotched eggs measure upward of two inches in length. The lesser yellowlegs (*T. flavipes*) is in form and colors nearly an exact miniature of the last, but is only 10 or 11 inches long, with a spread of 20 inches. Its range and habits are similar to those of the larger species, but it is much commoner in the East, flies in larger flocks and is better known to shooters of shore-birds. The eggs are more variable, the ground-color being clay or buff, and the markings usually very bold and distinct. The European greenshank (q.v.) occasionally straggles to our shores and may be distinguished from *T. melanoleucus,* which it resembles in size, by the distinctly green color of the lower legs and feet. About a dozen related species are found in other parts of the world and the genus *Helodromas,* containing our solitary and green sandpipers, is closely allied. For methods of shooting see SANDPIPER.

YELLOWPLUSH PAPERS, The, a series of satirical papers by William M. Thackeray, which appeared in *Fraser's Magazine* in 1837–38, as 'The Yellowplush Memoirs,' and in book form in 1841 in the volume entitled 'Comic Tales and Sketches.'

YELLOWS, a disease of the peach (q.v.).

YELLOWSTONE, formerly **SUBLETTE,** a lake in the Yellowstone National Park (q.v.), at the northeast base of the Rocky Mountain range. It has an elevation of nearly 7,800 feet above sea-level. It is irregular in form, having extensions called West Arm, South Arm

and South-East Arm. The Yellowstone River flows through the lake, or as sometimes given, the lake is an expansion of the river. It is about 20 miles long and 15 miles wide.

YELLOWSTONE, a river which has its rise in the Shoshone Mountains, in the northwestern part of Wyoming, near lat. 44° N. It flows north, entering the Yellowstone National Park (q.v.) at the southeast corner, and passes through Yellowstone Lake, which is usually called an expansion of the river. From the lake the course is northeast, east, then northeast to the Missouri River, which it enters at Buford, on the boundary between Montana and North Dakota. The total length of the stream is about 1,000 miles. It is navigable for nearly 800 miles from its junction with the Missouri. The largest tributaries come from the south, and are Big Horn, Powder, Rosebud and Tongue rivers. The Grand Cañon of the Yellowstone (see YELLOWSTONE NATIONAL PARK) is one of the wonderful sights in a region of wonderful scenery.

YELLOWSTONE NATIONAL PARK, the oldest and largest unit in the national park system, is a government reservation in the northwestern corner of Wyoming, and slightly overlapping the state boundaries into Montana on the north and west and Idaho on the west and south. Originally laid out with dimensions of 62 miles (east-west) by 54 miles (north-south), the park then had an area, in round figures, of 3,350 square miles. In 1929, 1930, and 1932, it was enlarged by annexation of some hitherto unprotected adjacent lands, and the original boundary was changed. In 1891, almost 20 years after the park was established, more than a million acres of forest land adjoining it on the east and south were set aside as the Yellowstone Timber Land Reserve, and in 1902 the Yellowstone Forest Reserve, now the Shoshone National Forest, was created, with headquarters near Cody, Wyoming. A little south of the southern boundary of the Yellowstone is the Grand Teton National Park, created in 1929.

Topography.—The geologic history of Wyoming is nowhere more vividly recorded than in the Yellowstone region. Of its several lofty plateaus, the Central, Pitchstone, Mirror, and others, the Central, with an elevation of about 7,000 to about 8,500 feet, is the highest; it is enclosed by ridges with peaks up to an altitude of 10,000 or 11,000 feet above sea level. The Continental Divide crosses the park from the southeastern corner to a point about midway between the southwest and northwest corners. The crest of the Absaroka range forms the eastern boundary of the park; the Gallatin Range extends down into the park from Montana, and to the south are the rugged Teton Mountains. Peaks in the western half of the Yellowstone vary in altitude from the 8,000 feet of Roaring Mountain to the 11,155 feet of Electric Peak. Mt. Washburn, in the north central section, reaches 10,317 feet. Among the highest points in the park are Eagle Peak, 11,360 feet, and Pollux Peak, 11,081; these are near the eastern boundary, and further to the east are ranges with numerous peaks exceeding 11,000 feet in height above sea level, as Sunlight Peak, 11,977 feet, and Fortress Mountain, 12,073 feet.

Volcanic and Glacial Aftermath.—The natural phenomena that abound in the park and make it an object of governmental supervision and popular interest are of volcanic and to some extent of glacial origin. In the geology of this and surrounding regions the evidences of ages of earth-history are exceptionally accessible. In one era of this history there was great volcanic activity, which was peculiarly extensive in the region of the Yellowstone. Here through ages mountains were built up, then worn down by erosion; basins filled, then washed bare again. Lava flows and the accumulation of ash beds marked alternating stages in the conformation of the land; in the Central Plateau of the Yellowstone they have been traced to great depths. The Absarokas are made up of volcanic rocks; this entire mountain range reveals to the geologist a history which includes a period of volcanic action. At another geologic period, too, glaciers gouged their way through parts of northwestern Wyoming.

Rivers and Lakes.—The Yellowstone River, rising in Wyoming south of the park, flows north into Yellowstone Lake, then through its grand canyon and on northeastwardly across Montana to join the Missouri, of which it is one of the principal tributaries. Shoshone, Lewis, and Heart lakes lie to the southwest of Yellowstone Lake. Smaller lakes scattered through the area are Gallatin, Swan, White, Cascade, Grebe, Wolf, Grizzly, Firehole, Mary, Beach, Mallard, Buffalo, Lilypad, Beula, Sylvan, Eleanor, Turbid, Twin Lakes, and Lake of the Woods.

Yellowstone Lake, at an altitude of 7,731 feet above sea level, has a water surface of 139 square miles, and a shore line of 100 miles. Its maximum depth is 300 feet, and its waters are blue or green, as the daylight varies. There are three or four islands, of which Frank Island is the largest. Back of a narrow beach stand the forests, and in the background tower mountain peaks. Some water plants grow in the lake; only native species of fish, the blackspotted or cutthroat trout, are found here, though many from outside the park have been introduced in its other waters; and in summer wildfowl—ducks, geese, swans, herons, sandhill cranes—frequent the grass-carpeted islands. At one time the lake was some 150 feet higher and 20 miles longer, extending to the base of Mt. Washburn. At that time the Continental Divide followed a different line, and the lake drained to the south and west, through the channel now held by Snake River, and emptied into the Pacific.

Fishing Bridge, a renowned fishing spot, spans the Yellowstone River at the outlet of Yellowstone Lake. The river flows a little to the west of north, through the cascades and past an area of mud geysers; then it turns off to the northeast, over the falls and into the Grand Canyon of the Yellowstone. The Upper Fall is 109 feet high; the Lower, or Grand Fall of the Yellowstone, more than 300. Showers of spray are sent up, which when touched by the sunlight look like innumerable, varicolored jewels. The canyon is more than 20 miles long; it is the supreme wonder of this «Wonderland.» On one side its walls are some 1,200 feet high; on the other there is a broken descent, with talus of delicately tinted chalky formations, marked at intervals by towering pinnacles of rock standing out in bold relief against the brilliant background. These take on many fantastic forms, creating the illusion that one is

YELLOWSTONE NATIONAL PARK: *Above:* Cloud and geyser seem to meet in this unusual feature. *Below:* Hot water pools and colored mineral deposits left by the overflow are found at Mammoth Hot Springs.

Ewing Galloway, N. Y.

YELLOWSTONE NATIONAL PARK: Flowing north through the park, Yellowstone River plunges some 300 feet over Grand Falls into Yellowstone Canyon

Screen Traveler from Gendreau

looking down upon the decaying splendors of antique architecture. From the base of these solemn sentinels the descent to the waterline is as abrupt as that from surface to torrent on the opposite side. Though the channel is from 60 to 160 feet wide, it appears no more than a silvery thread. At the northern end of the canyon are the Tower Falls, with a drop of 132 feet; these are the waters of Tower Creek making their way into the gorge of the Yellowstone. From this point the river follows a course slightly north of west into Montana. Other rivers are the Snake, which flows out of the park on the southern side; Falls and Bechler rivers, in its southwestern corner; Madison and Firehole rivers, in the western section, and Lamar River, in the northeast. A number of creeks, coming down from the high ranges, feed these streams.

Hot Springs and Geysers.—Most renowned of Yellowstone «sights» are the geysers. There are more than 3,000 springs, pools, and geysers. The latter are in the western half of the park, grouped in six basins; from north to south, the Norris, Lower, Midway, Upper, Shoshone, and Heart Lake basins. The Upper, which is the most active of these basins, contains Old Faithful, the most famous of all the geysers. It is a little apart from the other members of the group. Its eruptions, occurring with a fair regularity of timing, giving it its name, come at intervals of not less than 35 nor more than 80 minutes, and usually of 65 minutes. The eruption is preceded by a subterranean rumbling; then come vapor clouds, and finally a column of water rising to a height of 125 to 170 feet. The play of sunlight on the vapor produces a magnificent show of colors. Also in this basin are Giant Geyser, with a water jet attaining a height of 250 feet; Giantess, with an eruption that occurs not more than twice in a twelvemonth, lasts more than four hours, and reaches a height of 200 feet; and Riverside, which spouts obliquely, over the Firehole River, not vertically. Castle Geyser's cone is said to look like the ruins of an old castle. An interesting group is called Lion, Lioness, Big Cub, and Little Cub; their pre-eruption signal is likened to the roar of a lion. Others in various areas are Rocket, Grotto, Mastiff, Bijou, Monarch, Whirligig, and Catfish; Bijou was formerly called Young Faithful.

The hot springs and pools are related to the phenomena of the geysers; all together constitute a hot-water system extending throughout the western half of the park. A hot spring may look like the basin of a live geyser; a geyser may turn inactive and become a mere hot-water pool. These phenomena are regulated by variations in the nature of subterranean passages and reservoirs, affecting the flow of steam. The so-called «paint pots,» such as Fountain Paint Pot, are pools or spouters of mud; Mud Volcano, between Yellowstone Lake and Yellowstone Falls, looks like a caldron of simmering chocolate. Nymph Lake is bordered by many boiling pools and hot springs; Frying Pan Spring bubbles like grease in a pan, and gives forth sulphurous odors. Sapphire Pool boils every 12 minutes, overflowing its basin but producing no jet. The waters of many of these springs are beautifully colored by algae, dissolved rock, or reflection of bordering forests.

Climate.—The climate of Yellowstone Park is somewhat less extreme than that of the surrounding regions, but the summers are short and the winters severe. From mean temperatures of 18° to 20° in January and 62° to 65° in July, there may be variations to 40° below zero in winter and 90° above in summer. The park season runs from 20 June to 12 September; but the north entrance and some 60 miles of road are kept open all year, and from 1 May to 20 June and 12 September to 15 October limited accommodations for motorists are provided. The park is increasingly appreciated as a winter sports area, with skiing and snowshoeing, and the finest wildlife display found anywhere in America.

Flora and Fauna.—The Yellowstone forests are mostly of evergreens. Varieties of pine found here are lodgepole, limber *(Pinus flexilis)*, and whitebark; of fir, alpine and Douglas; of spruce, Engelmann; and of juniper, Rocky Mountain. Aspen, red birch, cottonwood and alder also occur. Trees are cut only in connection with the making of roads and trails, and to provide open space for camps. There are grassy meadows; gray hillslope areas of sagebrush, and sterile, bare spots near the hot springs. The painted cup or Indian paint brush *(Castilleja linariaefolia)*, the state flower of Wyoming, is found in practically all parts of the park. Other plants growing here are the gentian, wild rose, forget-me-not, windflower, buttercup, harebell, primrose, and mallow. Dogwood and Oregon grape also abound.

«Wildlife» in the park is protected. Bear, deer, and elk (wapiti), are numerous. Among the species of bear found here are the black and grizzly. There are antelopes and mountain sheep. A buffalo (bison) herd ranges in the less accessible eastern part of the park. More than 220 species of birds frequent the park, including ducks, geese, hawks, eagles, and the rare trumpeter swan.

The species of fish in the park waters include several varieties of game fish, as eastern brook, Loch Leven, Mackinaw, blackspotted or cutthroat and rainbow trout; Montana grayling, and the Rocky Mountain whitefish. There are also blob, chub, sucker, and dace. Some trout have been transplanted from Loch Leven, in Scotland; attempts to introduce landlocked salmon and largemouth bass have been unsuccessful. A Fish and Wildlife Service pamphlet says: «The native fish life of the park was profoundly affected by the great lava flow in Pliocene times.» When the lava cooled and the watercourses resumed their flow, many species were unable to get up the streams to the plateau. To make sport for anglers, it was necessary to stock the streams. There are hatcheries in the park. No fishing license is required, but the catch allowance is limited. The fishing season commonly is opened on 30 May.

History.—Previous to the 1870's the Yellowstone region was the least known area in the West. In 1806 John Colter, a member of the Lewis and Clark expedition and probably the first white man to set foot in this wonderland of the West, struck out on his own to explore, and in the following year he entered the present park area, from the south. His reports of the marvels of the region were regarded as products of imagination rather than accurate observation. For years afterward these inaccessible lands were visited only by hunters, trappers, and traders, in quest of furs. The famous scout

«Jim» Bridger (q.v.) told stories with the flavor of Baron Munchausen's, and it was only slowly that the underlying truth came to be recognized. Newspapers of the Northwest printed letters that gradually gained the public's confidence. In 1859 the federal government sent an expedition under Capt. W. F. Raynolds to explore the region, but it was unable to get through the mountains and fulfill its mission. The Civil War diverted attention from these explorations, but in 1870 Surveyor-General H. D. Washburn of Montana explored the region and published a report, while his associate N. P. Langford wrote articles which were widely circulated and which have been described as masterpieces of narrative and description. Reports of a federal expedition sponsored by the United States Geologic Survey and headed by Dr. Ferdinand V. Hayden, geologist, who had been a member of the Raynolds expedition, were published in 1871. The Washburn and Hayden reports attracted nationwide attention and, supported by the authority of state and federal agencies, commended popular acceptance. Congress passed an act creating the park «for the benefit and enjoyment of the people,» and on 1 March 1872 President Grant signed the bill.

Nathaniel P. Langford, who had been a member of the Washburn expedition, was the first superintendent of the park; he served five years, without compensation. In 1877 he was succeeded in the superintendency by P. W. Norris, who in turn gave way to P. H. Conger in 1882, followed by R. E. Carpenter in 1885. To Langford is given credit for guarding the park against designs of exploitation, and establishing its permanent status as a national possession. From 1886 to 1916 the park was administered by the army; in the latter year the National Park Service, in the Department of the Interior, was established. During the period of army control Gen. Hiram M. Chittenden (q.v.) built roads and published the results of his study of the park. Meanwhile, in 1894, a new act of Congress re-enforced the original legislation; it created the office of resident commissioner, with John W. Meldrum as first incumbent. In 1916 the National Park Service act was passed. In 1929, after ten years of service as superintendent of the park, Horace M. Albright became director of the national park system, an office which he held until 10 Aug. 1933; and Roger W. Toll succeeded him as head of the Yellowstone administration. Superintendent Toll served until his death in 1936, when he was succeeded by Edmund B. Rogers. As has been noted above, in 1929, 1930, and 1932 the park was enlarged by annexation of adjacent lands previously unprotected.

During the period of army administration a military post, Fort Yellowstone, was maintained; it was abandoned when the National Park Service assumed control, in 1916. The post was taken over by the service as headquarters for the park administration. The site is at Mammoth Hot Springs, five miles south of the north entrance. Up to 1928 the postoffice here was the only one serving the Yellowstone, but since that year several have been added. In the years preceding 1900, the maximum number of visitors was 10,680 in 1897. In 1905 attendance was considerably more than doubled. For some years thereafter it fell off, but in 1915, when automobiles were first admitted into the park, the total of visitors quickly rose to more than 50,000 a year. In 1929 the number was in excess of 260,000. In the early 1930's it slumped again, but in 1940 a new record of more than half a million had been set. This was exceeded in 1941 when 581,761 persons visited the park.

General Information.—No railroad runs into the park, but the Northern Pacific has a station at Gardiner, Mont., at the north entrance, and the Union Pacific has one at West Yellowstone, Mont., at the west entrance. Other railroad service is given by the Northern Pacific at Bozeman, and Red Lodge, Mont.; the Burlington, at Cody, Wyo.; the Chicago, Milwaukee, St. Paul and Pacific at Gallatin Gateway, Mont.; and the Union Pacific at Victor, Idaho. There are also bus services to these points. Travelers by air are landed at the West Yellowstone airport; airline connections are made at Butte, Mont., and at Billings, Mont. Bus tours over park roads are available.

Within the park, the main road system is roughly in the form of a figure 8. The Grand Loop Road, as it is called, includes 142 miles of improved highway. Connecting the Grand Loop with the five park entrances are about 100 miles of approach roads, while other subsidiary roads leading to interesting features bring the grand total to approximately 300 miles within the park. A number of trails are available for those who prefer to go afoot into the less frequented wilds. Rules for car operation are strictly enforced.

The park is well equipped for the comfort and convenience, health and safety of the visiting public. There are hotels, lodges, tourist cabins, cafeterias, automobile campgrounds, and gasoline stations. The campgrounds are supplied with water, sanitary facilities, and grates for outdoor cooking. Some 30 smaller sites are scattered throughout the park for persons who wish to avoid the main points of concentration. Several picture shops are operated; there are general stores and news stands at the principal centers, and automobile supply and repair shops. Boats, fishing tackle, saddle horses, and guides may be rented or hired. At Mammoth Hot Springs hospital service is available; trained nurses are stationed at the hotels and lodges, and medical service is available upon call, anywhere in the park. There are several postoffice, telegraph, and telephone stations. Through the park season, church services, both Protestant and Catholic, are held at several locations each Sunday.

Ranger naturalists conduct parties at Mammouth, Norris Geyser Basin, Madison Junction, Old Faithful, West Thumb, Yellowstone Lake, Fishing Bridge, Canyon, and Camp Roosevelt. Nature walks are conducted daily, and each evening, at most of these points, campfire talks are given. Museums have been established at Mammouth, Old Faithful, Norris Geyser Basin, Madison Junction, and Fishing Bridge. Official information bureaus and interesting exhibits are maintained in conjunction with these museums. A field exhibit near Obsidian Cliff "interprets" that mountain of volcanic glass for visitors; other roadside exhibits are located near Willow Park, Nymph Lake, Tuff Cliff, and Firehole Canyon.

In its effort to preserve unimpaired the park's scientific value and picturesque attractiveness—to make it inure to both «the benefit and the

enjoyment of the people"—the government seeks co-operation by the public in observance of the rules and regulations safeguarding the forests against fire, the park animals against harm, and the public itself against accident or injury. Consult Chittenden, Hiram M., *The Yellowstone National Park* (Palo Alto, Calif. 1940); Haynes, J. E., *Guide to Yellowstone National Park* (St. Paul, Minn. 1940); publications of the Office of National Parks, U. S. Dept. of the Interior.

YELLOWTAIL, or **BLANQUILLO,** a trachinoid fish (*Caulolatilus princeps*) of the coast of Southern California and southward, allied to the Atlantic tilefish (q.v.), which reaches a length of 40 inches. It abounds about rocky parts of the coasts, is good food and interesting as a gamefish.

YELLOWTHROAT. See MARYLAND YELLOWTHROAT.

YEMASSEE, The, "The Yemassee, a Romance of Carolina" (1835), one of the earliest and on the whole perhaps the best of the novels of William Gilmore Simms (q.v.), deals with the little-remembered Yemassee War of 1715 in a manner still effective after all the intervening changes of fashion in romance. Much of the material indeed recalls the older romantic commonplaces: the aspen-like heroine Bess Matthews; Gabriel Harrison, irresistible in love and war, who turns out to be the Palatine Charles Craven, capriciously masquerading; bloody, swaggering pirates; Indians as cruel as eloquent; and the accustomed paraphernalia of raids and sieges, and powwows and heroics. But along with these are such solid realities as Hector, the Negro slave, obviously studied from life as Simms knew it, and Mrs. Grayson, the settler's wife, too hard and strong to be a mere heroine. Above either romantic commonplaces or normal realities stands one episode so powerfully conceived and handled that it ought to have a secure place in the world of the imagination—the episode in which Matiwan, devoted Indian mother, kills her son Occonestoga in order that he may not suffer the disgrace which his tribe has already decreed for him. The book is packed with varied adventure, breathlessly recounted in a style often turgid and verbose but capable at times of dramatic economy and intensity. It is accurate as to topography, and is steeped in that traditionary lore of South Carolina upon which Simms drew for his happiest successes.

CARL VAN DOREN.

YEMASSEE WAR. See COLONIAL WARS IN AMERICA.

YEMEN, yĕm'ĕn, an independent imamate of southwestern Arabia, south of Saudi Arabia and north of the Aden Protectorate, bounded on the west by the Red Sea. The area is estimated to be 75,000 square miles, and the population numbers some 3,500,000. The capital is San'a (pop. 25,000), and other towns of the interior include Dhamar and Ta'izz; the principal seaports are Hodeida (pop. 40,000) and Mocha. Yemen contains some of the most fertile sections of Arabia, wheat, barley, alfalfa, grapes, and figs doing well in the interior highlands, and dates, sorghums, tobacco, sesame, senna, and indigo being cultivated in the coastal plain of the Tihama and other valleys; on the terraced western mountain slopes, at altitudes between 3,500 and 6,800 feet, the principal products are the world-famed Mocha coffee and kat (or khat), a narcotic plant which rivals coffee in value. Gold and silver are mined, and petroleum deposits may exist. Settled prior to 1,000 B.C., Yemen was subject at various periods to the Egyptians and the Ethiopians (see ARABIA—*History*). The people were converted to Islam in A.D. 628, and the country formed part of the Ottoman Empire from the 16th century down to the close of World War I. The imam (ruler) of Yemen enjoyed considerable autonomy under Turkish sovereignty, but his postwar claims to extensive territories involved him in disputes with Saudi Arabia which culminated in occupation of the imamate in 1934 by troops of that kingdom; the Treaty of Taif, concluded in June of that year, defined the boundaries between the two countries. Consult Scott, H., *In the High Yemen* (London 1942).

YEN, Japanese monetary unit, coined in 5, 10, and 20 yen gold pieces; the single yen piece is not coined. The yen is divided into 100 sen; and the rin is the tenth part of a sen.

YENBO, Saudi Arabia, seaport on the Red Sea, 115 miles west of Medina. It is used extensively by pilgrims to the Holy Places of Islam, and has a considerable transit trade. Pop. about 6,000.

YENIKALE, Strait of. See KERCH, STRAIT OF.

YENISEI, yĕn-ē-sā', river of the Russian Soviet Federated Socialist Republics, one of the longest streams in the world. It rises in the Sayan mountains of the Tuva Autonomous Region and flows generally north for a distance of 2,360 miles to enter a gulf of the Kara Sea, an arm of the Arctic Ocean; the estuary of the Yenisei is 140 miles long and has a breadth varying from 3,000 feet to 14 miles. The river has a drainage area of 1,042,000 square miles. Large cities on the banks of the river include Minusinsk, Krasnoyarsk, Yeniseisk, and Turukhansk; it is navigable to the last-named for large vessels. The waters of the Yenisei are clear and rich in fish. They are navigated by paddle steamers, drawing barges, and by a number of five or six cornered flat-bottomed boxes which convey flour down the stream, and are broken up at their destinations. The Yenisei receives from the right the Upper Tunguska (the outlet of Lake Baikal), the Stony (or Middle Tunguska), and Lower Tunguska. The voyage of Nils Adolf Erik Nordenskjöld (q.v.), in the summer of 1875, from Tromsö, Norway, to the mouth of the Yenesei opened up a trade by sea with northern Siberia; there are six weeks during the summer when the passage to and from the Yenesei can be made with little difficulty. The river is obstructed by ice for almost six months at Turukhansk and for about seven months at Krasnoyarsk, at which point the river is crossed by the Trans-Siberian Railway.

YENISEISK, yĕn-ē-sā'ĭsk, Soviet Union, town of the Krasnoyarsk Territory of the Russian Soviet Federated Socialist Republics, on the Yenisei River 200 miles north of Krasnoyarsk.

It possesses a notable museum of natural history and archaeology. The town lies in the center of a gold mining area, and carries on an extensive business in furs. Between May and November river steamers afford communication up the Yenisei from Yeniseisk to Krasnoyarsk. The town was founded in the 17th century. Pop. (1939) over 10,000.

YEOMAN, yō'mȧn, a term of early English origin first meaning a countryman and later used for a class of those who cultivate the soil. In Chaucer the yeomen are retainers, but later appear to have become small freeholders, the intermediate class between the gentry and the laborers. The word was also used for farmers, those who rented land. In the 18th century the landholding yeomen declined in number. The older meaning of retainer still exists in the Yeomen of the Guard (q.v.).

YEOMANRY, a force of volunteer cavalry in Great Britain consisting to a great extent of country gentlemen and farmers possessing their own horses and requisite equipment. The force was first raised in 1761 for home defense and the suppression of rioters, but it was not organized until 1794. The yeomanry were organized in regiments on a county basis, and underwent short periods of annual training. They were liable to be called out in aid of the civil power in case of riot at any time; in case of actual invasion, or the appearance of an enemy on the coast or during a rebellion, they might be assembled for actual service; they were then subject to the Mutiny Act and Articles of War, and might be called upon to serve in any part of Great Britain. For their services during the South African War, 1899–1902, they received the title of Imperial Yeomanry. In 1907 they became part of the territorial forces.

YEOMEN OF THE GUARD, in England, a corps of veteran soldiers of stately presence, employed on state occasions in conjunction with the gentlemen-at-arms as the bodyguard of the sovereign. The yeomen were constituted a corps in 1485 by King Henry VII, and they still wear the costumes of that period. The officers of the corps are a captain, ordinarily a peer, a lieutenant, and an ensign—all old army officers. There are also a "Clerk of the Cheque" and four "Exons," besides noncommissioned officers (messengers, sergeants major, yeoman bedgoers, yeoman bed-hangers), and 100 privates. They are the oldest military body in England. Their dress is striking; a red tunic faced and striped with purple and ornamented with gold lace; red knee breeches and red stockings; a ruff and a plumed hat; steel gilt halberd with red and gold tassel, and an ornamental sword.

YEOVIL, yō'vĭl, municipal borough, England, is situated in Somersetshire on the river Yeo, 127 miles southwest of London. It is a market center for the dairying area surrounding it. The town's industries include the manufacture of gloves, which have been made here since the 16th century, and large engineering works.

The Church of St. John is a notable edifice in the Perpendicular style of Gothic architecture, and is often called the "Lantern of the West." The town itself has been in existence since Anglo-Saxon times. Pop. (1951) 23,337.

YERBA MATE. See Maté.

YERBY, yĕr'bē, **Frank (Garvin),** American author: b. Augusta, Ga., Sept. 5, 1916. Of Negro parentage, he graduated at Paine College, Augusta, in 1937, took a master's degree at Fisk University the next year, and studied in the department of education at the University of Chicago during 1939. He taught in the English department at the Florida Agricultural and Mechanical College, Tallahassee, 1939–1940, and at the Southern University, Scotlandville, La., 1940–1941, and during World War II was engaged in war industry. His first story to be published nationally was "Health Card," treating objectively of a Negro couple in the hands of military police, which appeared in *Harper's Magazine,* May 1944; it won the O. Henry Memorial Award special prize for a first published short story in 1944, and was reprinted in the O. Henry collection for that year. Other of his stories dealing with the Negro people of the South were soon accepted by other magazines, and with publication of his first novel, *The Foxes of Harrow* (1946), Yerby achieved immediate success. Among his books are *Golden Hawk* (1948); *Pride's Castle* (1949); *Flood Tide* (1950), and *Saracen Blade* (1952).

YEREMENKO, Russ. yĕ-ryĕ-myân'kô; Ukrain. yĕ-ryā'myĕn-kô, **Andrei Ivanovich,** Russian army officer: b. Markova, Ukraine, Oct. 14, 1892. Conscripted into the Imperial Russian Army in 1913, he served in the ranks on the eastern front during World War I. In 1917, following the Treaties of Brest-Litovsk (q.v.) between Russia and Germany, he became a guerrilla leader in the Ukraine, and after the revolution in October of that year he joined the Red Army.

During World War II he took command of a field army on the northwest front, and his success in directing the forces which broke the German siege of Stalingrad earned for him the orders of Lenin and Suvorov.

YEREVAN, yĕ-rĕ-vän', or **EREVAN,** ĕ-rĕ-vän, city, Soviet Union, and capital of the Armenian Soviet Socialist Republic, lies 110 miles south of Tiflis, on the Zanga River, altitude 3,170 feet. The city is an important industrial and cultural center, and is situated in an orchard area with mountains to the north, and to the south the Aras River valley at the foot of Mt. Ararat. Its industries are the manufacture of machinery, synthetic rubber, nitrate fertilizers, tires, paints, lacquers, and window glass.

The city was founded c.661; was captured by the Russians in 1827, and by them ceded to the Turks a year later. Pop. (1946 est.) 300,000.

YERKES, yûr'kĕs, **Charles Tyson,** American financier: b. Philadelphia, Pa., June 25, 1837; d. New York, N. Y., Dec. 29, 1905. He became a stockbroker in Philadelphia in 1859, and entered banking in 1862. For refusal in 1871 to give preference to the city of Philadelphia for bonds sold on its account, he was indicted for misappropriating city funds, was convicted, and imprisoned. Pardoned after seven months in prison, Philadelphia cancelled her claim against him. In 1882 he removed to Chicago, Ill., and there acquired a controlling interest in the street railway system. He presented Yerkes Observatory (q.v.) to the University of Chicago.

YERKES, Robert Mearns, American psychobiologist: b. Breadysville, Pa., May 26, 1876. He graduated from Harvard in 1898, and taught comparative psychology there from 1901 until 1917. For the next two years he was director of the psychological laboratory at the University of Minnesota, and thereafter he headed the research information service of the National Research Council until 1924. In that year he went to Yale as professor of psychology, and in 1931 he was appointed director of the laboratory of comparative psychobiology at the Yale School of Medicine. His experimental studies of animal behavior were particularly noteworthy. Numerous works by him include *Introduction to Psychology* (1911); *The Mental Life of Monkeys and Apes* (1916); *The Mind of a Gorilla* (1927); *The Great Apes,* written in collaboration with A. W. Yerkes (1929), and *Chimpanzees: A Laboratory Colony* (1943).

YERKES OBSERVATORY, astronomical observatory of the University of Chicago (q.v.), located on Lake Geneva, near Williams Bay, Wis. It was founded in 1892 by Charles Tyson Yerkes (q.v.), who presented funds to the university sufficient for its building and equipment. It has a refracting telescope with an aperture of 40 inches. See also Observatory; Telescope.

YERMAK, Timofeyev. See Ermak Timofeev.

YEVPATORIYA, Russ. yĭf-pŭ-tô′ryĭ, or **EVPATORIA,** ĕf-pā-tōr′ĭ-ā, town, Russian SFSR, in west Crimea, is a Black Sea port, situated 40 miles north of Sevastopol. It is a center for the agricultural area around it which produces grain and livestock. The town's principal industries are salt working, meat and fish processing, and manufacture of clothing. It is largely a residential town, covering an area of two miles west to Lake Mainok—the latter being a salt lagoon.

Founded in the 1st century A.D., the old Tatar town still occupies the eastern section, while the new Russian section on the west grew up after 1910. It was annexed by the Russians in 1783; in 1854 Anglo-Saxon troops landed nearby, and in the following year the town was occupied by the Turks. Pop. (1926) 23,512.

YEW, evergreen coniferous shrubs or trees of the genus *Taxus.* The leaves are flat needles arranged in two ranks to the right and left of the stem, but in a horizontal plane. The flowers are dioecious, and have no perianth; the male inflorescences are composed of a few stamens partly united at the apex of a scaly, axillary stalk, with shield shaped bracts forming a spherical head. The female flowers are axillary, naked ovules seated on a fleshy annular disc, which becomes cup shaped and scarlet, and nearly encloses the bony seed. The European yew, a tree famous in the annals of Old World gardens, is *Taxus baccata.* It is readily recognizable by its lustrous foliage, so dark a green as to appear velvety and almost black in the shadows. When rather young the typical yew has a broadly pyramidal head, but in its old age it becomes ragged and broken, not unlike an aged hemlock. Some trees have attained a great age, and they reach to a height of 100 feet, and sometimes to a diameter of 10 feet. In cultivation there are several varieties of yew, including the Irish, with fastigiate branches and columnar habit, and the golden yews, with foliage, which, to a certain extent, is yellow. The dark yew was a favorite tree for planting in churchyards. It is even now a common plant in European cemeteries, and has been for centuries a symbol of mourning at funerals, and especially at those of unhappy lovers.

> Lay a garland on my hearse
> Of the dismal yew

This couplet in the *Maid's Tragedy* is an allusion to this custom. In India the yew is a sacred tree, its wood and gum being burned as an incense, and branches of it carried before ceremonial processions. Although the sweet and juicy scarlet aril of yew fruit does not seem to be poisonous, the enclosed seed is regarded with suspicion, especially when eaten by children, in any quantity. Young branches of yew, too, are dangerous to cattle, which are frequently killed by feeding upon them. The trunks of yews are twisted, ridged, and gnarled, and the shreddy bark has the rich red brown tone of an old cedar. The wood is hard, with an orange red or brown heart, which takes a fine polish and is valued for cabinet work and veneers; since it is also fine and close grained, flexible and elastic, easy to split and durable, yew wood was the chosen material for the bows of the English archers, and no other wood has ever equaled it for that purpose. The Indian tribes of the northwestern American coast arrived at the same conclusion in regard to the beautiful *Taxus brevifolia,* indigenous to that region and similar in appearance and size to the European tree. It was used by them for bows, spear handles, paddles and fishhooks, and is the most durable timber that man can find for his fence posts. There is another arborescent American yew, found in Florida, a bushy tree (*T. floridana*) with many stout spreading branches and a short trunk. It rarely exceeds 30 feet in height. A Japanese species (*T. cuspidata*), with a bright red bark, is of bushy habit, and more hardy and successful than the European yew. This is a great favorite with the Japanese, who clip it into fantastic shapes. The most familiar yew in Canada and the eastern United States is *T. canadensis,* a very low, shrubby species with decumbent branches radiating in every direction and forming thickets hard for a man to travel through, but a first-rate cover for grouse. It grows in moist lands under the shade of trees, and is readily recognized by its dark foliage and the glowing, crimson, oblong, cuplike fruits.

YEZD, yĕzd, Iran, capital of a province of the same name, in an oasis on a sandy plain, 175 miles southeast of Isfahan. The old part of the town, enclosed by a high mud wall, is defended by a citadel within which are a governor's palace, the principal mosque, and several public buildings. The chief manufactures are silk stuffs, velvets, and coarse woolens known as *numuds.* There are more Zoroastrians in Yezd than in any other Iranian town. The city dates from the 5th century. It was visited by Marco Polo in 1272. Pop. (1941) 60,066.

YEZEDEES or **YEZIDIS.** See Religious Sects.

YEZO, former name of the Japanese island of Hokkaido (q.v.).

YGGDRASILL, or **YGDRASIL,** ĭg′drà-sĭl,

in Scandinavian mythology, the giant ash tree overspreading the whole world and reaching above the heavens. It binds together earth, heaven and hell, and its roots stretch out to the Asa or Aesir gods in heaven, to the frost giants, and to the underworld. A marvelous fountain springs up under each of these three great roots; and in the tree, whose boughs drip continually with honey, dwell an eagle and the squirrel Ratatöskr. At its roots the serpent Nithöggr gnaws, and between the serpent and the eagle runs the squirrel constantly endeavoring to provoke the two to strife.

YIDDISH LANGUAGE. Yiddish, the Englishized form of German *Jüdisch* (Jewish), is one of the names applied to the various German dialects spoken by the Jews of German origin in the diaspora, in eastern Europe and elsewhere whither Jews have emigrated. In Russia it is known under the name of *Jargon,* while philologically it is generally spoken of as *Judeo-German.*

No literary documents of any consequence bear upon the condition of this group of dialects previous to the 16th century, and even in the printed works up to a hundred years ago the literary norm seems to have attempted an approach to the literary German, though even then the deviation was considerable and fairly uniform. In the last century the spoken dialects have been asserting themselves in the literary productions, so that the uniformity no longer exists, each author writing in the variation familiar to him from childhood.

It seems that at first, in the Middle Ages, the German Jews employed the language of their Christian neighborhood without any change whatever; in their intercommunication with their co-religionists they transcribed this German with Hebrew characters and introduced, Germanizing them, such Hebrew words as were necessitated by the observances of the Mosaic faith. When the German Jews, in the 14th and 15th centuries, settled in Poland, they were cut off from the rest of the German nation, and so their native dialects perpetuated themselves in the form in which they were brought from their homes. They were subjected, however, to the double influence of their Slavic neighborhood and the language of the Bible and the Talmud, to which the Jews devoted themselves with unwonted zeal. In vocabulary, the Yiddish is predominantly German, less than one third having been derived from Slavic, Rumanian, and Hebrew sources. In pronunciation, the influence of Russian and Polish is doubtful or less transparent, while Hebrew, instead of affecting it, was itself affected by the current pronunciation of Yiddish. In syntax and idiom, both the Slavic and the Hebrew have considerably modified the native German, without, however, obliterating the original German basis. At present, three chief varieties may be distinguished in the Yiddish of Russia, the Lithuanian, the Polish, and the Southern; the dialects in Austria and Hungary are more nearly related to the two latter, while the Rumanian is more akin to the Polish variety. In the United States all three varieties may be heard, but they are strongly influenced in vocabulary by the English; and in the periodic press the Lithuanian variety, affected by literary German, seems to supersede all other dialects. The three varieties correspond to their places of origin in Germany, the Lithuanian issuing from a Middle-German home, the other two from various Upper-German localities. The precise *provenience* has not yet been ascertained, as the linguistic study of Yiddish has heretofore been greatly neglected.

The chief differences between Yiddish and the modern German are these: Phonetically, Yiddish represents a mediaeval stage of German when, for example, *î* and *ei* were still carefully distinguished, while *u* before a nasal had not yet changed into *o;* on the other hand, the consonantism, especially the treatment of *pf,* seems to correspond to a later stage. The vocabulary of Yiddish is rich in words only sporadically found in German dialects and common to the Middle-High-German literary language. The words from the Hebrew are phonetically treated as Yiddish words, while those from Russian and Polish, to some extent, underwent the changes due to the peculiarity of Yiddish, and present some interesting data to the Slavic scholar. In grammar, Yiddish has developed certain peculiarities which are common to various German dialects. Most prominent are the disappearance of final unaccented *e,* of the genitive case in the declension of the noun, of the imperfect tense in the verb. In syntactic structure, Yiddish resembles English, rather than German, and in English-speaking countries naturally adopts some of the English idioms. But, on the whole, Yiddish is an important group of German dialects, well worthy of a thorough study by the Germanic philologist.

Leo Wiener,
Emeritus Professor of Slavic Languages and Literatures, Harvard University.

YINGKOW. See Newchwang.

YLANG-YLANG, ē'läng-ē'läng, a tree of the custard apple family, found in southeast Asia, from the flowers of which is distilled an exquisite perfume. The tree attains a height of 60 feet, and has drooping, greenish-yellow flowers, three inches long, of great fragrance. The first flowers appear in the third year, and in the eighth the yield is as high as 100 pounds; the bloom occurs every month. Perfume is distilled from the petals by the use of water only, no chemicals being required.

YMIR, ü'mêr, in Scandinavian mythology, the personification of Chaos, or the first created being, produced by the antagonism of heat and cold in Ginnungagap, the primeval abyss. Slain by Odin and thrown into Ginnungagap, his flesh was transformed into land, his bones becoming the mountains, his blood the rivers and lakes, his hair the forests, while his skull constituted the heavens, and his brains the clouds.

YOAKUM, city, Texas, in De Witt and Lavaca counties, 120 miles southwest of Houston, served by the Southern Pacific Railroad. It is the center of an agricultural region, and leather products are manufactured. An annual harvest festival, the Tomato Tom-Tom, is held here. Pop. (1950) 5,231.

YOGA, yō'gä (meaning, in Sanskrit, concentration) one of the six schools or systems of philosophy, that of Patanjali, the essence of which is meditation. It believes in a primordial soul which has had existence from an earlier period

than primeval matter, and holds that from the two arose the spirit of life (Mahanatma). Theoretically at least, its devotees can acquire even in this world entire command over elementary matter by certain ascetic practices, such as long continued suppression of the respiration, inhaling and exhaling the breath in a particular manner, sitting in 84 attitudes, fixing the eyes on the tip of the nose, and endeavoring, by force of mental abstraction, to unite themselves with the vital spirit which pervades all nature and is identical with Siva. When this mystic union is effected, the Yoga can make himself lighter than the lightest, or heavier than the heaviest substance, or as small or as large as he pleases; he can traverse all space, can become invisible, can equally know the past, the present, and the future, and can animate any dead body by transferring to it his own spirit. It is claimed that the whole doctrine of the Yoga works toward the establishment of the Supreme Being; and that it possesses the means by which the soul may become finally united with the Creator from whose hand it came. The system is said to have been founded by Patanjali (q.v.), who claimed that eight distinct stages were necessary in the development of the soul before it reached that condition in which it was exempt from further transmigrations. These stages are yama (self-control), niyama (religious observances), prānāyama (breath regulation), pratyāhāra (restraint of senses), dhāranā (making the mind firm), dhyāna (meditation), samādhi (deep contemplation). These correspond generally to the general characteristics of the system given above. Each stage must follow in its order and is dependent upon the attainment of all the stages that precede it; and the great object of the whole is to reach the final stage. Owing to the difficulty of the attainment of all these successive stages of perfection, the adherents of the Yoga believe that it is very rarely that any one reaches them all in this life and that consequently most persons must pass through several births and existences in the attainment of the final goal. In the course of this progress, however, one is believed to acquire wonderful powers. He is enabled to make himself light or heavy, at will; to acquire a knowledge of the past and the future; to understand the language of all animals; to penetrate the thoughts of others; to remember all that has happened to him in supposed former stages of existence; and even to transcend all this and to attain to a knowledge of what is going on or has taken place in the stars and in all other worlds. To these powers, the believer in the Yoga adds that of the ability to make himself infinitely small or large beyond imagination. These are accompanied by wonderful powers of body and will and the nicest discrimination in all things, together with the ability to transport oneself anywhere suddenly at will. These wonderful powers are gradually acquired, and finally result in the complete separation of the soul from the corporal body in the ultimate triumph of the former.

YOKE, a piece of timber, hollowed or made curving near each end, and fitted with bows for receiving the necks of draft animals, by which means two are connected for hauling loads. A frame of wood fitted to a person's shoulders for carrying a pail or other load suspended on each side. The ancients regarded the yoke as a symbol of slavery, and it was customary for vanquished armies to pass under a yoke, formed like a gallows, of two upright spears, and a third fixed transversely at top. The word *subjugate* (*sub,* under, and *jugum,* yoke) is a reminder of this custom.

YOKKAICHI, yôk-kī-chē, Japan, seaport on the south coast of the island of Honshu, on Ise Bay 23 miles southwest of Nagoya. There are manufactures of silk and cotton goods, paper, and a unique type of faience. The hot springs of Yunoyama are 12 miles from the city. Pop. 58,471.

YOKOHAMA, yō-kō-hä'mà, Japan, seaport on the island of Honshu, in Tokyo Bay 18 miles southwest of Tokyo. In 1859 it superseded Kanagawa, which it now includes, as a treaty port open to foreign commerce, and subsequently it became the country's principal seaport. Commercial buildings occupy the east of the city, the western part being residential and the center containing the prefecture, customhouse, and other official buildings. Yokohama was practically destroyed by a great earthquake on Sept. 1, 1923, and the tidal wave and fire that followed. The reconstructed city contains a large number of modern concrete structures along wide thoroughfares. The long breakwaters built during 1889–1896 to convert the open roadstead into a safe harbor were also damaged severely by the earthquake and required extensive reconstruction. Yokohama is the center of Japan's silk exporting industry. Pop. (1940) 968,091.

YOKOI HEISHIRO, yō-kōy hāy-shē-rō, Japanese philosopher and statesman: b. Kumamoto, before 1810; d. Kyoto, Feb. 15, 1869. His fame as a scholar in Chinese and as lecturer and expounder of the Oyomei philosophy (q.v.) made the feudal castle lords compete for the honor of his presence and the use of his talents. Many of the makers of the modern Japan evolved after the civil war of 1868 were his pupils, carrying out his ideas. His best work was done in Fukui. When the new government was formed in 1867, after the coup d'etat in Kyoto, the aged scholar was summoned to advise the new men in power. Gaining their confidence, he proposed that the *eta* and *hinin* (not human), outcasts numbering nearly one million, should be raised to citizenship, and that freedom of conscience be permitted. He was attacked by ruffians in the street, shot, and beheaded for "holding evil opinions," that is, for Christian idealism. When the emperor proclaimed the constitution of Japan in 1889, Yokoi was accorded posthumous honors.

YOKOSUKA, yō-kō-sōō'kà, Japan, seaport and naval station on the Bay of Tokyo, 12 miles south of Yokohama. The spacious landlocked harbor possesses modern docks and shipbuilding yards. About a mile from the town is the grave of Will Adams (q.v.), the first Englishman to enter Japan. Pop. (1935) 182,871.

YOKUT INDIANS, a group of about two dozen small tribes, forming the Mariposan linguistic stock of North American Indians, occupying an irregular area in central southern California from Fresno River in the north to near the southern extremity of Tulare Lake in the south, and between the Sierra Nevada in the east and the Coast Range in the west; the Yokuts occupy

a strip, 10 to 20 miles wide, extending southeastward from Tulare Lake along the eastern base of the latter range to Mount Pinos, about lat. 34° 45′, together with an isolated area, occupied by the Cholovone division, in San Joaquin Valley from the Tuolumne northward. The tribes in general were segregated by the natural features of their territory, such as river valleys, and each tribe had its hereditary chief. Their village consisted of a single row of tule-thatched, wedge-shaped houses, with a continuous *ramada* or shelter of brush along the front. In early times, when large game was abundant, hunting formed an important pursuit, but with the coming of the whites and the disappearance of the game they were compelled to resort almost exclusively to the products of the soil, the streams, and lakes, although rabbits and quail were always abundant and were commonly trapped. Seeds of various kinds were gathered for use as food, as also were grasshoppers, caterpillars, worms, and the larvae of insects. Dogs were raised for the same purpose, and even skunks were not despised; but the coyote and the rattlesnake were always tabooed. Their basketry, excellent in shape, design, and execution, formed their chief handiwork. The Yokut women were chaste before the settlement of their country by the whites. Marriage was perhaps by purchase, the husband residing at the house of his wife; infanticide was practised in cases of deformity, and the dead were generally cremated. The Yokuts are now but a remnant of a once comparatively populous group of tribes. Early warfare with the Paiutes, who pressed them closely from the east, and later and more disastrous contact with white ruffians who found the Indians in their way, practically exterminated many of the tribes. Their present population is about 500, of Indian habits and life. But numerous members of the race have been absorbed into the life of the nation and are no longer numerated as members of the Yokuts tribes.

YOM KIPPUR, a rabbinical term designating the Jewish Day of Atonement. See ATONEMENT.

YONEZAWA, yō-nĕ-zä-wä, Japan, a city in the northern center of the island of Honshu, east of Niigata. In Japanese annals it had a long and interesting feudal history. Its old castle grounds now constitute a public park. For more than 150 years the town has been famous for its silken fabrics. Pop. 50,448.

YONGAMPO, yŏn-gäm′pō, Korea, a seaport on the left bank of the Yalu estuary, near Uiju, with a large harbor. It played an important part in the Sino-Japanese War of 1894–1895 and in the Russo-Japanese War of 1904–1905. See KOREA.

YONGE, yŭng, **Charlotte Mary,** English novelist and children's writer: b. Otterbourne, Hampshire, Aug. 11, 1823; d. there, March 24, 1901. She was educated privately in Otterbourne, where she lived all her life and where she came under the influence of John Keble (q.v.), the Anglican theologian of High Church views who was vicar of neighboring Hursley. The inculcation of the High Church faith became the dominating note of her long series of novels and other books, of which there were more than 160 in all. She made her name widely known in 1853 by the publication of a novel entitled *The Heir of Redclyffe;* she devoted part of the proceeds to fitting out a missionary vessel. *The Southern Cross,* for service in the Southwest Pacific. Her next great success was with *The Daisy Chain* (1856), the profits from which went towards establishing a missionary college in Auckland, New Zealand. Among subsequent works of fiction were *The Prince and the Page* (1865); *The Dove in the Eagle's Nest* (1866); *The Caged Lion* (1870); and *The Pillars of the House* (1873). The dialogue in her novels was inspired, and she had great power of characterization. Nevertheless, her later novels showed her to be out of touch with the new generation, which had cast off the smug manners and pseudo-culture of the Victorian period. Besides novels, she also wrote a great number of biographical and historical works, including *Kings of England* (1848); *History of Christian Names* (1863); *Cameos from English History* (1869–99); *Life of Bishop J. C. Patterson* (1873); *The Book of Golden Deeds* (1874); and *Eighteen Centuries of Beginnings of Church History* (1876).

From the age of seven until her death she taught Sunday school, and at the age of 20 she began to publish articles in the *Magazine for the Young.* She edited the *Monthly Packet,* a juvenile magazine, from 1851 to 1890; edited two Sunday school papers; and, generally under the pseudonym "Aunt Charlotte," wrote many books for children. Christabel Coleridge's *Life of Charlotte M. Yonge* (New York 1903) includes her autobiography; Ethel Romanes published *Charlotte Mary Yonge: An Appreciation* (London 1908).

YONKERS, N. Y., a city of Westchester County, on the Hudson River at the mouth of the Nepperhan River, 14 miles north of New York City; it is served by the New York Central Railroad and by passenger and freight river steamers. A river ferry links the city with Alpine, N. J. Yonkers (the "Terrace City") is built on a series of terraces which rise from the Hudson to an elevation of 426 feet above tidewater. The view from the elevated portions includes a long distance up and down the Hudson, the Palisades on the opposite bank of the river, and the beautiful valley to the east.

From early times Yonkers has been a shipping and trading point. A hat factory was established here in 1840, and an elevator plant in 1854. Sugar is refined and carpets manufactured, and other products of industry include wire and cable, chemicals, clothing, and dental supplies. The city has a frontage of nearly five miles on the Hudson, and extends along the Bronx River for about seven miles. It contains several parks. The Frederick Philipse Manor House, built in 1682 and enlarged in 1745, is of historical interest; it was used as the city hall from 1867 until 1872, when it became the property of the State of New York and was constituted a museum. Yonkers also has a Hudson River Museum. In the northern part of the city, a section named Glenwood, is Greystone, a beautifully landscaped and planted estate created in 1873 by Samuel Jones Tilden; later it came into the possession of Samuel Untermyer, who left it to the city—but the gift was not accepted. Also in Glenwood is the Boyce Thompson Institute for Plant Research, founded in 1924, which specializes in the study of plant growth as affected by light and chemicals.

The city has four large hospitals, the General, Professional, St. John's and St. Joseph's; and Leake and Watts Orphan Home, the Hebrew Home for the Aged and Infirm, and private institutions. The public and parochial school systems are good. Here are St. Joseph's Seminary, training men for the Catholic priesthood, and Sarah Lawrence College for women (in Bronxville). Three daily newspapers are published here, the oldest dating from 1863.

There was an Indian village here, Nappeckamack (town of swift water), and the site was bought in 1639 by the Dutch West India Company. In 1648 Adriaen Van der Donck built a mill here, and Jonkheer (Master) Van der Donck's estate was called De Jonkheer's Land—shortened and anglicized to Yonkers. It became a part of Philipse Manor in 1672 and the town was called Philipsburg. The town of Yonkers was founded in 1788. Yonkers had a population of 7,500 in 1855 when it was incorporated as a village, and about 15,000 in 1872 when it was chartered as a city. At that time the southern part was called Kingsbridge. The growth of the population was very rapid in each of the decades from 1890 to 1940. As late as 1930 more than one quarter of the total population was foreign born, with Italians, Poles, Irish, Scotch, Germans, Czechoslovaks, and English (ranking in that order) accounting for three fourths of the alien born. The city is governed by a mayor and a common council. Pop. (1940) 142,598; (1950) 152,798.

Consult Cushman, E., *Historic Westchester, 1683–1933* (Yonkers 1933)

YONNE, yôn, France, a northern interior department bounded by Seine-et-Marne, Aube, Côte-d'Or, Nièvre and Loiret; area, 2,892 square miles; capital, Auxerre. The surface is generally intersected by low hills, sometimes barren, but usually covered with fruitful vineyards, which yield the famous Chablis, Joigny, Auxerre and Tonnerre wines. The climate is temperate, and the air pure and healthful, except in some wet, marshy spots. The minerals include iron, red and yellow ocher, building stone, lithographic stones, pavement and potter's clay. The manufactures are of coarse woolens, woolen covers, serge, glue, sugar, glass, etc. The trade is in wheat, wine, vinegar, wood and charcoal, ship timber, wool, cattle, iron and ocher. Pop. (1936) 271,685; (1946) 266,014.

YORCK (or **YORK**) **VON WARTENBURG,** yôrk fŏn vär'tĕn-bo͝ork, Count **Hans David Ludvig,** Prussian army officer: b. 1759; d. Oct. 4, 1830. He served in the Polish campaign of 1794 and in the war against France in 1806, and reached the rank of major general in 1807. During Napoleon's invasion of Russia in 1812 he commanded the Prussian contingent. When he realized that the Grand Army of France was doomed, he concluded with the Russians the convention of Taurogen which neutralized the Prussian forces. During the campaign of 1813–1814 he commanded a Prussian corps against France, fighting successfully at Möckern and Bautzen on the Katzbach, and at Leipzig; and also took part in the assault upon Paris.

YORICK, yŏr'ĭk, (1) The king's fool, whose skull is apostrophized by Hamlet in the fifth act of Shakespeare's tragedy of *Hamlet.* (2) The pseudonym adopted by Laurence Sterne in *A Sentimental Journey.* (3) The parson in Sterne's *Tristram Shandy,* intended as a portrait of himself.

YORITOMO, yô-rê-tô-mô (Minamoto Yoritomo), Japanese soldier and statesman; b. 1147; d. 1199, one of the most famous characters in Japanese history. In the middle of the 12th century Japan was dominated by two rival military clans, the Minamoto and the Taira. In 1160 the Taira defeated the Minamoto and killed one of their chieftains, Yoshitomo. His son Yoritomo was banished and lived in exile until 1180, when he gathered an army consisting of his father's retainers and some new followers. He met a much larger army of the Taira and defeated them brilliantly with the help of his younger brother Yoshitsune (yô-shê-tso͝o-nĕ, 1159–1189). The final decisive battle of this campaign was a naval engagement at Dan no Ura, near Shimonoseki, in 1185. The power of the Taira was broken, and Yoritomo became actually the ruler of Japan, although nominally he was subject to the emperor. In 1192 he was given the title of shogun, or military governor. He established his capital at Kamakura, and he was the first of a succession of shoguns who ruled Japan under the feudal system until the middle of the 19th century, when European influence entered the country.

He became jealous of Yoshitsune, who was honored as a hero for his military and naval victories. Yoshitsune, hearing that his brother planned to have him assassinated, raised an unsuccessful rebellion, after which he was murdered by one of his brother's followers.

Yoritomo proved to be an able and intelligent governor, and he instituted many reforms, both civil and military. He was brave, astute, and calculating, ready to use any means to achieve his ends. See also Japan—*History: From the Earliest Times to 1853.*

YORK, yôrk (House of York). This English royal line was founded by Richard Plantagenet, 3d Duke of York, grandson of Edmund of Langley, 1st Duke of York (see York, Duke of). The York kings, who reigned between 1461 and 1485, were Edward IV, Edward V, and Richard III. On their behalf the Wars of the Roses (see Roses, Wars of the) were fought.

YORK, Duke of, a title frequently conferred on the second sons of British monarchs. It was first borne, however, by Edmund of Langley (1341–1402), fifth son of Edward III, who received the title in 1385 after accompanying Richard II to Scotland. Three times between 1394 and 1399, while the king was absent from the realm, he acted as regent. In 1399 he failed to defend the king's interests in opposition to Henry of Lancaster; and ultimately supported the latter, who ascended the throne as Henry IV. Edward of Norwich or Edward Plantagenet (1373?–1415), elder son of Edmund, succeeded as 2d Duke of York. Richard II, his cousin, made him admiral of the fleet and appointed him to other posts. As reward for his assistance against the lords appellant, in 1397, the king made him grants of land and conferred upon him the duchy of Albermarle and the office of constable of England. In 1399 Henry IV deprived him of his offices and estates for participating in the murder of Thomas of Woodstock, duke of Gloucester,

but he was restored to favor in 1401. He was imprisoned for a few months in 1405 for his share in the attempt to kidnap the earl of March and Roger Mortimer, the latter's brother. Serving under Henry V in the English invasion of France, he was killed at Agincourt while commanding the right wing of the army. RICHARD PLANTAGENET (1411–1460), grandson of Edmund of Langley and nephew of Edward of Norwich, succeeded as 3d duke of York. His mother was Anne Mortimer, granddaughter of Lionel, duke of Clarence, the third son of Edward III; by virtue of this descent, the house of York alleged its superior right to the throne over that of the house of Lancaster, which was descended from the fourth son of Edward III. He was the lieutenant general of Henry VI in France and Normandy (1436–1437 and 1440–1445) and the king's lieutenant in Ireland (1447–1457); and during the king's illnesses (1454–1455 and 1455–1456) he served as protector of the realm. In 1460 he marched his forces on London to claim the throne for himself. A compromise was reached whereby he was proclaimed heir apparent and protector. The Lancastrians forced him to give battle at Wakefield, where he was killed. Two of his sons ascended the throne as Edward IV and Richard III; a third was George, duke of Clarence. RICHARD PLANTAGENET (1472–1483), duke of York, second son of Edward IV, was a victim of the struggle for the crown after his father's death. He and his elder brother, Edward V, were put to death in the Tower of London, supposedly on the orders of the protector, the duke of Gloucester, who gained the throne as Richard III.

The title of duke of York was also borne by Henry Tudor (later Henry VIII), Charles Stuart (later Charles I), James Stuart (later James II), and Henry Benedict Maria Clement Stuart (see YORK, CARDINAL). George III created Frederick Augustus, his second son, duke of York and Albany (q.v.). The dukedom of York remained in abeyance until 1892, when the title was conferred upon the second son of the prince of Wales (later Edward VII), who ascended the throne as George V. The latter's second son bore the title from 1920 until his accession in 1936 as George VI.

YORK, Alvin Cullum, American soldier: b. Pall Mall, Tenn., Dec. 13, 1887. He fought in France during World War I. As a sergeant of the 328th Infantry, 82d Division, in the Argonne on Oct. 8, 1918, he killed 20 Germans and captured 132 of the enemy and 35 machine guns. He was awarded the United States Medal of Honor and the French Croix de Guerre. Subsequently he established the York Foundation for the education of mountain children and became a local leader of the prohibition and world peace movements.

YORK, CARDINAL (HENRY BENEDICT MARIA CLEMENT STUART), last prince of the British royal house of Stuart: b. Rome, Italy, March 6, 1725; d. Frascati, Italy, July 13, 1807. He was the second son of James Francis Edward Stuart (the Old Pretender) and brother of Charles Edward Louis Philip Casimir Stuart (the Young Pretender). Soon after birth he was created duke of York by his father, then in exile. In 1746 he went to Rome, where, the next year, Pope Benedict XIV made him bishop of Ostia and a cardinal; in 1761 he was made bishop of Frascati. Through the favor of the French court he enjoyed the revenues of two rich abbeys, and he also had sinecure benefices in Spain and Spanish America. After his brother's death in 1788 he assumed the title of Henry IX, king of England. Stripped of his fortune by the French Revolution, he took refuge in Venice. Now penniless, he was awarded an annual pension of £4,000 by George III; he bequeathed certain of the British crown jewels in his possession to the prince regent (later George IV).

YORK, city and county borough, England, county seat of Yorkshire, at the confluence of the rivers Foss and Ouse, 20 miles east-northeast of Leeds. The ancient city, with a circuit of nearly three miles, is enclosed by double walls, originally Roman but restored by Edward I and partly repaired at subsequent periods; the walls are pierced by four imposing gates or bars. The city forms a perfect storehouse for the antiquary. The minster or cathedral dates from the 7th century, but did not begin to assume its present form till 1171, and was not completed till 1472. A square massive tower rises from the intersection to the height of 235 feet, and two other lofty towers of graceful proportion, 196 feet, flank a richly-decorated western front, divided by paneled buttresses into three compartments, of which that in the center is chiefly occupied by a beautiful window and a splendid portal. Measured without the walls, the whole length, from east to west, is 524 feet, and the width across the transepts, north to south, 222 feet; length, from west door to choir, 264 feet; length of choir, 162 feet; breadth of body and side aisles, 109 feet. The interior consists chiefly of a lofty nave, separated from its aisles by long ranges of finely clustered columns, a still loftier choir, lighted by a magnificent and beautifully blazoned window, and a Lady Chapel continuing the choir, and containing some beautiful monuments. The chapter house, entered from the north transept of the cathedral, is a richly decorated octagon, and near it is a fine old chapel, originally forming part of the old archiepiscopal palace, and now appropriated to the library. Other notable buildings and establishments are an ancient Gothic guildhall (1446), and spacious mansion house adjoining; the fine old ruins of Saint Mary's Abbey; Clifford's Tower, part of the city castle founded by William the Conqueror; the fine old merchants' hall. Manufactures include iron and steel products, glass, chemicals, and leather goods. The archbishop of York has the title of primate of England; the city's chief magistrate takes the title of lord mayor.

York may have been the early British *Caer Ebranc* of the Brigantes; and under the Romans, as *Eboracum* or *Eburacum,* it was the capital of the British province and headquarters of the 6th legion. Hadrian lived here in 120, while Severus and Constantius Chlorus died here. After the departure of the Romans, York so far retained its importance as to become the capital of Northumbria, whose king, Edwin, in 624 made it an archiepiscopal see. In the 8th century its diocesan school attracted students not only from all parts of the kingdom, but from France and Germany, and sent out scholars who afterward acquired European celebrity. Here the first English Parliament was held by Henry II in 1160. In later times it makes a distinguished figure in almost all the great epochs and events of English history, during the Civil War surrendering tc the Parlia-

mentarians after a siege of several weeks. Pop. (1951 est.) 105,336.

YORK, town, Maine, in York County, situated on the Atlantic Ocean 25 miles south-southwest of Biddeford; it is served by the Boston and Maine Railroad. The town, which includes the summer resorts of York Beach and York Harbor, is generally known as Old York. It has a number of buildings of historic interest, among which is the jail, now a museum, which is one of the oldest in the United States. The township contains several villages. York was set off in 1622, from land granted by the Plymouth Council to John Mason and Ferdinand Gorges. In 1624 the place was called Agamenticus. On March 1, 1640, a territory of 21 square miles was incorporated as a borough by Sir Ferdinando Gorges, and chartered as the city of Gorgeana in 1642. This was the first municipal corporation made by the English in North America. On the death of Charles I, in 1649, Gorgeana City, Isle of Shoals, Wells, and Kitterytown united and established a confederacy. In 1652 the confederacy and all of Maine came under the control of Massachusetts. The city charter of Gorgeana was revoked, and the name changed to York. The limits of the present town are about as in 1652. In the early years the town suffered from Indian depredations; one attack, in 1692, resulted in the massacre or capture of about one half the inhabitants. In 1716 the legislature of Massachusetts made York the shire town of Yorkshire, now York County. Pop. (1940) 3,283; (1950) about 3,500.

YORK, city, Nebraska, seat of York County, 41 miles east of Grand Island, served by the Burlington Lines and the Chicago and North Western Railroad. Farming and stock-raising flourish in the county and it is a large egg producing center. The city has a varied list of industrial activities, including the manufacture of feed grinders, medicines for livestock, and foundry and machine-shop products. It is the trading center for a considerable area. York has public and parochial schools, and is the seat of York College, a coeducational institution opened in 1890. Here too is the state farm of the Independent Order of Odd Fellows. An orphanage supported by the Methodist Episcopal Church also has a farm. Three parks, East Hill, Harrison, and Central, afford recreational facilities. Outside the city limits is a state reformatory for women, with a farm; in 1933 women prisoners in the state penitentiary were moved to this institution, which was opened in 1920. York was laid out in 1869 and was incorporated in 1872. Two years later an academy was established. The neighboring settlement of New York was added to the city in 1880. Pop. (1940) 5,383; (1950) 6,298.

YORK, city, Pennsylvania, and York County seat, altitude 370 feet, on Codorus Creek; 27 miles southeast of Harrisburg; on the Maryland and Pennsylvania; Pennsylvania; and the Western Maryland railroads; and state and federal highways, with an airport. It is in a productive farming section, which in colonial times was called the "breadbasket of America," and is now famous for its tobacco.

York is the trade name of ice machinery and air-conditioning equipment, and of safes and locks, made here. Other factory products are: cigars, cigar boxes, wall paper, other paper products, chains and cables, water turbines, artificial teeth, roofing and other building materials.

The city is laid out in blocks 520 feet long and 480 feet wide. The older blocks are built solid along the street, except for occasional narrow alleys, which lead to a second row of houses. The older houses are brick, many have a small porch three or four feet above the sidewalk. The center of the old town was Continental Square, site of the old courthouse. Three old church buildings are: the Friends' Meeting House (1765, 1766, 1780), St. John's Episcopal (1766, 1769), and the First Presbyterian (1789, rebuilt 1860). Christ Lutheran Church, built in 1813, is on the site of buildings of 1743 and 1753. Two modern Lutheran churches, Union (1928) and St. Matthew's (1933) have woodcarvings by the Oberammergau actor, Alois Lang. The principal parks are Highland, Farquehar (on a hill; play grounds; tiny model of the courthouse, built in 1756, torn down in 1841), and Penn Common, a park established by the Penn heirs. The York County Fair grounds have entrances dedicated to World War veterans.

A permanent settlement was made here in 1735 by a German colony, the first white settlement west of the Susquehanna. In 1741 the town was laid out by John, Thomas and Richard Penn. It was incorporated as a borough in 1787 and chartered as a city in 1887. In 1749 the first Court of General Quarter Sessions was held here. The first military company in Pennsylvania to offer resistance to Great Britain was organized in York in 1774. In 1777 the Continental Congress left Philadelphia, fearing capture by Howe's army, and convened in York September 30. Congress continued to hold sessions here until June 27, 1778. In 1863 Confederate forces occupied the city before the Battle of Gettysburg. Rifles were made in York in Colonial times; paper in 1800; a foundry and forge were set up in 1820; and a blast furnace in 1823. Early York achievements included a sheet iron river steamboat, 1825; the prize-winning coal-burning locomotive *York,* 1831; and *Codorus,* the first American wood-burning iron steamboat. The first railroad came in 1850, and the Codorus Canal was opened in 1853. Pop. (1940) 56,712; (1950) 59,704.

YORK, city, South Carolina and York County seat; 76 miles northwest of Columbia; on the Carolina and Northwestern, and Southern railways. Situated in the Piedmont section of the state, York is a tree shaded residential town in a cotton, grain, general farming and pine timber region. Manufactures include cotton and lumber products. Near by is the Kings Mountain National Military Park. York was settled in 1757 and until 1915 was called Yorkville. Pop. (1940) 3,495; (1950) 4,170.

YORK, a river in Virginia, formed by the confluence of the Pamunkey and Mattapony rivers. It is the tidal estuary of the rivers, which begins at West Point and flows southeast to the Chesapeake Bay, into which it empties about 18 miles north of the James River. It is 40 miles long and navigable to the head of tide water. At its entrance, on York Spit, is a lighthouse.

YORK, Battle of, in the War of 1812. Admiral Perry's victory at Lake Erie and Gen.

William Henry Harrison's defeat of Proctor at the Thames successfully concluded one part of the campaign for the invasion of Canada. As the next step Gen. Henry Dearborn planned to capture York (now Toronto), besiege Fort George by land and water, and then move on to Kingston after being joined by the troops at Buffalo, which were to capture Forts Erie and Chippewa. Leaving Sackett's Harbor defenseless, Com. Isaac Chauncey with 14 vessels, carrying 112 guns and 980 men, conveyed Dearborn, Zebulon M. Pike and 1,600 troops to York, which was attacked on the morning of April 27, 1813. The British garrison of 600 regulars and militia under Major General Sheaffe were driven back toward their main works but when about 60 yards away a powder magazine was exploded by the British causing great havoc and killing about 40 British and 100 American soldiers, Pike being among those mortally wounded. Nevertheless the Americans pressed forward and finally drove the regulars toward Kingston and captured the militia, besides large quantities of stores and a 10-gun brigade. The public buildings were then set afire.

YORK AND ALBANY, Frederick Augustus, Duke of. British army officer: b. London, Aug. 16, 1763; d. Jan. 5, 1827. The second son of George III, in infancy he was made prince-bishop of Osnabrück; he retained the bishopric until 1803. In 1784 he had been promoted to the rank of major general in the British army and created duke of York. He married Frederica (1767–1820), daughter of Frederick William II of Prussia, in 1791. During 1793–1795 he served in Flanders in command of the British forces against the French. He was made field marshal in 1795 and appointed commander in chief of the British army in 1798. Because his mistress, Mary Anne Clarke (1776–1852), accepted bribes to secure army promotions, he was removed from his post in 1809. Acquitted of corrupt practices by a House of Commons committee, he was reinstated in 1811. Though incapable as a field officer, he did much to revive the military spirit. Appointed his father's guardian (1818), on George IV's accession he became heir to the throne. He founded the Duke of York's School, London.

YORK COLLEGE, located at York, Nebraska. It was founded under the auspices of the Church of the United Brethren in Christ, and was opened to students in 1890. It is under the control of a board of trustees composed of three members at large, five members from York County, and representatives of nine conferences in the Southwest and Pacific areas of the church. A merger of the founding church and the Evangelical Church makes York College the only educational institution west of the Missouri River operated by the Evangelical United Brethren Church. York is a four-year liberal arts college, and offers work leading to the following degrees: A.B., B.S., and B.S. in Education. Its organization includes today the College of Liberal Arts, Expression Department, a Conservatory of Music, etc. A summer school is also maintained with courses which are intended especially for teachers. The Conservatory of Music offers courses in piano, organ, voice, and violin, and also band and chorus. Instruction in physical training is given, and a full program of sports is carried through the entire year. The students maintain Young Men's and Young Women's Christian Associations, and two literary societies. The college newspaper, *The Sandburr,* is published bi-weekly. A new building, Middlebrook Hall, a combined girls' dormitory and student union, erected at a cost of a quarter of a million dollars, was completed in 1949. The college is a member of the Nebraska Association of Church Colleges. Enrollment (1949–1950) 212.

G. T. Savery,
Business Manager, York College.

YORKSHIRE, county, England, bounded on the north by the Tees, separating it from Durham, east by the North Sea, south by Lincoln, Nottingham, Derby and Cheshire, and west by Cheshire, Lancaster and Westmoreland; area, 6,067 square miles. Yorkshire is divided into trithings, or three ridings, respectively, the north, east and west, each having a separate lord lieutenant, but a single high sheriff for the county. The main portion of the county forms a large central valley stretching southeast to the Humber, flanked on one side by the Pennine range and on the other by the Cleveland Hills, and drained chiefly by the Ouse and its tributaries. Considerably more of the North Riding is pasturage than is under cultivation, but it includes the vale of York, with an area of about 1,000 square miles, in which there is much fertile land growing all kinds of crops. It also includes the Cleveland district, with its great bed of iron ore. In the North Riding is the capital of the whole county, York, Scarborough, a favorite watering place, and Whitby, famous for its jet. In the East Riding the area under cultivation greatly exceeds that laid down in permanent pasture. Its industrial activity is centered in the great seaport of Hull. In the West Riding the proportion of land laid down in permanent pasture is larger than in any other, being two-thirds of that under cultivation. The West Riding has long been famous for its woolen and worsted manufactures, of which it is now the chief seat. Their development has been in modern times aided by the proximity of coal and iron. The great coal field of the West Riding yields not only the Silkstone bituminous coal, most valuable as a house coal, but also the Barnsley thick coal, semi-anthracitic. There are important manufactures of chemicals in both the South and the West Ridings. Leeds produces every variety of woolen goods, as well as manufacturing clothing and paper; Bradford, mixed worsted fabrics and yarns; Dewsbury, Batley and adjoining districts, shoddy; Huddersfield, plain goods, with fancy trousering and coatings; and Halifax, worsted and carpets; Barnsley is famous for its linen manufactures, of which Leeds also is a seat, as well as of that of leather. Next to the woolen and other textile industries comes the manufacture of iron and steel machinery, and implements of every description. Leeds is one of the principal seats of all kinds of mechanical engineering, and Sheffield of iron-work and cutlery. The county was a part of the kingdom of Diera from the 6th century until the Danish Conquest in the 9th century; and it suffered severely under the Norman Conquest. It has many ancient castles and fine examples of ecclesiastical architecture. Pop. (est. 1949) 4,607,590.

YORKTON, town, Canada, capital of Mackenzie District, Saskatchewan, 100 miles northeast of Regina and situated on the Canadian Pacific, and the Canadian National railways.

It is an important agricultural center, and is a distributing point for many wholesale concerns It has a tanning and flour mill, and manufactures brick and lumber. A Royal Canadian Air Force training base was located here during World War II. Pop. (1951) 7,074.

YORKTOWN, yôrk'toun, city, Texas, in De Witt County, 30 miles west-northwest of Victoria, and served by state highways and (for freight only) the Texas and New Orleans Railroad. It also has a municipal airport. A trading center in a farming and oil producing section, it has cotton ginning, cottonseed oil and peanut oil mills, and poultry packing. It was founded in 1848 by Capt. John York and was incorporated in 1871. Government is by mayor and council. Pop. (1950) 2,596.

YORKTOWN, town, Virginia, seat of York County, altitude 50 feet, situated on the York River, 11 miles east-southeast of Williamsburg. Here was fought the last important battle of the Revolutionary War, ending with the surrender of Lord Cornwallis on Oct. 19, 1781. The British threatened the town in 1814, and Union forces under Gen. George B. McClellan besieged it and drove out the Confederates in 1862. The Yorktown Battlefield, much of Jamestown Island, the Colonial Parkway, and the Cape Henry Memorial form the Colonial National Historical Park. Buildings of interest include Grace Church (1697), the Moore House, where the surrender of Cornwallis was negotiated, a courthouse containing records dating back to 1633, an old "customs house" (built about 1706), and a monument commemorating the victory of the allied French and American armies in 1781. The battlefield is preserved as nearly as possible as it was in 1781. For historical details see articles immediately following. Pop. (1950) 384.

YORKTOWN, Siege of, *in the American Revolutionary War.* After the Battle of Guilford Courthouse (q.v.), Lord Cornwallis with his army of 8,000 men withdrew in August 1781 down the York Peninsula to Yorktown in order to secure the protection of the British Fleet, which effectively ruled the coastal waters. He threw up numerous earthworks fortifying the town, and he also erected fortifications at Gloucester Pond, opposite Yorktown, on the York River. The Marquis de Lafayette, who had recognized the possibilities of trapping Cornwallis and had followed him to Yorktown, communicated with General Washington, then in his headquarters on the Hudson River, and the latter, with a force of over 6,000 men, two thirds of them French, left immediately (August 19), traveling by land to Philadelphia, then to Elktown at the head of the Chesapeake Bay, and arriving at Williamsburg September 14.

Meanwhile, the French fleet under Comte François de Grasse, numbering 24 ships of the line, had moved from their anchorage off Newport, Rhode Island, reached the Chesapeake River on August 31, and after anchoring at the mouth of York River, disembarked the 4,000 infantry on board. Cornwallis was securely blockaded both by sea and land, and with the recent additions of the French troops, was now outnumbered two to one. By the beginning of September York River was effectively closed and the Americans and the French began to strengthen their lines.

On September 5, the English squadron under Adm. Thomas Graves, who had been misinformed of the French fleet's whereabouts, appeared in Chesapeake, and in the naval battle that ensued, was thoroughly defeated, returning to New York. Immediately after the battle, the Comte de Barras, commander of a French flotilla at Newport, arrived, bringing with him eight additional ships of the line and 10 transports, also cannon for the siege of Yorktown.

The allied armies, now greatly superior in numbers to the enemy and confident of success, encamped closely around Yorktown and the siege was regularly begun on September 29. The first parallel trench was opened October 6 and completed October 9, when the Americans opened fire and the cannonade became constant and effective. On October 13, the Americans made an assault from a second parallel and the outer works of the British were carried by storm. At daybreak, October 15, the British made a sortie from their encampments with 350 men and succeeded only in spiking a few guns which were promptly restored to action. Cornwallis then attempted a night escape by boats, leaving his sick, wounded, and baggage behind, but a terrific storm frustrated the plan. On October 17 Cornwallis proposed to surrender, and on the 19th Brig. Gen. Charles O'Hara led out the entire British Army into an open field where, in the presence of the allied ranks of France and America, 7,247 English and Hessian soldiers laid down their arms and became prisoners of war; the garrison forces becoming prisoners of the United States, while the sea forces, numbering 850 sailors, were prisoners of the French.

Although neither side was conscious of the fact, the surrender actually represented the end of the war. Yorktown's surrender occasioned the downfall of Frederick North's cabinet in England, and King George III appointed American sympathizers in the new cabinet. There were no more battles of consequence during the Revolutionary War, even though the final drafts for peace did not arrive until nearly a year after the siege.

Consult Arthur, Robert, *The Sieges of Yorktown, 1781 and 1862* (Washington, D.C. 1927); Kibler, J. L., *The Cradle of the Nation* (Richmond, Va. 1931); Bonsal, Stephen, *When the French Were Here* (New York 1945).

YORKTOWN, Siege of, *in the Civil War.* On April 4, 1862, Gen. George B. McClellan, with 53,000 men and about 100 guns, started from Fort Monroe up the York Peninsula for his campaign against Richmond. His plan of operation was to move in two columns, one on the right direct to Yorktown and another along the James River westward of and beyond Yorktown to the vicinity of Williamsburg. Should the Confederate works at Yorktown and Williamsburg offer serious resistance he designed to land Gen. Irvin McDowell's 1st Army Corps, reinforced if necessary, on the left bank of the York or on the Severn, and move it on Gloucester and West Point, in order to take in reverse whatever force the enemy might have on the peninsula and compel him to abandon his positions. At the end of the first day's march Gen. Samuel P. Heintzelman's 3d Army Corps on the right bivouacked at Howard's Bridge and Cockletown beyond, and Gen. Erasmus D. Keyes' 4th Army Corps on the left, at Young's Mill, near James River. On April 5, Keyes resumed his march for the Halfway House, between Yorktown and Wiliamsburg, but had hardly got on the road when it was ascertained

that a large force of the enemy, with a battery, was at Lee's Mill, six miles beyond, barring the way over the Warwick. Keyes advanced and in the afternoon found the situation as reported, and after some artillery firing he encamped for the night. On the right Heintzelman advanced to near Yorktown, came under artillery fire from the works, and encamped fronting them, where he was destined to remain a full month. Yorktown, as well as the line of the Warwick southward to James River, was held by Gen. John B. Magruder with about 11,000 men, and was brilliantly defended.

For 10 days McClellan remained in front of Magruder, making some reconnaissances, but no serious demonstrations, although urged by President Lincoln to move upon and break the enemy's line. McClellan was instead engaged in bringing up troops and guns preparatory to a regular siege and was asking for heavy reinforcements and more heavy siege guns. He adopted the slow method of a siege because of his exaggerated idea of the Confederate strength in his front, although he at no time estimated the forces of Magruder at more than 15,000 to 20,000, and his own initial strength of 53,000 men had been increased to over 100,000 men. He declared himself seriously weakened by the removal of McDowell's corps of 33,400 men to protect Washington which had been left with a guard of less than 20,000 raw troops. However, at McClellan's urgent request, Gen. William B. Franklin's division was sent him April 10, but these troops were held aboard their transports until after the evacuation of Yorktown.

On April 16, an attempt was made upon Magruder's lines at Lee's Mill (q.v.) by a reconnoitering force of 200 men who were not reinforced, but resulted in failure, and McClellan, giving up the idea of carrying the Confederate position by assault, devoted his attention entirely to siege operations against Yorktown. Under the direction of Gen. Fitz-John Porter, who was made director of the siege, Gen. John G. Barnard, chief of engineers, and Gen. William F. Barry, chief of artillery, the operations were conducted elaborately and with great skill. General Barry reports that the siege train consisted of 101 pieces, among them two 200-pounder rifled guns and 40 mortars, varying in size from 13 inches to eight inches. In number and weight of metal these guns were far superior to those of the Confederates. The Confederate general, Joseph E. Johnston, who had been assigned to the defense of the peninsula and Richmond on April 17, had by that date no more than 50,000 troops on the line, and he made no strenuous attempt to interfere with McClellan's operations. However, he had determined to hold his position until McClellan was ready to attack and then to fall back without waiting to have his troops driven from their works. By April 30, McClellan had present for duty 112,392 men, including Franklin's division. McClellan proposed to open fire on the morning of May 6 with all his guns and to press the siege until final assault should be deemed practicable. But Johnston, who had learned that McClellan's batteries were approaching completion and would soon be ready to open fire, made his dispositions for retreat. On the night of May 3, leaving some serviceable heavy guns behind, he evacuated Yorktown and fell back to Williamsburg on the way to Richmond.

Bibliography.—Barnard, J. G., *The Peninsula Campaign* (New York 1864); McClellan, H. R., *McClellan's Own Story* (New York 1887); Allan, W., *The Army of Northern Virginia in 1862* (Boston 1892); Webb, A. S., *The Peninsula* (New York 1881–1908).

YORKVILLE, yôrk'vĭl, village, New York, in Oneida County, altitude 420 feet, situated on the Mohawk River, three miles west-northwest of Utica, and sharing its railway service. Yorkville, chiefly residential, was settled before 1800 and incorporated in 1902. It is on the old road to Fort Stanwix, and is six miles from the Oriskany Battlefield. Henry Inman, the American painter, was born here, and his home, built in 1792, is still standing. Pop. (1950) 3,528.

YORKVILLE, former village, New York, absorbed by New York City. It was bounded by what is now Lexington Avenue to the East River, and by 59th and 96th streets, with its center between 83d and 89th streets, east of the Old Boston Post Road. Points of interest include the Gracie Mansion, built about 1794, and situated in the Carl Schurz Park; Smith's Folly, a tremendous mansion built in 1795, of which only the stables, which have been converted into the Towle House, are standing; the New York Hospital and the Cornell University Medical College; and the famous Rockefeller Institute for Medical Research.

Yorkville was founded about 1790, and was successively a farming village, the center of fine country estates of wealthy New Yorkers, a commuting center from 1834 when the New York and Harlem Railroad connected with Prince Street, and later the section became known as a foreign quarter, first German and Irish, and then Central European.

YORUBALAND, yôr'ŭ-bà-lănd, a former independent kingdom of Africa, now part of Western Provinces, Nigeria, West Africa. The old kingdom was situated between Lagos Lagoon and the Niger River, and the Dahomey Territory and Dini country, and during the 17th century was a strong empire formed by several states of a common linguistic stock. However, owing to Moslem and Fulah depredations, it disintegrated into petty, warring kingdoms about 1830, and in 1888 became a British protectorate.

The natives, called Yorubas, are of Negro stock, but many have light skins, due to Arab and Berber blood. They were more civilized than neighboring tribes of Negroes, being an agricultural race, rather than stock-raising, and they lived in large, well-built communities. Their ancient capital was Ibadan (pop. 1931, 387,133), and other Yoruba cities include Abeokuta (45,763) and Lagos (126,108) Pop. about 3,166,000.

YOSEMITE NATIONAL PARK, yō-sĕm'ĭ-tē, California, one of the great scenic wonders of North America. It was established as a national park in 1890, after it had been ceded by Congress to California in 1864 as a public trust. In 1906, the State of California receded the park to the United States, under whose guidance it has since been. The grant originally embraced Yosemite Valley and the Mariposa Grove of big trees, but now includes within its boundaries Wawona Basin; Hetch Hetchy Valley; Tuolumne Meadows, near which are Waterwheel Falls, Muir Gorge, Tenaya Lake, Mount Lyell Glacier, and the Grand Canyon of the Tuolumne; and Merced and Washburn lakes. It has a total area of 1,182 square miles. The park is reached by

buses from Merced, Calif., which is the gateway town to Yosemite, while in the park itself there are hundreds of miles of bridle paths and hiking trails, and more than 150 miles of auto roads. Camping areas, stores, lodges, and hotels are conveniently located.

The valley is in the shape of a huge U, and is approximately seven miles long and a mile and a half wide. It stands nearly 4,000 feet above sea-level, while the tremendous granite cliffs that surround the valley stand as high as 3,500 feet above that. Over this ring of cliffs cascades the most impressive series of waterfalls in North America, some of them ranking among the world's highest.

Points of Interest.—Entering the valley from the lower end, one passes through the portal formed by El Capitan (7,654 feet), a gigantic mass of granite rising 3,609 feet above the valley floor on the north, and Cathedral Rocks, rising 2,592 feet, on the south. Over the side of Cathedral Rocks pours Bridalveil Fall (620 feet), and opposite is Ribbon Fall (1,612 feet). Through the valley winds the Merced River which initially plunges 594 feet over Nevada Fall, and further down drops 317 feet over Vernal Fall. Opposite Sentinel Dome (8,117 feet) are the Yosemite Falls (upper, 1,430 feet; lower, 320 feet). Between the upper and lower falls is a series of cascades, making the total drop 2,565 feet to the valley floor. Other falls are Illilouette (370 feet) and Widow's Tears (1,170) which flows during the spring. Other peaks surrounding the valley include: Basket Dome (7,602 feet); Clouds Rest (9,930); Glacier Point (7,214); Liberty Cap (7,072); North Dome (8,657); Half Dome (8,852); Eagle Peak (7,773); Taft Point (7,503). Mariposa Grove (q.v.) contains some superb specimens of giant sequoia.

History.—The valley, once the stronghold of the Yosemite (Grizzly Bear) or Awani Indians, was probably first seen by white men when a party led by Capt. Joseph R. Walker viewed it in 1833. The valley was entered in 1851 by a detachment of militia led by James D. Savage, which attempted to drive Tenaya, chief of the Yosemites, out of the valley. Lafayette H. Bunnell, a member of the expedition, suggested naming the valley Yosemity after the Indians living there. John Muir, the American naturalist, lived here from 1868 to 1874, and was later instrumental in helping to establish the national park. Horace Greeley was one of the valley's earliest visitors, and lent his support for preserving it.

YOSHIDA, yō-shē-dä, **Shigeru,** Japanese statesman: b. Tokyo, Sept. 22, 1878. The fifth son of Tsuna Takeuchi, he was adopted as a child by his father's friend, Kenzo Yoshida. He was graduated from Tokyo Imperial University Law College in 1906, and thereafter served in several subordinate posts in the consulates at Tientsin, Mukden, London, and Rome; in the embassies at Washington and London; as consul general in Tientsin (1922–1925) and Mukden (1925–1928); as minister to Sweden (1928); as vice minister of foreign affairs (1928–1930); and as ambassador to Italy (1930–1932) and Great Britain (1936–1939). He was imprisoned from June to August 1945 for urging peace efforts through British channels. In October 1945 he was appointed foreign minister in the Cabinet of Kijuro Shidehara, and on May 16, 1946, headed his first Cabinet—a coalition of Liberals and Progressives—which was sworn in on May 22. Originally criticized for his defense of Japan's conquest of Manchuria and for his associations with the Zaibatsu (family industrial monopolies), Yoshida emerged as Japan's leading political figure in the postwar occupation period. Regarded as ultra-conservative and pro-Western in viewpoint, he remained premier (except for the period May 1947 to October 1948) through several political and economic crises, and signed the Japanese Peace Treaty at San Francisco on Sept. 8, 1951.

YOSHIHITO, yō-shē-hē-tō, emperor of Japan: b. Tokyo, Aug. 31, 1879; d. Hayama, Dec. 25, 1926. The third son of Mutsuhito (Emperor Meiji), he was proclaimed heir apparent on his eighth birthday, and acceded to the throne as 123rd emperor (reign name, Taisho) on his father's death, July 30, 1912. He was educated at the Peer's School (1887–1891) and studied under tutors, traveled widely throughout his realm, and served in the House of Peers from 1897 until his accession. He was married to Princess Sadako in 1900; Hirohito, eldest of their four sons, succeeded him.

YOSHIMASA, yō-shē-mä-sä, Japanese shogun: b. 1435; d. 1490. Eighth in the line of Ashikaga shoguns, he was the grandson of Yoshimitsu (q.v.). His rule (1443–1474) was characterized by uprisings in 1461, resulting from famine and pestilence, and by the civil war of 1467–1477. He was known as an art patron, particularly of painting and the theater.

YOSHIMITSU, yō-shē-mē-tsōō, Japanese shogun: b. 1358; d. 1395. The third and most powerful of the Ashikaga shoguns, he ruled from 1367 to 1395. During these years he was instrumental in halting the civil war between the north and south (1392), in subduing piracy, and in fostering relations with China. On his retirement he became a monk, but continued to exercise authority from his palace at Kyoto.

YOSHINOBU, yō-shē-nō-bōō (also known as Hitotsubashi, hē-tō-tsōō-bä-shē), Prince Tokugawa. See Tokugawa.

YOSHITSUNE, yō-shē-tsōō-nĕ, Japanese warrior: b. 1159; d. 1189. The son of Yoshitomo, he was exiled as a child by the Taira clan, but escaped from his monastery prison with the priest, Benkei, and in 1180 led the Minamoto clan in an uprising against the Taira clan which culminated in the annihilation of the latter at Dan no Ura in 1185. Thereafter he was cruelly treated and finally slain by order of his jealous brother, Yoritomo, who became shogun in 1192.

YOST, yōst, **Fielding Harris,** American athletic director: b. Fairview, W. Va., April 30, 1871; d. Ann Arbor, Mich., Aug. 20, 1946. Educated at Lafayette College and the University of West Virginia, he coached football at several universities before becoming head coach at the University of Michigan (1901–1927) and director of athletics there (1921–1941). He devised several outstanding blocking and signaling systems in collegiate football, and wrote *Football for Player and Spectator* (1905).

YOUGHAL, yôl, urban district and seaport, Ireland, in County Cork, located on the

Blackwater, 27 miles east of Cork. The parish church is formed of the nave and aisles of the ancient collegiate church, built by the earl of Desmond in 1464; the Water Gate, the Clock Gate and Sir Walter Raleigh's house, Myrtle Grove, are other notable features. The export of agricultural produce and the fisheries are the chief industries. According to local tradition the potato was first planted at Youghal by Raleigh, who was mayor in 1588. Pop. (1951) 3,197.

YOUMANS, yōō'mănz, **Edward Livingston,** American scientist: b. Coeymans, N.Y., June 3, 1821; d. New York, Jan. 18, 1887. Partially blind at times through many years of his life, he pursued his studies by the aid of his sister, Eliza Ann Youmans, and became widely known as a popularizer of science. He lectured extensively and, in 1872, founded *Popular Science Monthly,* which he continued to edit until his death.

YOUMANS, Vincent, American popular song and musical comedy composer: b. New York, N.Y., Sept. 27, 1898; d. Denver, Colo., April 5, 1945. At the age of four he began playing chords on the piano, which encouraged his mother to have him study with the organist, Charles André Feller, and other teachers. After attending Trinity School at Mamaroneck, N.Y., and Heathcote Hall at Rye, N.Y., he entered a Wall Street brokerage house as a clerk in 1916. He enlisted in the navy during World War I and was assigned to an entertainment unit at Great Lakes Naval Training Station, where he was soon producing and writing musical shows. After the armistice he secured a job as song plugger for T. B. Harms, music publishers, and then rehearsed singers for Victor Herbert's musical productions. His first important success came with *Oh, Me! Oh, My! Oh, You!* sung in *Two Little Girls in Blue* (1921). Together with Herbert Stothart, he wrote the songs for *Wildflower, Mary Jane McKane,* and *Lollipop* (1923). The greatest triumph of his career was the score for *No, No, Nanette,* which opened in London and New York in 1925, and eventually had 17 companies touring throughout the world. Later shows for which he provided the music were *A Night Out* (1925); *Oh Please* (1926); *Hit the Deck* (1927); *Rainbow* (1928); *Great Day* (1929); *Smiles* (1930); *Through the Years* and *Take a Chance* (1932). In 1933 he went to Hollywood to write the score for the film, *Flying Down to Rio,* but that same year was forced to retire because of tuberculosis. For the next 10 years he lived in Colorado and California, studying serious music and working on an opera and a symphony. In 1944, his unsuccessful production of *Vincent Youmans' Ballet Revue* opened in Baltimore, but never reached Broadway.

During the 1920's and early 1930's, Youmans was one of the most gifted and prolific of the younger group of popular song and musical comedy composers. Among his best known songs were *Tea for Two; I Want to Be Happy; Hallelujah; Sometimes I'm Happy; Without a Song; Carioca; Drums in My Heart;* and *Orchids in the Moonlight.*

YOUMANS, William Jay, American chemist, brother of E. L. Youmans (q.v.): b. Milton, Saratoga County, N.Y., Oct. 14, 1838; d. Mount Vernon, N.Y., April 10, 1901. He studied chemistry at Columbia College and at the Sheffield Scientific School, New Haven, and was graduated from the medical department of the New York University in 1865 and practiced his profession for a time at Winona, Minn. In 1871 he was called to assist his brother editing the *Popular Science Monthly.*

YOUNG, yŭng, **Arthur,** English agricultural writer: b. London, Sept. 11, 1741; d. there, April 20, 1820. He was intended for a mercantile career, but early adopted the profession of agriculture, carrying on farms at various places, and especially on his paternal estate, near Bury Saint Edmunds. He soon became famous as a writer on farming and allied topics and especially for his agricultural tours. He also carried on an extensive correspondence with public men both at home and abroad, Washington being one of his correspondents. In 1784, he began the publication of his *Annals of Agriculture* of which 46 volumes were issued. This work had the most important influence upon the art of agriculture in England and a considerable portion of it was translated into French under the auspices of the government. In 1793, he was appointed secretary of the newly erected board of agriculture, with a salary of £400 a year. Young not only visited and examined with great attention many parts of England and Ireland, but also made several tours on the Continent. His work was highly important, not only in its service to agriculture, but from the standpoint of social and political observation. He became blind some years before his death.

Among his numerous works are *The Farmer's Letters to the People of England* (1767; enlarged edition 1777); *Six Weeks' Tour through the Southern Counties* (1768); *Six Months' Tour through the North of England* (1770); *Farmer's Guide* (1770); *Farmer's Tour through the East of England* (1771); *The Farmer's Calendar* (1771); *Tour in Ireland* (1780); *Travels in France during the Years 1787–1789* (1792–1794), treating of agriculture and national resources, the social and political condition of the people, this volume is the most trustworthy source of information regarding the state of France on the eve of the revolution; *Essays on Manures* (1804); *The Rise of Prices in Europe* (1815). By order of the French Directory his agricultural works were published in French in 20 volumes entitled *Le Cultivateur Anglais* (1800–1801).

Consult Leslie, Stephen, *Studies of a Biographer* (1898); his autobiography edited by Miss Betham Edwards (1898); and bibliography by Anderson in Hutton's edition of *Tour in Ireland* (1892).

YOUNG, Brigham, president of the Church of Jesus Christ of Latter-day Saints (commonly called the Mormon Church) from 1844 to 1877: b. Whittingham, Vt., June 1, 1801; d. Salt Lake City, Utah, Aug. 29, 1877. In early life he moved to Cayuga County, N.Y., where he followed the occupation of carpenter and glazier. In 1829, he moved to Mendon, N.Y., where he obtained from Samuel H. Smith, brother of Joseph Smith, the prophet, a copy of the Book of Mormon. His investigation resulted in his conversion and he joined the church, being baptized and confirmed April 14, 1832. He was ordained an elder and immediately began active service in the ministry, preaching and baptizing in the regions about Mendon. When the main body of the Latter-day Saints settled

in Kirtland, Ohio, he also made his residence there, and was actively engaged traveling and laboring in the ministry. He also spent much of his time as a carpenter and builder, assisting in the erection of the Kirtland Temple in 1833–36, and having the supervision of much of the work on that building. When the Council of the Twelve Apostles was organized in 1835, he was chosen as a member of that body, and, following the death of David W. Patten, became president of that council, which is the second council in the Church. He passed through the persecutions in Missouri in 1838–39 and led the members of the Church from that State to their refuge of safety in Illinois, following the exterminating order given by Gov. Lilburn W. Boggs of Missouri. In the fall of 1839 he started on a mission to Great Britain, where, with other members of the Council of Apostles, he labored until 1841, preaching and organizing branches throughout the British Isles, where thousands of converts joined the Church. Following the assassination of Joseph and Hyrum Smith, in 1844, Brigham Young, by virtue of his position as president of the Twelve Apostles, became the presiding officer of the Church, and when the Council of the First Presidency was again organized, he was unanimously chosen president, with Heber C. Kimball and Willard Richards as his counselors. On the forcible expulsion of the Church from Illinois in 1846, he led the Latter-day Saints through toils and dangers, which nothing but the most untiring energy could have conquered, over the plains and tablelands to the valley of the Great Salt Lake. Here, in the heart of the Rocky Mountains, he founded Salt Lake City, 24 July 1847, in a land most uninviting. Due to untiring industry and determined perseverance, this exiled people, under his direction, soon made the deserts blossom and the waste places fruitful and a pleasant habitation. In 1849 an attempt was made to organize a State, to be called the State of Deseret, that being the name given by the Latter-day Saints to that region. The United States government refused to sanction the new State, but in 1850 the Territory of Utah was organized and Brigham Young was appointed governor by President Fillmore. He served in that capacity until 1858, when he was succeeded by Alfred Cummings of Georgia. A false report having reached Washington that the «Mormons» had burned the court records and were in rebellion, President Buchanan sent out an army to the Territory. President Young declared that the Latter-day Saints had been driven and persecuted by armed forces so many times that they would not be so driven again. If an army with hostile intent entered the Territory they would find it a barren waste, in the condition in which the pioneers found it in 1847. The body of the people journeyed to the southern portion of the Territory, leaving in Salt Lake City only enough forces to apply the torch to every substance, including their homes, that would burn. When it was discovered that the records were intact and that the report of a «Mormon» rebellion was false, the matter was amicably settled.

During the administration of President Young, the doctrine of marriage for eternity, including plural marriage, was openly taught. This doctrine was based on a revelation given to Joseph Smith and recorded in July 1843. The practice of plural marriage brought on opposition, and laws were later passed by Congress against the doctrine, which finally resulted, during the administration of President Wilford Woodruff, in the abandonment of the practice by the Latter-day Saints.

Brigham Young was the friend of true education and with his associates founded the University of Deseret, now the University of Utah; the Brigham Young Academy, now the Brigham Young University in Provo, and the Brigham Young College in Logan, Utah. He encouraged and assisted in the building up of the Union Pacific and Southern Pacific railroads and the telegraph line across the plains, and in various other ways was the prime mover in the great development of the West. See MORMONS.

YOUNG, Charles Augustus, American astronomer: b. Hanover, N. H., 15 Dec. 1834; d. 4 Jan. 1908. He was graduated at Dartmouth in 1853, was professor of mathematics, physics and astronomy in Western Reserve College (1857–66); and of astronomy and physics in Dartmouth (1866–77). He was professor of astronomy at Princeton 1877–1906. He accompanied the eclipse parties to Iowa in 1869, and to Spain in 1870; the transit of Venus party to Peking, China, 1874, and organized the Princeton eclipse expedition to Denver in 1878. He was the discoverer of the green line of the solar corona in 1869, identifying it with the line 1,474 of Kirchoff's scale. At the 1870 eclipse he detected the so-called «reversing layer» surrounding the solar photosphere, and in 1872 at Sherman, Wyo., noticed the bright reversal of many lines of the solar spectrum in ordinary sunlight. He was recognized as an authority in spectroscopy and lectured in the courses of the Peabody Institute at Baltimore, the Lowell Institute at Boston, and at many colleges. He wrote 'The Sun' (1882); 'General Astronomy' (1889); 'Elements of Astronomy' (1890); 'Lessons in Astronomy' (1891); 'Manual of Astronomy' (1902).

YOUNG, Charles Mayne, English tragedian: b. London, 10 Jan. 1777; d. Southwick, Sussex, 28 June 1856. In 1798 he made his début at Liverpool as Young Norval and his first appearance in London, in 1807, was as Hamlet. As Hamlet, Iago and Falstaff he was seen at his best, but his repertoire was very extensive. In 1829 he declined an offer of $50,000 for a 10 months' tour in the United States and in 1832 retired with a fortune of $300,000. At his farewell benefit at Covent Garden, 31 May 1852, he appeared as Hamlet, with Mathews as Polonius, and Macready as the Ghost. Consult J. C. Young, 'Memoirs of Charles Mayne Young' (1871).

YOUNG, Clark Montgomery, American educator: b. Hiram, Ohio, 1856; d. 1908. He attended Hiram College and after 1883 was employed in educational work in South Dakota. He was secretary of the Territorial board of education of Dakota in 1889 and of the State board of education of South Dakota, and in 1892 became professor of history and sociology in the University of South Dakota, where he was dean of the faculty from 1902. Author of 'The State and Nation' (with G. M. Smith); 'History and Government of South Dakota'; 'Elements of Pedagogy'; etc.

YOUNG, Edward, English poet: b. Upham, Hampshire, July 3, 1683; d. Welwyn, Hertfordshire, April 5, 1765. He was educated at Oxford and in 1708 was nominated to a law fellowship in All Souls College. Befriended by the Duke of Wharton, an annuity of £100 was granted him by the duke. In 1719 and 1821, respectively, appeared his tragedies of *Busiris* and *Revenge,* both produced at Drury Lane. In 1725 he began the publication of a series of satires, *The Universal Passion.* He now took holy orders and in 1728 was nominated one of the royal chaplains. In 1730 the College of All Souls presented him with the rectory of Welwyn, in Hertfordshire, to which the lordship of the manor was attached. In 1731 he married Lady Elizabeth Lee, daughter of the Earl of Lichfield, and after his marriage the poet lived much in retirement at Welwyn, sadly disappointed that church preferment, which he so eagerly desired and so unscrupulously belauded those in power to obtain, was refused him. The work by which he is best known is *The Complaint, or Night Thoughts on Life, Death and Immortality* (1742–45), a series of argumentative poems in blank verse, intended to prove the immortality of the soul and the truth of the Christian religion—a work displaying great force of pious and somewhat gloomy reflection, and containing many lofty passages, but marred by a straining after antithesis and ornament. The *Night Thoughts* were translated into French and German and were as popular on the Continent as at home. Of Young's three tragedies, *Busiris* (1719) *The Revenge* (1721); and *The Brothers* (1753), only the second has kept a place on the stage. His *Night Thoughts* has never since ceased to be popular and many of its sententious lines have become proverbial. The poem is not destitute of real excellence, but a note of insincerity runs through it and the poet too often substitutes pomposity for dignity. Consult Mitford edition of Young's *Poetical Works* with *Life* (1854); Thomas, *Le poète Edward Young* (1901); *Worldliness and Other-Worldliness,* by George Eliot, in *Westminster Review* for 1857, reprinted in her *Essays and Leaves from a Notebook* (1884).

YOUNG, Ella Flagg, American educator: b. Buffalo, N.Y., Jan. 15, 1845; d. Washington, D.C., Oct. 26, 1918. She was educated at the Chicago Normal School, and took the degree of Ph.D. at the University of Chicago in 1900. She engaged in teaching in 1862, and was married to William Young in 1868. She was appointed superintendent of schools in Chicago in 1887, and in 1899 she became professor of education at the University of Chicago. She served as principal of the Chicago Normal School in 1905–09, and in 1909 she again became superintendent of Chicago schools, resigning in 1915. She was actively connected with various educational associations, and was in 1910–11 the first woman president of the National Education Association. In 1906–09 she edited the *Educational Bi-Monthly.* She published *Isolation in the School* (1901); *Ethics in the School* (1902); *Some Types of Modern Educational Theory* (1902), etc. Consult McManis, John T., *Ella Flagg Young* (Chicago 1916).

YOUNG, Franklin Knowles, American author and inventor: b. Boston, Mass., Oct. 21, 1857. He is the inventor of an automatic breech action for small arms and field artillery. Author of *The Minor Tactics of Chess* (1894); *The Major Tactics of Chess* (1898); *Grand Tactics of Chess* (1898); *Chess Strategics Illustrated; Field Book of Chess Generalship* (1923).

YOUNG, Sir Frederick, English publicist: b. London, June 21, 1817; d. Nov. 9, 1913. He was formerly a London merchant and traveled extensively in Greece, Turkey, South Africa and Canada. He was active in securing Victoria Park, London and Epping Forest to the public, and in establishing the People's Palace. He took great interest in emigration and was one of the earliest advocates of imperial federation. He published *Long Ago and Now* (1863); *New Zealand: Past, Present, and Future; A Winter Tour in South Africa* (1890); *A Scheme for Imperial Federation* (1895); *Exit Party* (1900); *A Pioneer of Imperial Federation in Canada* (1902), etc., and edited *Imperial Federation* (1876).

YOUNG, Frederic George, American educator: b. Burnett, Wis., June 3, 1858. He was graduated at Johns Hopkins University in 1886; was vice-principal of the State Normal School, in Madison, S. Dak., 1887–90; principal of the Portland High School, Ore., 1890–94; president of Albany College, Ore., 1894–95; and professor of economics and sociology in the University of Oregon 1895–1920; dean of the Graduate School 1900–20 and dean of the School of Sociology after 1919; editor of the *Commonwealth Review* of the University. He edited *Sources of the History of Oregon* and the *Quarterly Journal of the Oregon Historical Society.* Author of *Exploration Northward* (1898); *The Lewis and Clark Expedition in American History* (1901); *Procedure for Tax Reform in Oregon* (1909). Died Jan. 4, 1929.

YOUNG, George Ulysses, American mine owner and public official: b. Hamburg, Ind., Feb. 10, 1867. His parents emigrated to Kansas in 1880, and two years later, he began teaching school. He was admitted to the bar in 1890, and worked for several years in railroad construction. He was principal of the Williams schools (Arizona) for four years, and while there was owner of the Williams *News,* with Capt. W. O. O'Neill. Since 1903 he has been in the mining business, becoming vice-president and general manager of the Madizelle Mining Company, and president of the Young Mines Company. In 1916 he was elected mayor of Phœnix, Ariz., the first to serve under the commission form of government. From 1909–12 he was territorial secretary of Arizona.

YOUNG, James, Scottish chemist: b. Glasgow, July 13, 1811; d. May 14, 1883. He began his career as a cabinetmaker, but in the evenings studied chemistry under Professor Graham in Anderson's College, Glasgow, and became his assistant both there and afterward at University College, London (1832–38). Receiving appointments in chemical works at Manchester and elsewhere, he discovered a method of distilling oil from bituminous shale, and thus became the founder of the mineral-oil industry of Scotland, besides leading to the development of the petroleum industry in

America and elsewhere. (See PARAFFIN). He acquired a large fortune, endowed a chair of chemistry in Anderson's College, and fitted out at his own expense an expedition in search of Livingstone in 1872.

YOUNG, James Thomas, American publicist: b. Philadelphia, Pa., 23 Sept. 1873. He was graduated at the University of Pennsylvania 1893, and later studied at German, French and Swiss universities, taking the degree of Ph.D. at Halle in 1896. He is at present professor of public administration, University of Pennsylvania. He is the author of 'The New American Government and Its Work' (3d ed. 1933), and articles on political science and university training for business.

YOUNG, Jesse Bowman, American Methodist clergyman and author: b. Berwick, Pa., 5 July 1844; d. 1914. He graduated at Dickinson College in 1868, but had previously served three years in the Union army during the Civil War, becoming captain in the 84th Pennsylvania volunteers. Entering the ministry in 1868, he held pastorates in Pennsylvania and Kansas City, Mo., and was subsequently editor of the *Central Christian Advocate* (1892–1900). Author of 'What a Boy Saw in the Army'; 'Days and Nights on the Sea'; 'Helps for the Quiet Home' (1900); 'Our Lord and Master' (1903); 'Wellsprings in the Desert' (1905); 'Charms of the Bible' (1910); 'The Battle of Gettysburg' (1913), etc.

YOUNG, SIR John, BARON LISGAR, English statesman: b. Bombay, India, 31 Aug. 1807; d. Ireland, 6 Oct. 1876. He was graduated at Oxford in 1829, called to the bar in 1834, and sat in the House of Commons in 1831–55. He was lord of the treasury 1841–44; secretary of the treasury in 1844–46; chief secretary for Ireland in 1852–55; and lord high commissioner of the Ionian Islands 1855–59. He succeeded to the baronetcy on the death of his father in 1848 and from 1861 to 1867 was governor to New South Wales. Appointed governor-general of Canada in 1868 he filled this post till 1872, when he was succeeded by the Earl of Dufferin. During his Canadian governorship he suppressed the Riel rebellion in 1870 and was rewarded with the title of Baron Lisgar.

YOUNG, John Russell, American journalist: b. Downingtown, Pa., 20 Nov. 1841; d. Washington, D. C., 17 Jan. 1899. In 1857 he was copyholder on the Philadelphia *Press;* and later its news editor. At the outbreak of the Civil War he became war correspondent, and was with the Army of the Potomac from the battle of Bull Run to the end of the Chickahominy campaign, when he returned to Philadelphia and became managing editor of the *Press.* In 1865 he joined the editorial staff of the New York *Tribune,* resigning in 1869; established the *Morning Post* in Philadelphia; and the *Standard* in New York (1869); and was European correspondent of the New York *Herald* (1871–77). As correspondent of that paper he accompanied General Grant in his journey round the world in 1877, and was attached to the editorial staff of the *Herald* 1879–82. He was Minister to China 1882–85; and was appointed librarian of Congress 30 June 1897. Author of 'Around the World with General Grant' (1879); and editor of 'Memorial History of Philadelphia' (1895).

YOUNG, Owen D., American lawyer and industrial executive: b. Van Hornesville, N. Y., 27 Oct. 1874. He was graduated from St. Lawrence University (New York) in 1894, and from the law school of Boston University in 1896. He began practice in Boston in the latter year, and until 1913 was a member of the firm of Tyler and Young. Since then he has devoted the greater part of his time to industrial matters and to public service. Although well known prior thereto, Mr. Young established an international reputation in 1924, when as a member of the First Committee of Experts appointed by the Reparations Commission, he went to Europe and assisted in framing the so-called Dawes Plan, under which Germany made reparation payments to the Allies until 31 Aug. 1929. Mr. Young served as temporary Agent-General for Reparations under this plan during its inauguration. In 1928 he was appointed a member of the second commission of experts chosen to work out a plan of reparation payments based on a revision of the Dawes Plan, and served as chairman thereof. The commission sat at Paris from 11 Feb. until 7 June 1929, and turned in a report which came to be known as the «Young Plan.» In 1919 Mr. Young served as an alternate member of President Wilson's first Industrial Conference, and as a member of the same executive's second Industrial Conference. In 1921 he served as a member of President Harding's Conference on Unemployment; in 1924, as a member of the National Distribution Conference, and also as unofficial adviser to the London Conference of Premiers; in 1925–28 as chairman of the American Section of the International Chamber of Commerce. Mr. Young is president of the board of trustees of St. Lawrence University; of the Walter Hines Page School of International Relations; member of the General Education Board; of the International General Education Board; a trustee of Teachers College, Columbia University; of the Brooklyn Law School. The honorary degree of LL. D. has been conferred on him by Union College (1922), Tufts College, Harvard University, Dartmouth College (1924), Johns Hopkins University, Colgate University, Columbia University, Yale University (1925), Rutgers University, Princeton University, Lehigh University (1926), Brown University, University of the State of New York (1928), Hamilton College (1929), and University of California (1930). New York University conferred the degree of D. C. S. on him in 1927. He was chairman of the board of the General Electric Company, (1922–39), chairman of the board of the Radio Corporation of America until 1929, and is an officer or director of numerous other great corporations, including the Federal Reserve Bank of New York. Japan decorated him with the Order of the Rising Sun (4th class), 1921; France made him a commander of the Legion of Honor in 1924; Belgium conferred on him the Grand Cross of the Crown of Belgium in 1930.

YOUNG, Samuel Baldwin Marks, American soldier: b. Pittsburgh, Pa., 1840. He rendered important service in the Civil War, entering the Volunteer Army of the Union in 1861 as a private, and rose to a colonelcy at the end of the war. He was brevetted major for services at Sulphur Springs (1863); lieutenant-colonel at Amelia Springs (1865); colonel at Sailors Creek (1865) and brigadier-general of volunteers for his share in the final

action against General Lee. At the close of the Civil War he entered the regular army as second lieutenant, took part in the Indian Wars, commanded a brigade at Santiago, and won a decisive victory at Las Guasimas 24 June 1898. In 1899 he was in charge of the cavalry advance of Lawton's Division in its march through northern Luzon, and for his services was appointed military governor of northwestern Luzon; and later commander of the first district of the Department of Northern Luzon. He was then appointed commander of the Department of California. In 1902 he became first president of the Army War College Board, chief of staff and lieutenant-general of the army. He was retired 9 Jan. 1904. In 1909–10 he was president of the Brownsville Court of Inquiry; and from 1910 to 1917 was governor of the Soldiers' Home at Washington, D. C. Died 1 Sept. 1924.

YOUNG, Samuel Hall, American Presbyterian clergyman: b. Butler, Pa., 12 Sept. 1847. He was graduated at the University of Wooster, Ohio, in 1875, and at the Western Theological Seminary, Allegheny, Pa., in 1878; and ordained in the Presbyterian ministry in 1878. Going to Fort Wrangel, Alaska, as a missionary and explorer in 1878, he organized the first Protestant church in Alaska in 1879; and afterward held pastorates in California, Illinois, Iowa and Ohio. Sent to the Klondike in 1897, he established the First Presbyterian Church in Dawson in 1898; and organized missions in Eagle, Romfort, Nome and Teller. He was superintendent of Presbyterian missions in Alaska 1901–13; special representative for Alaska of the Presbyterian Board of Missions, New York, 1913–21; general missionary for Alaska 1922–25, and special representative. D. 1927. Author 'Alaska Days' with John Muir (1915).

YOUNG, Thomas, English physicist and archæologist: b. Milverton, Somerset, 13 June 1773; d. London, 10 May 1829. He was of Quaker parentage, and at the age of 14 possessed a remarkable knowledge of Latin, Greek, French, Italian, Hebrew, Persian and Arabic. He studied medicine at London and Edinburgh, taking his M.D. at Göttingen in 1796 and later studying at Cambridge. As early as 1799 Young wrote his celebrated memoir on the 'Outlines and Experiments respecting Sound and Light,' which speedily conducted him to the discovery and demonstration of the interference of light. This discovery alone, according to Sir J. Herschel, would have sufficed to have placed its author in the highest rank of scientific immortality. He described astigmatism in 1801; formulated a correct theory of color perception; and made important contributions to hæmadynamics. In 1801 he became professor of natural philosophy at the Royal Institution, and in 1802 foreign secretary to the Royal Society — an office which he held for the remainder of his life. The series of lectures delivered in connection with his professorship form the substance of his great work, 'Natural Philosophy and the Mechanical Arts' (1807). In 1811 he was elected physician to Saint George's Hospital. In 1818 he was appointed secretary to the board of longitude, superintending the 'Nautical Almanac.' He became also a linguist of high ability and is known for his successful pioneer work in deciphering Egyptian hieroglyphic inscriptions and working out the hieroglyphic alphabet. He was author of many scientific papers and of 'An Account of Some Recent Discoveries in Hieroglyphical Literature and Egyptian Antiquities' (1823). Consult Peacock, 'Life of Young,' and 'Miscellaneous Works,' edited by Peacock and Leitch (1855).

YOUNG, Sir William, Canadian jurist and statesman: b. Falkirk, Scotland, 8 Sept. 1799; d. Halifax, Nova Scotia, 8 May 1887. He was educated at Glasgow University, and later joined his parents in Nova Scotia, where he was admitted to the bar in 1826. He was elected to the legislature of Nova Scotia in 1832, and in 1839 he was, with Herbert Huntington, delegated to go to England to urge the establishment of a responsible government for Nova Scotia. He was appointed a member of the Executive Council in 1842, and in 1843–54 he was speaker of the legislature. He was Premier and Attorney-General of Nova Scotia in 1854–57, and was again Premier in 1859–60. He then retired from politics, and was appointed Chief Justice of the Supreme Court of Nova Scotia in August 1860. He was knighted in 1868; and in 1881 he retired from the bench.

YOUNG, William, American poet and dramatist: b. Illinois, 1847; d. 2 Oct. 1920. He published 'Wishmakers Town,' poems (1885–98); and the plays: 'Jonquil' (1871); 'The Rogue's March' (1872); 'Pendragon,' verse (1881); 'The Rajah' (1883); 'Ganelon,' verse (1888); 'The Home of Mauprat,' with J. G. Wilson (1882); 'Joan of Arc,' adaptation in verse (1890); 'If I Were You' (1892); 'Young America' (1894); 'The Princess of Bagdad' (1896); 'Ben Hur,' dramatization (1899); 'Woman's Wiles' (1898); 'The Sprightly Romance of Mersac' (1900); 'Oh, What Riddles these Women Be!'; narrative poem (1900); 'A Japanese Nightingale' a dramatization (1903); and 'The Sea-Green Man' (1907).

YOUNG ENGLAND, a political party active in London about 1844 and led by Mr. Disraeli, after he had begun to oppose the general policy of Sir Robert Peel. Besides its founder it contained some young men of ability and position, prominent among them being Lord John Manners, later Duke of Rutland; George Smythe, afterward Viscount Strangford; and Baillie-Cochrane, afterward Lord Lamington. Its program was the reconciliation of the aristocracy and the Church on the one hand, and the people on the other; and its adherents sought to re-establish the political ascendency of the aristocracy by demonstrating its ability to govern. Its principles were attractively expounded in Disraeli's two fictions, 'Coningsby' and 'Sybil.'

YOUNG GERMANY, a group of literary and political innovators in Germany, headed by Heine (q.v.). Its followers were devoted to the promotion of liberal ideals in literature and in politics, among them being Börne, Gutzkow, Laube, Heller and Kühne. The movement was strongest in the 1830's and collapsed after the failure of the revolution of 1848.

YOUNG IRELAND, the name applied to an Irish political group, active between 1840

and 1850. They at first adhered to O'Connell, but soon became very radical in their opinions; advocated physical force, and separated from the conservative Irish politicians in 1844. *The Nation* was their political organ and in this journal the Irish people were constantly incited to revolt. In 1848 John Mitchell (q.v.), one of the leaders of the party, was arrested and sent to Tasmania, and the attempted insurrection which followed soon collapsed, two of the leaders, T. F. Meagher (q.v.), and W. S. O'Brien (q.v.), being sentenced to death, but their sentences were presently commuted to transportation.

YOUNG ITALY («Giovane Italia»), a society of Italian republicans formed by Giuseppe Mazzini (q.v.) in 1831, whose aims were the emancipation of the Italian peninsula from the control of Austria, and the union of the various portions of the country under a republican rule. Its greatest activity was in 1834, when Mazzini led an unsuccessful invasion of Savoy. The influence of the society soon declined, but it was of service in arousing Italian patriotism and it formed the model for similar organizations elsewhere in Europe, such as Young France, Young Germany, etc.

YOUNG MEN'S CHRISTIAN ASSOCIATION. A Young Men's Christian Association is an organization composed of young men who are united together for the purpose of ministering to the spiritual, intellectual, social and physical needs of young men. Any young man of good moral character, regardless of race or creed, may become a member of this organization and enjoy its privileges; but only active members, who are ordinarily members of Protestant evangelical churches, can vote or hold office. Local associations are usually under the administration of a board of directors, which employs to administer its work officers known as general secretaries, physical directors, boys' secretaries, etc. Local societies are independent and autonomous in their administration, but are affiliated together into state and interstate, as well as national unions. These national unions are under the administration of a national committee. The national organizations are further united into a world's organization, having its headquarters at Geneva, Switzerland. The world's organization is administered by what is known as the central or World's Committee of Young Men's Christian Associations, 52 Rue des Paquis. Since December 1924 the official organization of the general body in the United States has been the National Council of the Young Men's Christian Associations of the United States. A similar National Council exists in Canada. The corporate title of the National Council of Y. M. C. A.'s of the United States is The International Committee of Young Men's Christian Associations.

History.—The establishment of the Young Men's Christian Association was occasioned by the growth of the modern city. The growth of cities to be found throughout the more industrial parts of the world created an environment which made necessary special efforts in behalf of young men. Without the rise of the city, the parlors, gymnasiums, reading-rooms, educational classes, Bible studies, religious meetings of this youth organization of over 1,761,000 members throughout the world with its secretaries, directors, committees, unique buildings, and useful influence would never have been started.

The association movement was founded by a young man who came from the country to the city. It was founded at first for commercial young men living away from home in cities. Without the spread of the city it might have remained a London institution, and never have become a world-wide organization. The city has become the dominant factor in modern life. Young men form the largest and most important element of the large army which is annually invading the city from the country. The proportion of young men in the city is much larger than in rural districts. In the city, the home and the church have a smaller place in the life of the average young man than in the country. The city is full of opportunities to gratify temptation. Contrasted with the country, where life is in the open air and activity is chiefly muscular, life in the city is indoors and far more full of nervous excitement. It should also be said that the city has brought young men together in large numbers, and so made possible an organization among themselves in their own behalf.

The history of the association falls into five periods: (I) Founding of the Association, 1844–55; (II) Development of the Association Ideal, 1855–78; (III) Expansion of the Movement, 1879–1913; (IV) Work During the World War, 1914–19; (V) The Last Two Decades.

Period I, 1844 to 1855. Founding of the Young Men's Christian Association.—The founder of the Young Men's Christian Association, George Williams, later Sir George Williams, who was born at Ashbury Farmhouse, near Dulverton, southern England, in 1821, grew into manhood at the time when the industrial revolution in England was attracting young men from the country to the town. He went to London in October 1841, and became a clerk in the dry goods establishment of which he was afterward the proprietor. At that time there were some 80 young men employed in the different departments of the business. Through Mr. Williams' efforts, a Young Men's Christian Association was organized, for the purpose of establishing religious services and Bible classes among the young men employed in various houses of business in London. This organization took effect on 6 June 1844. The name was suggested by Christopher Smith, George Williams' roommate. The constitution provided that the association should seek to promote the spiritual and mental improvement of young men engaged in the drapery trade, that its membership should be young men who gave decided evidence of conversion to God and that its management should be in the hands of a small board chosen from the membership. This movement rapidly assumed important proportions. Prayer meetings and Bible classes were soon established in 14 different business houses, and a «missionary» to young men was employed in January 1845. In 1848 apartments were rented, in which a library, reading-room, restaurant, social parlors and educational classes were provided; and young men who made no religious profession were invited, upon the payment of a small fee, to use the privileges of the organization, though they were given no share in its management and were known not as members but associates. A lecture course was established, which soon be-

came the most important lecture platform in London. Branches of the parent society sprang up in different parts of the metropolis, and provincial branches in different parts of the United Kingdom became affiliated with the parent society.

The association was marked by intense religious zeal. Through personal interviews by its members with young men, through Bible classes and evangelistic meetings for men, a persistent campaign was carried on to win young men to lead a religious life. The social services developed considerably during the first seven years. In 1851, in the Central Association, there were 225 members and 425 associates. There were estimated to be 750 members and associates in the other branches in the metropolis. At this time there were eight societies in London, and 16 in various parts of the United Kingdom. The 24 associations enrolled approximately 2,700 young men.

Knowledge of this work came to America in the fall of 1851 at three different centers—Montreal, Boston and New York. The first movement took place at Montreal, where, through the efforts of two young men who had become acquainted with the London work through published copies of the lectures delivered before the London Association, an association was formed on 25 Nov. 1851. In November 1851 George Petrie, who had become well acquainted with the London work during a visit to that city, called together a group of his personal friends in New York. These conferences, however, did not result in organization until encouraged by the success at Boston, where the first association in the United States was established.

A letter published on 30 Oct. 1851, describing in detail the work of the London Association, came under the eye of Capt. Thomas V. Sullivan, who was active in Christian work among seamen, and so impressed him that he determined to establish a society in Boston. His purpose was accomplished at a meeting held on 29 Dec. 1851, in the chapel of the old South Meeting House in Spring Lane. The Boston society laid great emphasis upon the association as a social center. It introduced the committee system, and inaugurated the plan of restricting voting and officeholding to members who were in good standing in an evangelical church. It was the Boston society which gave character and direction to the American movement. It immediately became one of the leading religious agencies of the city. Twelve hundred young men joined its membership; 10,000 copies of its constitution and by-laws were printed and scattered widely over the eastern part of the United States; representatives of the society assisted in founding associations at other points, and through its influence, by the year 1854, some 26 associations had been established in different parts of the Union.

Through the efforts of Chauncey M. Langdon, a government employee in Washington, and later a clergyman in the Episcopal Church, a convention of the American associations was called at Buffalo in June 1854. This convention established an alliance of the associations of the United States and Canada, under the supervision of an executive committee which was instructed to call annual conventions, and to do everything in its power to foster and extend the work of the associations. The organization was made international at the suggestion of a delegate from the association at Toronto, Ontario, who had been invited to the convention. This alliance was known as the American Confederation, and it was largely through its influence that the American movement rapidly extended the number of associations throughout North America.

In the meantime, through the efforts of George Williams and others, associations had been established at Paris and other points in France, and at Geneva, in Switzerland. Prior to the founding of the association, a movement known as the «Junglingsverein» (Youth's Union) had been started among young workingmen in Germany in the year 1834. This had already come into friendly correspondence with the associations in England. The German associations, while not on a strictly interdenominational basis, were invited into alliance with the Young Men's Christian Association, and continued actively in this fellowship until their withdrawal from the World's Alliance in July 1939.

The culminating event of the early period was the first convention of the associations of all lands, held at Paris in 1855, at which the memorable statement of belief known as «the Paris basis» was adopted. This has been called the apostles' creed of the association, and did much to unify the movement. It was proposed by Mr. Frederick Monnier, a layman from Strasbourg, and was read before the convention, all the delegates standing, «in which position it was then solemnly passed by the unanimous vote of the whole assembly. The members present then knelt together, gratefully to acknowledge the mercy of God and to entreat His benediction on the decision at which they had arrived.» The basis was as follows:

> The Young Men's Christian Associations seek to unite those young men, who, regarding Jesus Christ as their God and Saviour according to the Holy Scriptures, desire to be His disciples in their doctrine and in their life, and to associate their efforts for the extension of His kingdom among young men.

The reports of this convention showed the estimated strength of the association movement as follows:

	Associations	Members
Continent of Europe:		
Germany	130	6,000
Switzerland	54	700
France	49	700
Holland	10	400
Belgium and Italy	3	60
Total	246	7,860
British Isles	47	8,500
United States and Canada	36	14,000
Total	329	30,360

The period from 1844 to 1855 saw the association founded in the various Protestant countries, an international committee established for North American work and a uniform basis adopted by the associations of all lands. The fundamental principles of the association began clearly to emerge. Although the movement was at first primarily religious and spiritual in character, the association was led to add service facilities for ministering to the intellectual and social needs of young men. It recognized the principle that ministering to the needs of a man is one of the surest ways to promote his reli-

gious life; and on the other hand, that the Christian religion demands the development of all human powers and their use in the service of God. It was upon these two truths, the power of environment to mold character and the adaptation of the religion of Jesus Christ to redeem man in body, mind and spirit, that the Young Men's Christian Association rested its claim for recognition among the agencies of the Church.

Period II, 1855 to 1878. Period of Development of the Association Ideal.—During the years from the Paris convention in 1855 to the Geneva convention in 1878, when a central executive committee for the associations of the world was established, with headquarters at Geneva, the Young Men's Christian Associations were gradually developing a world consciousness as an organization, and slowly evolving a method of work for ministering to the needs of young men. During this period, the American associations rose to comparative pre-eminence, and the type of association developed here has in later years spread throughout the world.

The six years preceding the Civil War were remarkable for two events in the American associations, the creation of the International Committee, with its work of supervision, and the unique revival which stirred the entire country during the years 1857 and 1858. During these years, the central committee of the confederation was located respectively at Washington, Cincinnati, Buffalo and Philadelphia. This migratory plan was soon found to be a source of weakness, but much good was accomplished. Annual conventions were held, and information regarding the new movement was widely disseminated. Many new associations were founded; and at the outbreak of the war there were 240 associations in North America, with an estimated enrolment of 30,000 members.

In 1856 several members of the New York association established a union prayer-meeting, chiefly for men, at the Dutch Reformed Church, in Fulton street. This was carried on for nearly a year, and in the following September it was given over to Mr. J. C. Lamphier, the city missionary of the Dutch Reformed Church, with the understanding that it should be continued on a union basis. The committee of the association arranged to co-operate heartily in this meeting.

In the fall of 1857 came the financial panic which prostrated the business interests of the country. Large numbers of men began immediately to attend this noon prayer-meeting and, under the auspices of the New York association, many more union meetings were established in different parts of the city. Similar meetings were conducted by all the Young Men's Christian Associations throughout the country. It was estimated that over 300,000 persons were added to the evangelical churches of America as a result of this revival.

The years from 1861 to 1866 in America were overshadowed by the cloud of the Civil War. The financial depression and the distractions attending the outbreak of the war brought the association to the lowest point it ever reached. The Boston membership fell front 2,400 to 700. The New York City association, at the beginning of 1862, had but 151 members; it was burdened with a debt of $2,400, and its work had sadly declined. It is recorded that only 60 organizations survived the war; and yet, in the midst of this depression and apparent weakness, the association undertook one of the most heroic tasks ever undertaken by a religious organization.

Through the influence of the association in New York, heartily seconded by those of Boston, Washington, Philadelphia, Chicago and other places, the United States Christian Commission was organized. This was the first organized attempt, on a large scale, to minister to both the spiritual and material needs of soldiers in time of war. This form of effort became later a widely-organized service of the associations. In the Spanish-American War and in the Boer War a service program for the welfare of the soldiers was carried on by the associations. The same effort was made with marked success by the associations of Japan among Japanese troops in the Russo-Japanese War. The association was prepared with experience and resources on a world scale to render a similar social service to the Allied armies in the First World War. The plan of work of the United States Christian Commission was to send out delegates with supplies and needed comforts, who should spend some five or six weeks without remuneration, nursing the sick and wounded, distributing literature, conducting evangelistic and religious meetings, bearing messages from home, and in various ways encouraging and helping the soldiers. About 4,800 of these delegates were sent to the front during the Civil War. The following table shows the vast efforts of this commission in raising money and supplies for the soldiers:

*Receipts by the United States Christian Commission

	1862	1863	1864	1865 (4 mos.)	Total
Cash	$40,160	$358,200	$1,297,755	$828,357	$2,524,472
Supplies	191,096	558,637	1,584,592	1,432,298	3,766,623
Totals	$231,256	$916,837	$2,882,347	$2,260,655	$6,291,095

* Moss, 'United States Christian Commission.' p. 729.

This was an heroic service, and won for the association the admiration and confidence of the public. In the meantime, the New York City society had secured for its secretary Robert R. McBurney, and for its president William E. Dodge, Jr. It had on its board of directors Hon. Cephas Brainerd, who had been identified with its work from the beginning, and who had early perceived the true mission of the association. Mr. Dodge with his associates set about developing in New York a work specifically adapted to the needs of young men, and introduced a new era in association history. Mr. Dodge was in sympathy with the idea of a clean, home-like social center for young men, and with the providing of opportunities for physical training. It was at his suggestion that the constitution of the New York City association was

altered so as to provide for the erection of a gymnasium. Mr. Dodge was also influential in enlisting large gifts for the association. He was himself the largest donor to the first building.

The years from 1866 to 1870 mark the revival of North American work after the war. In June 1866 an international convention was called at Albany, which outlined a new policy for the associations. The plan of a migratory international committee was abandoned, and the headquarters were permanently established in New York City. Hon. Cephas Brainerd was, a year later, chosen chairman of this committee, a position which he held for 25 years. This convention announced the platform that the work of the association should be limited to young men, although it was some years before this became the actual practice. The convention established a day of prayer for young men in November, which has become a world-wide observance. It also arranged for the organizing of state committees, and the beginning of what is usually spoken of as state work. The great contribution of this convention, however, was the emphasis which it placed on the true field of the Young Men's Christian Association as distinctive work for young men. In his opening address, Mr. Brainerd said: «Our future progress rests upon an unswerving devotion to the primary objects and aims of this association—the social, mental, and religious improvement of young men. As organizations with these avowed objects, we challenge attention. As seeking these ends we are prominently before the world. Because of these things we are what we are. When we deviate from them, we trench upon ground assigned to others.»

As yet there was no uniformity among the associations in America as to the conditions of membership. At the international convention held in Portland, in 1869, it was decided that only members of evangelical churches should vote or hold office in the association, and it was stated that:

> We hold those churches to be evangelical which maintaining the Holy Scriptures to be the only infallible rule of faith and practice, do believe in the Lord Jesus Christ (the only begotten son of the Father, King of Kings, and Lord of Lords, in whom dwelleth the fulness of the Godhead bodily, and who was made sin for us though knowing no sin, bearing our sins in His own body on the tree) as the only name under heaven given among men whereby we must be saved from everlasting punishment.

In the meantime, in New York City a determined effort was being made to erect a suitable building adapted to the needs of young men. In addition to the work already undertaken for the spiritual, intellectual and social improvement of young men, it was decided to add a gymnasium for physical training. After an earnest canvass for funds, and a most careful study of plans, the historic building on the corner of 23d Street and Fourth Avenue, which provided under one roof for the various phases of association activity, was erected. This building cost $487,000, and was opened to the public in November 1869. Here was developed the modern type of the diversified work for the cultivation of Christian manhood, which has become characteristic of the American associations, and which later spread throughout the world.

A unique feature of this building, which has been widely copied in association buildings was the central reception-room or lobby, in which was the general office of the secretary, and through which every one must pass upon entering the building. From this reception-room opened the reading-room, the parlors, the amusement-room, the gymnasium, the library, the educational classrooms and the secretary's private office. This enabled the secretary in charge to oversee the various activities which were housed under one roof, and to keep in touch with the multitude of young men who took advantage of the privileges of the association.

The years from 1870 to 1878 in America may be characterized as a period of adaptation of the main idea of association to the needs of young men, and the extension of this work to various classes of young men. It is an interesting fact that, as soon as the organization specialized its work and limited it to young men, it immediately found a large field for service. In 1872, at Cleveland, a branch association was founded for work among railroad men. This met with a hearty response from the men themselves. A secretary was employed, rooms were opened at the railway station of the Lake Shore and Michigan Southern road and an effort made to extend the work elsewhere. Similar societies were also organized at a number of the terminal points, and in the fall of 1875 the attention of Mr. Cornelius Vanderbilt was called to this work. Through his endorsement other railroad officials became interested in this movement. It was soon found that it was worth while for railroad corporations to provide the facilities and attractions of a Young Men's Christian Association for the welfare of their employees.

As early as 1858, at the state universities of Michigan and Virginia, student Young Men's Christian Associations had been organized. Early in the 70's, Mr. Robert Weidensall organized similar societies in a number of colleges. By 1876 there were 25 college associations, with about 2,500 members. Through the influence of Mr. Luther D. Wishard, a student at Princeton, representatives of all college associations were invited to the international convention held at Louisville, Ky., in 1877. This resulted in the inauguration of the intercollegiate movement as a department of the work of the International Committee. An extended effort was also made during this period among German-speaking young men, and toward its close a parallel work was begun among colored young men.

One of the most important agencies developed during this time was the work of supervision. The International Committee located in New York steadily grew in resources and influence. A number of the most prominent Christian business men of New York City and other parts of the country accepted positions of responsibility upor this committee. In 1868 Mr. Robert Weidensall became the first traveling secretary, being located in the West with headquarters at Omaha, afterward Chicago. He was for many years in the service of the committee, doing a vast amount of pioneer work, organizing state committees, and introducing many new phases of work for young men. In later years he tried particularly to foster what is known as county work for young men in rural districts. Mr. Richard C. Morse accepted a position with the International Committee in December 1869, first as editor of the *Associa-*

tion Monthly, and in 1872 as executive secretary of the committee, in which position he continued until 1913, when he was succeeded by Dr. John R. Mott. Mr. Morse was then appointed consulting secretary.

At the close of this period, 1878, the American International Committee had in their employ eight traveling secretaries, and in addition to the general work, were supervising work for railroad men, college students, German-speaking young men and colored young men. The budget for 1878 showed an expenditure for supervision on the part of the International Committee of $16,875. The American associations at this time reported 141 employed officers. Of these, 100 were general secretaries, 21 assistants, 12 state and 8 international secretaries.

In other lands, while war, ecclesiastical conditions and general conservatism retarded the growth of the association, a marked development had taken place. Every three years conventions of the associations of all lands were held in different European cities. To these the American associations since 1872 have regularly sent representatives. During the early 70's, Mr. Moody held his evangelistic campaigns in the British Isles, and did a great deal to stimulate the work of the Young Men's Christian Association in securing money for buildings, in arousing spiritual zeal and in calling the attention of the Church to this important work. In 1878 some 40 representatives of the American associations attended the world's convention, which met at Geneva, Switzerland. Up to that time there had been no established headquarters for the world's work. General affairs had been administered from London through Mr. W. E. Shipton, the secretary of the London association. It was chiefly through the influence of the French and American delegates that the Geneva convention voted to organize the work of the associations in all lands under an advisory committee, which should have a quorum located at Geneva, Switzerland. Col. Charles Fermaud, an officer in the Swiss army, and a man with bright business prospects in Geneva, consented to give up his calling and accept the position of general secretary of this committee. By the year 1878, with the establishment of the world's committee, the Young Men's Christian Associations of the world may be said to have developed their ideal of work for young men.

Period III, 1878 to 1913. Period of Expansion.—Great expansion was the striking characteristic of the period from 1878 to 1913. The association ideal of a four-fold work for the whole man had been developed by the American associations under Robert R. McBurney's aggressive lead. This ideal was promoted throughout America under the supervision of the International Committee. The American type of work for young men in this period of expansion was soon to be extended throughout the world largely by the efforts of the American International Committee.

In North America the associations between 1878 and 1913 increased in membership six-fold, from 99,000 to nearly 600,000 members; in value of property 38-fold, from $2,300,000 to $88,300,000; the number of buildings 13-fold, from 56 to 770; the cost of current operation 36-fold, from $376,000 per year to $13,725,000.

The three chief factors which most profoundly influenced the association movement during this period were: (1) the securing of property, (2) of trained secretaries and directors who give their whole time to this service, and (3) the development of state and international committees of supervision. The carrying on of an all-round work for young men—physical, social, intellectual and spiritual—demanded not only experienced and able men to conduct the work, but commodious and properly adapted structures in which it could be housed.

The «discoverer and demonstrator» of the secretaryship was Robert R. McBurney, who was secretary of the New York City association from 1862 until his death in 1898. Under his leadership, this office was developed and the number of employed men increased. Of all the innovations the association movement brought forth, the most novel was the secretariate. To this may be attributed its permanence and continued growth. There were, in 1913, 3,853 men devoting themselves to this service as a life work, forerunners of a novel professional service in administering informal education and recreation. The pre-eminence of the American associations is perhaps due to this policy of employing salaried officers. About five-sixths of the secretaries employed by the associations of all lands are in the United States and Canada.

Not only have men been employed for supervisory work, but since 1870 there has been an increasing demand for Christian young men to devote their lives to service in the association as physical directors. Six hundred and thirteen such men were employed in 1913. To the Christian physical director, the Young Men's Christian Association owes the development of the physical department, which aims not only to give young men physical training and rugged, vigorous bodily development, but also to develop character. This department has proved a great attraction to young men. In 1896 the Year Book reported 52,672 men as using the physical department of the association. In 1918 there were 242,000 enrolled in gymnasium classes, of whom 118,000 were boys. Much of the progress of such physical programs was due to the leadership of Dr. Luther Halsey Gulick, who became instructor of physical training at the Association Training School at Springfield in 1886, in which position he continued until 1900. In 1888 he was also appointed secretary of the International Committee for the physical department, in which office he served until the spring of 1903. He was succeeded at the Springfield school by Dr. James H. McCurdy and on the International Committee by Dr. George J. Fisher. The Young Men's Christian Association long did the most extensive work in physical training of any agency in the country. It is also interesting that at one time 40 per cent of the physical directors in academies and colleges had been furnished by the association. The physical department has proved not only a means for physical well-being, which is much needed under modern city conditions, but also a means of helping young men maintain standards of personal purity.

In 1878 there were 8 international and 12 state secretaries and 94 secretaries in local associations. Just after the war (1919) there were 704 county, state, and international employed officers engaged in supervisory work, 30 instructors in the training colleges, 3,245 men

serving city associations, 550 with railroad associations, 139 with student associations, 78 with associations for colored young men, 77 with army and navy associations and 113 in other forms of service. There were a total of 4,936 salaried officers employed by the associations of North America.

In 1885, at Springfield, Mass., a school was established for the training of general secretaries for the Young Men's Christian Association. The year following a physical department was added for the training of physical directors. This school at first offered a two-years' course of study, which was later extended to three years. In 1890 a similar school was established at Chicago. This institution also conducts a summer term at Lake Geneva, Wis. In 1902 a summer school was established at Silver Bay, Lake George, N. Y. These educational agencies seek to thoroughly train officers for the Young Men's Christian Association as a life work. About one-sixth of the officers of the association have received training at these institutions. The courses of study cover the Bible, Church history, psychology, sociology, religious pedagogy, physiology, anatomy, anthropometry, physical diagnosis, physiology of exercise, gymnastics, athletics, aquatics, history of the Young Men's Christian Association, methods of work among young men, etc. There are about 500 students enrolled in these two institutions in addition to those attending the summer institutes. The summer schools long attracted so many of the employed officers (over 1,500 in 1919) that six additional summer schools were later established in the South, the West and in Canada. The Southern associations maintained for some years a graduate training college at Nashville, Tenn. The first summer school was held at Lake Geneva, Wis., in 1884.

The building movement in America soon developed with increasing momentum. In 1890 there were 205 buildings, valued at $8,350,000, in the United States and Canada; in 1900 there were 359; in 1902 there were 460. The number in 1919 passed the 1,000 mark, and the gross value of all real estate was over $96,000,000. Growth since has been phenomenal. There could be no greater testimony, no higher mark of the confidence of Christian philanthropists and ordinary men in the Young Men's Christian Association and its work than the investment of large sums of money in association property. The type of architecture developed by the Young Men's Christian Association is of the club order, its buildings being homelike and social.

One of the striking developments of this period in the city work has been the growth of the educational classes. Immediately upon the erection of the building on the corner of 23d Street and Fourth Avenue in New York City, evening classes were begun in different subjects for young men. Similar classes were carried on in other cities, and by 1892, 20,526 different men were under instruction. In 1892 George B. Hodge was appointed secretary for the educational department of the International Committee, and this work has been systematized and greatly developed by his successors and others. International examinations were now held annually, in which large numbers of students took part. International certificates were accepted by more than 100 different colleges and institutions. An illustration of the growth of this department was seen in Boston, where the association in 1918 reported 3,843 different students, studying in its educational department. This association had a law school which had been given by the legislature a charter, granting the right to confer degrees. It had the Huntington Avenue school for boys who are preparing to enter college. It had schools of engineering and of certified accountancy. The Boston association also subsequently incorporated «Northeastern College,» of which the educational director, Frank P. Speare, was president. This college supervised branch work in the neighboring city associations of Massachusetts and Rhode Island. Nearly every association provided a reading-room, 700 reported having libraries and many others were distributing stations for public libraries.

In 1918 the Year Book reported 82,000 students in the day and evening association schools. There were 327 secretaries and assistants supervising this work and 2,203 paid instructors who were giving part-time service.

The religious spirit of the association has been dominant from the beginning. All welfare work for young men—economic, physical or educational—was conceived of as an expression of the religious spirit and as contributing to a many-sided personality and a symmetrical Christian character. This distinguished the association from boys' clubs, social settlements, Boy Scouts and many other agencies for the social betterment of young men. There has been a large conservative element in the association which has held theologically to traditional orthodox teaching. The association did, however, make remarkable progress in its distinctly religious work. This became organized into a system with five features: (1) Religious meetings; (2) individual interviews; (3) classes in religious education; (4) social service; (5) missions. Religious meetings were chiefly held on Sunday afternoon. These were for many years almost exclusively of an evangelistic character, but in later years have in many cases become forums for the community where the great social, civic and religious problems of the day are discussed by prominent leaders from an ethical standpoint. At Springfield, Mass., under the leadership of Kenneth Robbie, such a Sunday afternoon forum was maintained for several years with an attendance often reaching 4,000.

Mr. Fred B. Smith during this period was secretary of the religious department of the International Committee. Under his leadership general evangelistic campaigns for young men were promoted culminating in the Men and Religion Forward Movement of 1912 in 60 North American cities. In 1918 there were reported 1,061,000 auditors at theatre meetings, 2,273,000 auditors at shop meetings. These were held outside association buildings. In the buildings there were reported 2,276,000 auditors at men's meetings and 295,000 at boys' meetings. There were a total of 6,000,000 auditors at these various religious meetings. There were 32,500 decisions for the Christian life reported and 6,434 young men reported as uniting with churches.

In religious education the chief emphasis was put upon Bible classes, but there was an increasing diversity of program which later evolved into a department of religious educa-

tion. In more progressive associations like the 23d Street branch in New York City, there were classes in «Christianity and Modern Thought,» led by the secretary, Burt B. Farnsworth, courses in Church history, life problems, sex hygiene and social service.

In spite of the depletion of attendance of young men at colleges and universities during the World War, most gratifying reports came from student associations. In 1917 there were 27,000 students in classes in religious education. These were chiefly in Bible classes, but nearly 3,000 were in mission study classes and 4,000 were in classes studying «North American Problems.»

An important phase of the religious work of the association was the interest in foreign missions which it has aroused among young men. The Student Volunteer Movement, which was an outgrowth of the student department, was the chief missionary agency in the colleges of this country. It annually secured a large number of students to volunteer for foreign missionary service. At one time as many as 4,000 students have been enrolled as volunteers in all colleges. In the men's colleges in 1917 the number was 1,237. In later years the effort became broadened to include all religious callings, home as well as foreign. In 1917 there were reported 280 undergraduates as preparing for the secretaryship of the Y. M. C. A. and 3,066 for the ministry.

This third period of association history was also marked by a great extension in the work for different classes of young men. In August 1895 the World's Student Christian Federation of undergraduates of all lands was established. This became the largest organization among undergraduates in the world. In the United States and Canada the movement has been extended to professional schools, theological seminaries and other institutions of learning. There were (1919) 791 college associations upon this continent, enrolling 51,117 student members. American student associations own buildings valued at $1,581,000. There were 137 student secretaries devoting their whole time to this work.

The work for railroad men also became one of the most remarkable features of Christian endeavor. Railroad corporations which controlled three-fourths of the railroad mileage on this continent contributed from the corporation funds large amounts toward the current expenses of the railroad associations. There were 122 buildings, valued at $7,422,000, occupied by these associations, with a membership of 94,000 railroad men. There were 550 secretaries engaged in this department.

Since 1879 the International Committee had employed a secretary to develop the work among colored young men. The work among colored young men was greatly stimulated by the offer of Julius Rosenwald of Chicago, a wealthy business man of Jewish race, to give $25,000 toward the erection of a building for a colored Young Men's Christian Association to any community which would raise $75,000 additional. This offer was continued for a period of many years, during which some 12 colored association buildings were erected. There were (1913) 150 associations of colored young men, with 17,600 members, with 77 employed officers, with property valued at $1,716,000. The secretary of the International Committee for this department was Jesse E. Moorland. There were nearly 90 Indian associations, with 900 members, under the direction of a traveling secretary, a native American Indian.

Largely as an outgrowth of the work for students in other lands, the American International Committee was invited by missionaries in India to inaugurate a work among young men in non-Christian lands. This work was always conceived as in subordination to the church and as a supplementary work where missions have already been developed. There were 118 secretaries of the American International Committee in India, Ceylon, Japan, China, Brazil, and other foreign lands (1913).

The policy on the foreign field was to develop self-governing and self-supporting local association and national committees. In countries outside of the United States, Canada and Europe there were 292 associations with 58,231 members, occupying property valued at $700,000. In these associations there were 462 employed officers, four-fifths of whom were natives. In the promotion of this work in 1910 President William Howard Taft invited a conference at the White House, attended by about 100 leading Christian laymen, which resulted in securing $2,000,000 for the foreign work.

Even before the Spanish War began steps had been taken to inaugurate a work among the seamen of the navy, and after the war a building was equipped for seamen at the Brooklyn navy yard. This department then developed rapidly, and in the course of time there was an organized movement among the seamen of the navy which was deemed promising. Through the munificence of Mrs. Helen Gould Shepard and Mrs. Russell Sage, an attractively equipped building has been erected for the Naval Association, near the navy yard in Brooklyn, at a cost of $1,000,000. Work was soon developed at seven other home ports and also in the Philippine Islands. There were 77 secretaries in the army and navy associations of the United States at the outbreak of the First World War.

For many years the work of the associations was limited to young men between 16 to 17 years of age and upward. It is an interesting sociological development that, in the prosecuting of its work for young men, the association has been led to give its attention to work among boys. Careful study led to the conviction that effort ought to begin at the age when the boy is becoming a man—at the dawn of adolescence. There are almost as many boys in cities between the ages of 12 and 17 as there are young men. The first boys' department was organized at Salem in 1869, but it is only in recent years that a determined effort has been made to organize a work among boys. In 1890 there were four secretaries giving their time to this department. This number had increased in 1903 to 107. It was 545 in 1919.

In 1903 there were 46,000 members in boys' departments. This number had increased by 1917 to 152,600. The work is carried on at 985 different points. The most unique feature of this department became known as the boys' camp, which was first developed by the Young Men's Christian Association, and later became a large factor in American life. In 1903, 214 summer camps were conducted by the American associations.

One of the most important developments of recent years has been the extension of the association among men engaged in industrial pursuits. The associations were originally for commercial young men. Afterward associations were organized for students and later for railroad men. The city associations in later years began to attract large numbers of skilled mechanics to their membership, and later in Eastern associations 35 per cent of the members belonged to this class. An industrial association existed in 1897 in connection with the Johnson Steel Plant at Lorain, Ohio, and an association building at a cost of $25,000 was erected for the use of the workingmen. Similar associations were established at Proctor, Vt.; Wilmerding, Pa.; Stampo, Ark.; Douglas, Alaska, and Cananea, Mexico. An extensive work was undertaken among the coal miners in Pennsylvania and the lumber men in a number of states. The Colorado Fuel and Iron Company and their employes combined to establish a series of associations among the workmen at the different plants of the company similar to the railroad Young Men's Christian Associations. It was the experience of the railroad and industrial associations which prepared the way for the unparalleled service rendered to the armies during the World War.

The distinctive industrial department was under the direction of Charles R. Towson of the International Committee, who had 11 associates. There were 117,000 industrial workers who were association members. In 70 cities special industrial secretaries were employed. There were 134 association buildings erected especially for men in industry at a cost of $4,717,000. In 1917 the companies contributed $417,000 toward current expenses and the employes paid an equal amount in membership fees.

The industrial revolution which attracted the young men to the city, and so created the basis for the Young Men's Christian Association, had to a large extent depleted the rural districts of young men. At the same time it remained true that a majority of young men were found in the country. There were 8,000,000 young men in the country districts of the United States and Canada. For many years an effort was made to discover some method of carrying on association work among these men. What is known as county work had proved so successful that in 19 different states county organizations were formed, the most extensive work being carried on in Michigan, where 32 county secretaries were employed in 26 counties. The plan provided for a county committee, which employed a traveling secretary to project, supervise and stimulate Christian work among the young men in the county, organizing Bible classes, men's meetings, in many cases establishing reading-rooms, social parlors, sometimes educational classes, and in some instances organizing clubs for athletics of various kinds. County conventions were held, and extensive activity programs among youth were conducted through the entire county. There were over 150 secretaries employed in county work.

Under Mr. Morse's leadership the staff of the International Committee had increased from two executive secretaries in 1869 to 93 on the home field and 175 on the foreign field in 1915. The budget of the committee had grown from $2,345 in 1869 to $354,000 for supervision of the home field and $433,000 for the foreign field. The North American type of association work for the whole man had largely through the influence of the International Committee spread to Europe and widely through the colleges and cities of Asia, Africa and South America.

Membership fees ranged from $2 to $25 per year in addition to receipts from dormitories, restaurants, educational classes and many other features. The income of the North American associations for the year ending 30 April 1917, exclusive of receipts from contributions and endowments, was $13,071,609—this amount was paid by the young men. The receipts from contributions were $2,140,114 and from endowment $325,561.

Period IV, 1914 to 1919. The World War Period.—The important features of these years were (1) the enlarged activity of the home work in the rural field, in industry and among boys; (2) the continued growth in the foreign field; (3) the novel work for the prisoners of war, both in allied countries and in the Central empires; and (4) and beyond all of these the transcendent work for the armies of America, France, Italy and Russia carried on by the American associations and for British and Canadian troops carried on by the British and Canadian associations. The work for war prisoners was peculiarly the task of the American associations prior to the American declaration of war against Germany in April 1917. No other country was free to undertake this service. By May 1916 there were over 4,000,000 men in the prisoner-of-war camps of Europe (Report International Convention, 1916, page 91). These men were in enclosures containing from a few thousand to 40,000 persons, who were practically without occupation. Through the efforts of Dr. John R. Mott and other American secretaries detailed from the foreign field, reciprocal permission was secured from belligerent governments and a most beneficent service inaugurated for this vast body of prisoners. The policy was to erect in each camp an inexpensive hut or service building, organize a camp association, establish educational classes, athletics and games, furnish a reading room, supply writing material, inaugurate shows and entertainments and carry on religious meetings or classes as desired. In co-operation with the Red Cross, food kitchens were established and supplied, the sick men nursed and clothing and other necessaries provided. During the first 17 months of the war $300,000 was raised in the United States for this work and the following year $1,167,322 was raised and expended for work in Europe among both prisoners and soldiers. This Christian service to the prisoners saved men from starving, restored morale, awakened new hope and often educated men for a new sphere in civil life.

On the Mexican border in the summer of 1916 there were a total of 150,000 American troops called into service under conditions, not only full of discomforts and hardships, but full of menace to moral character. The army and navy associations were quick to respond to this need. Thirty-eight temporary buildings were erected. Tents were used at six additional points and special motor equipments devised with moving picture machines, graphophones and other features. There were 350 secretaries,

clergymen and business men employed in this service. Free stationery was provided for the writing of 5,000,000 letters home. Recreational and educational facilities were promoted by trained leaders. For this work during eight months $308,000 was raised. At the entertainments there were present nearly 3,000,000 auditors; a customary type of religious work was carried out and over 13,000 soldiers registered new Christian decisions. The chairman of the Army and Navy Department of the International Committee was William Sloane of New York and the executive secretary John S. Tichenor. This work on the Mexican border prepared the way for widely extended service among American troops during the World War—the climax of the work of the Young Men's Christian Associations. Upon the declaration of war in April 1917 the International Committee immediately offered the services of all the Young Men's Christian Associations of America to the government, and this offer was cordially accepted by President Wilson.

On 10 April Dr. Mott called a conference of association leaders to meet at Garden City, L. I. He outlined plans for the establishment of a National War Work Council of 100, which should be appointed by the International Committee, carry on all work for the American soldiers and make reports to the International Committee. Dr. Mott asked that the associations raise $3,000,000 to sustain this work until 31 Dec. 1917.

The conference enthusiastically endorsed the plan proposed and devised methods to cooperate in securing the fund needed in 30 days. Two days later a meeting was held of the International Committee; the proposition was approved, the National War Work Council appointed and the first meeting called for 28 April. William Sloane became chairman, Cleveland H. Dodge, treasurer and Dr. John R. Mott, general secretary. George W. Perkins was made chairman of the finance committee; Lucien T. Warner, chairman of the committee on personnel and John Sherman Hoyt, chairman of the committee on activities.

It is well known how much vaster the American forces became by land, sea and air than was at first anticipated. The Young Men's Christian Association with heroic effort expanded its services to meet the enlarged need.

The advantages of this work to the comfort, the morals and the spirit of the troops was so great that requests came from the French government for a similar service to the French army. Later an urgent appeal was similarly responded to from both Russia and Italy. Under American leadership work for French troops was carried on at 1,350 *Foyers du soldat* and in Italy at 2,000 *case del soldato.* The British associations in the same manner did an extended work for the British soldiers in England and France. This effort was carried on under the leadership of the National Secretary, Sir Arthur Yapp, who was knighted by King George as a recognition of this service.

The Canadian associations under their own National Council ministered in an equally thorough manner to the Canadian army; about 700,000 Canadians were enlisted, of whom about 400,000 were sent overseas. This work overseas was in charge of Lieut.-Col. Gerald W. Birks of Montreal and in France under the direction of Maj. Ernest M. Best. This service began in Canada in August 1914 and was carried on during the entire war. The Young Men's Christian Association of Canada was made a part of the military establishment and the secretaries became officers in much the same manner as chaplains.

The work for the American army was divided into two sections, (1) the home camps; and (2) the work overseas. Overseas, E. C. Carter, who had been national secretary for India, was placed in charge at Paris. The first problem of the War Work Council was to secure funds. To these appeals the citizens of America responded with great liberality. The first request for $3,000,000 met with contributions amounting to $5,000,000. So vast did the work become that this amount subscribed in May 1917 was exhausted by October and it became necessary to borrow large sums. A second campaign, of which A. H. Whitford, general secretary at Buffalo, was director, was inaugurated in November 1917; an appeal was made for $35,000,000 to carry on the war work at home and abroad for one year. This appeal met with a response of $54,000,000. In the meantime other agencies beside the Young Men's Christian Association had become enlisted in a large way. As the association had been the pioneer since the Civil War in this form of effort it furnished certain standards and methods for work undertaken by other agencies. In accordance with the desire of the government Commission on Soldier's Activities appointed by the War Department, the various agencies, exclusive of the Red Cross, which were engaged in promoting welfare work for the army and navy combined their budgets for a joint campaign for November 1918. The budgets were approved by the commission and a total of $170,000,000 was asked for. Of this sum the allotment for the Red Triangle work was 58 per cent. Dr. John R. Mott was made director-general of this campaign and Mr. C. S. Ward, the originator of the short term campaign method for securing funds, was associated with him. In spite of the adjustments incident to the signing of the armistice during the campaign the effort was successful, the subscriptions amounting to $203,000,000—the largest voluntary offering for religious welfare work ever made.

Some facts about the activities carried on among all commands of troops on the home side of the Atlantic for the year ending 30 April 1919 are as follows (Year Book 1919): Different men served, 4,000,000; number of employed officers, 4,600; funds expended, $30,000,000; number of units, 1,171; attendance at entertainments, 27,000,000; participants in athletic sports, 2,500,000; lectures given, 39,044; attendance at educational classes, 5,404,000; at Bible classes, 2,085,000; at religious meetings, 14,181,000; decisions for the Christian life, 195,414. A most effective service was also rendered by the local associations throughout the country to soldiers on liberty leave, and a carefully organized work for the men in transit on the troop trains. The problem of personnel was most difficult; only men beyond military age could be used and the proportion of those interviewed who were qualified and were physically fit to stand the arduous work required was less than one in 10. Short term intensive courses of training cov-

ering one month were established. A total of 25,926 persons were recruited and assigned to this service at home and overseas, of whom 5,145 were women. Only 700 of those so assigned had previously been Y. M. C. A. secretaries. Of the total, 12,955 served overseas.

The most challenging work of all was with the Expeditionary Forces in France. Here over 3,000 miles from its base of supplies, the association undertook to serve 2,000,000 men scattered through France and later western Germany, both in leisure areas back of the front and in the war area itself.

The «Y» was operating in March 1919 in France 587 buildings erected by the association, 596 leased buildings and 782 tents and army buildings. «These buildings were used as centers where the men could congregate, write letters, read magazines, books and papers, play games, visit and feel relieved of a certain amount of the restraint necessary to army life.» (Perkins). In them were conducted concerts, moving picture shows, all sorts of entertainments and religious services. The buildings were open to all welfare organizations. Religious services were conducted by Protestants, Catholics, Jews and all other religious organizations, regardless of creeds.

A large number of well-trained athletes led in athletic games and in boxing and wrestling. Athletic supplies were given without charge to the soldiers. A number of theaters were operated in different parts of France.

In the canteen alone the «Y» in France from June 1918 to April 1919 handled 2,000,000,000 cigarettes, 32,000,000 bars of chocolate, 18,000,000 cans of smoking tobacco, 50,000,000 cigars, 60,000,000 cans of jam, 20,000,000 packages of chewing gum and 10,000,000 packages of candy. These were only a few of the items handled. Because of the difficulty in buying supplies, the «Y» operated in France 20 biscuit factories, 13 chocolate factories, three candy factories and three jam factories. All of this canteen service was undertaken unexpectedly and carried on in addition to the regular work for the men—physical, social, intellectual and religious.

It was not surprising that following the war a period of intense criticism arose among the soldiers, and later the American public, based chiefly on the difficulties encountered in operating these canteens. Chief Justice Taft, in his Foreword to the history of Y. M. C. A. services in the First World War ('Service with Fighting Men') said, «During the war, the burdens put upon the Young Men's Christian Association by the Government were too heavy. The limitations imposed by the paramount requirements of the campaign prevented it from doing all that was assigned to it. The Government gave up the canteen work overseas, and required the Y. M. C. A. to take it over. The difficulties that it had to meet are fully set forth in these volumes, and the short-comings of the service are candidly recognized and stated. These, which it was impossible to avoid, taken with the attitude of discontent of our soldiers after the Armistice, psychologically natural in their impatience to get home, led many to utter complaints and spread criticism that did the Association great injustice. Fortunately, a proper sense of proportion has returned and the probability of injury to the prestige of the Association, which was so freely predicted, has faded away, and the institution is stronger than ever in the appreciation of the people.»

Period V, 1920 to 1941. The Last Two Decades.—The two decades since the First World War represent two widely different periods: the former characterized by apparent prosperity, the latter characterized chiefly by the necessitous adjustments of depression years. In the first, demobilization of war services led to extensive scholarship and other assistance programs among returned service men. Association work was reorganized and augmented in permanent military establishments and housed in handsome buildings. Important developments in regular association services included establishment of a National Council composed chiefly of laymen, extensive modern building construction, greatly expanded budgets and contributed income as well as increase of indebtedness, and enlargement of program and staff in regular foreign service. In America important modifications also occurred through acceptance of progressive educational methods, and emphasis upon the individual as a whole, demanding well-integrated experience in clubs, forums and informal educational opportunities. Women and girls were increasingly admitted to membership and shared in activities. The first postwar decade was climaxed by the Twentieth World's Conference of Y. M. C. A.'s at Cleveland, preceded by the Third World's Assembly of Y. M. C. A. Boys' Workers and the First World's Assembly of Young Men at Toronto.

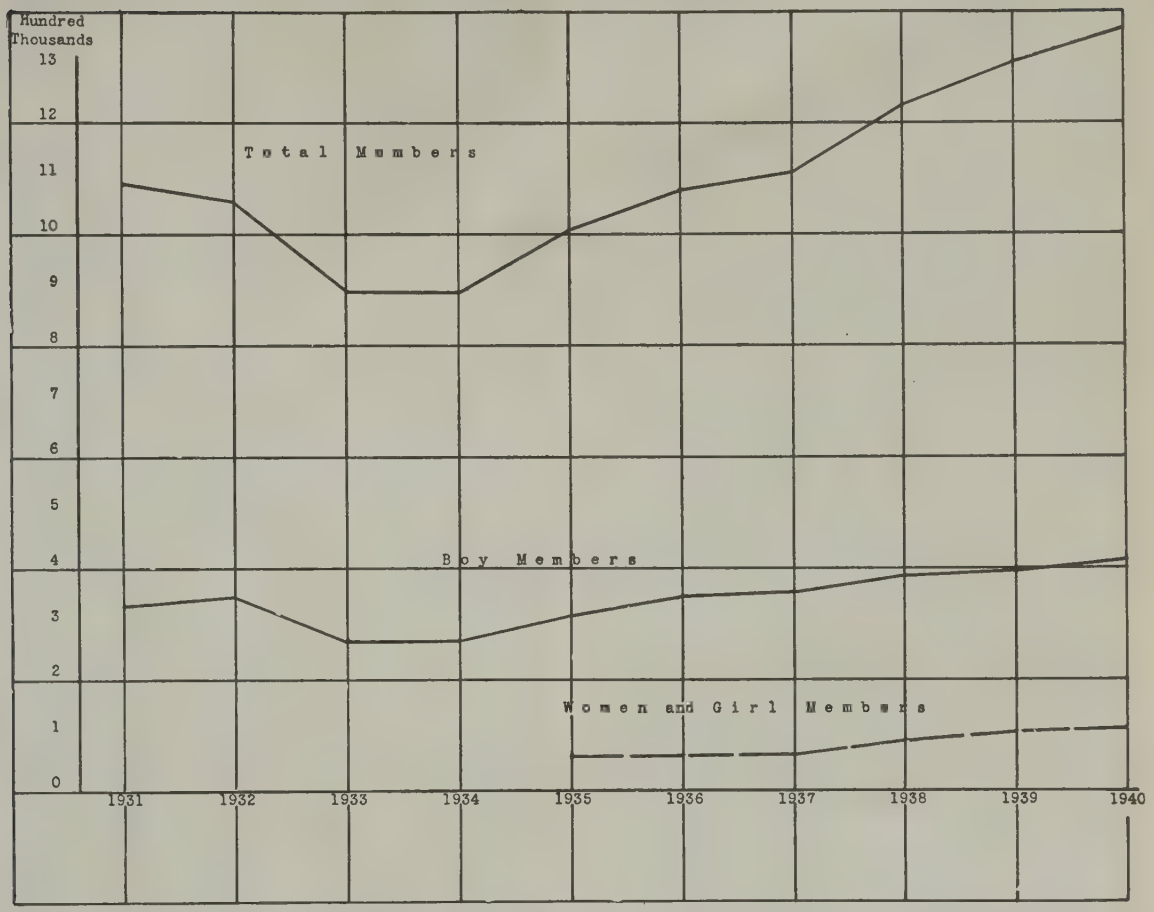
The effects of the great depression dominated adjustments of the last decade. The total income of over 60 millions in 1930 declined to but 35 millions in 1933, with attendant reductions of membership, salaries, staff and mounting debt. Nevertheless, through increased use of trained volunteers and gradual economic restoration these later years have witnessed marked growth of constituency, program enrichment, and experimentation with democratic youth organization. Boys' work gained in volume and effectiveness. More than seven thousand Hi-Y clubs were reported, and unified through plans for national registration and biennial national congresses. Specialized national councils among young men, industrial foremen, and students gave democratic control to characteristic youth constituencies.

In 1940 American associations numbered 1,196 with 1,224,410 members, 116,679 enrolled groups and expenditures of over 51 millions. Canadian associations numbered 76 with 51,582 members, 5,939 enrolled groups, and $2,186,400 expenditures. Combined capital investments were $267,000,000

With the advent of the Second World War, regular Y. M. C. A. services among military personnel, much extended by 1939, were combined with the Y. W. C. A. and four other private agencies in the United Service Organizations for national defense, for welfare and religious services in nearby communities. Fourteen millions were raised by the American people to finance these programs for the first year. Specialized club buildings were provided by the government.

At the end of 1942, there were 1,168 organized USO operations of which 694 were buildings with well-equipped club facilities (including 187 federal recreation buildings), 218 were modestly equipped service centers, 99 were service centers for aid to travelers, 99 were rest lounges

GROWTH OF ASSOCIATION MEMBERSHIP 1931 TO 1940
For United States and Canada



Note: There has been a significant rise in the number of members, following depression years—a gain much larger than that accounted for by the formal reporting (since 1935) of women and girl members by an increasing number of local associations.

for service men in railway stations and other transit points, and 58 were mobile service and maneuvers units. Of a total of 1,399 agency operations included in the above, the Y. M. C. A. was designated to operate 327 or 23.4 per cent. Of 1,911 specially assigned USO professional workers recruited under agreed standards and administered through national agency personnel offices, the Y. M. C. A. portion included 491 or 25.7 per cent. Outside continental United States, there were 88 special operations with a staff of 119 not directly administered by any single agency. Of these workers, the Y. M. C. A. supplied 51.

The conception of the United Service Organizations represents a genuine social innovation both in its interfaith character and in co-operation between private agencies and the federal government. Besides the Y. M. C. A., the Y. W. C. A., the National Catholic Community Service, the Salvation Army, the Jewish Welfare Board and the National Travelers' Aid Association joined in approaching the government as a group of private religious agencies to work, in line with their experience and genius, not in camp areas but in adjacent communities where service men on brief leaves wanted respite from military life and sought constructive relaxation and recreation among civilians. The partnership of government in providing nearly two hundred attractive recreation buildings was a natural development in places where a serious overload was created by the war emergency. The agreement left the agencies free to provide social, recreational and religious programs, in co-operation with local community organizations, among military and industrial groups. The American people subscribed 32 million dollars in late 1942 to carry this work through the operating year ahead.

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YOUNG PEOPLE'S CHRISTIAN ENDEAVOR UNION OF THE UNITED BRETHREN IN CHRIST, founded 5 June 1890. It is a union of all forms of young people's societies within the church, uniting them for the purpose of denominational direction. It was originally named the Young People's Christian Union. Its official organ, *The Watchword,* was founded in 1893. With its junior societies the organization numbers over

2,000 societies and more than 85,000 members. It contributes about $10,000 annually to missions.

YOUNG PEOPLE'S SOCIETY OF CHRISTIAN ENDEAVOR. See CHRISTIAN ENDEAVOR, YOUNG PEOPLE'S SOCIETY OF.

YOUNG PRETENDER, The, a title applied to Charles Edward Stuart, son of the Pretender. He was defeated by the Duke of Cumberland at Culloden, 16 April 1746.

YOUNG'S TRAVELS. In 1767 Arthur Young began that series of journeys, or farming tours, which were the basis for his graphic sketches of rural England, Ireland and France. His first trip included Southern England and Wales, and an account of his observations appeared in 1768 under the title 'A Six Weeks' Tour through the Southern Counties of England and Wales.' Following this first survey, he traveled through Northern and Eastern England from 1768–70; this resulted in 'A Six Months' Tour through the North of England' (4 vols., 1770), and 'The Farmer's Tour through the East of England' (2 vols., 1771). These books contain a wealth of information relative to the social, economic and political conditions in England during the latter half of the 18th century. Young was a most determined and indefatigable tourist. He visited practically every county in England, inspected farms, described farm methods and implements used. He met all classes of people, from peasantry to nobility. His information concerning rural conditions, such as rentals, produce, livestock, and means of transportation and communication in the kingdom, was founded on actual examination. Two features especially roused Young's indignation. In the first place, he saw on every side vast tracts of land uncultivated and in waste; even all the cultivated land, with rare exceptions, was placed under the same unvarying rotation. Everywhere there seemed to be inability to put the land to its best use. Then, too, Young had no patience with poor roads. In 1770, on the Preston-Wagan turnpike, he measured ruts "four feet deep and floating with mud, only from a wet summer"; and again he says, "I know not in the whole range of language terms sufficiently expressive to describe this infernal road. Let me most seriously caution all travelers who may accidentally propose to travel this terrible country, to avoid it as they would the devil; for a thousand to one, they break their necks or their limbs by overthrows or breakings down." His description of other highways is given in an equally lucid manner. Young's works on England were very favorably received, being translated into most of the European languages by 1792.

In 1776 he made a tour of Ireland, publishing his 'Tour in Ireland' in 1780. He remained in Ireland three years and during part of this time was occupied in managing an estate in County Cork. The result of his stay, nevertheless, was a survey of the country which, for accuracy, fullness of detail, and acuteness of observation, is invaluable to this day. He stated clearly and exposed unsparingly the causes which retarded the progress of Ireland. He strongly urged the repeal of the penal laws which oppressed the Catholics; he condemned the restrictions imposed by Great Britain on the commerce of Ireland, and also the perpetual interference of the Irish Parliament with industry. The work abounds in elaborate statistics and tables of prices; as Marie Edgeworth well says, it is «the first faithful portrait of the inhabitants.»

'Travels in France' (2 vols., 1792) is probably the best known of Young's writings. He made his first visit to France in 1787 largely as the result of an invitation from the French nobleman, the Duke of Laincourt. He traversed France in every direction just before and during the first movements of the French Revolution, and he paints not only a picture of French agriculture but describes institutional conditions in France at that critical period. This work, while of great intrinsic merit in itself, has been greatly enhanced and widely circulated because of the fact that it is one of the most valuable sources to which historians have turned for a comprehensive statement of the actual pre-revolutionary situation in France. He visited one out-of-the-way region after another, recording in diary fashion his impressions vividly and candidly. From the first page to the last he sets forth the abject wretchedness of the majority of the people and the stagnant conditions of trade and commerce caused by inefficient government. His earliest journey took him in a southwesterly direction through the Orleannais and the Berri, where for the first time he met with the *métayage,* which he described as «a miserable system that perpetuates poverty and excludes instruction»; and further, he describes the fields as «scenes of pitiable management; and the houses of misery.» Throughout the entire work the *métayage,* or farming on half profits, is condemned in the strongest terms. Poitou is described as «an unimproved, poor and ugly country.» Young said it seemed greatly in need of «communication, demand and activity of all kinds.» Journeying on to Languedoc, he found the land in a high state of cultivation and the peasants happy; he concluded his journey by a visit to Landes on his way to Bordeaux. Young's second journey took him through Brittany and Anjou, which he described as a land «possessing nothing but privilege and poverty» — while Maine and Anjou — «have the appearances of deserts.» His third tour of France covered a much greater area. He started with Champagne, traveled through Alsace-Lorraine, made his way through to Jura, Burgundy, the Bourbonnais, Auvergne; took a glimpse of the Rhone valley, visited Avignon and Compte de Nice. His impressions on this journey are not so full, and this fact is probably due to the extent of territory covered and the local disturbances. Young found that half, if not two-thirds, of the land was already in the hands of small proprietors. Peasants supplied the industry and carried out what improvements were made, thus illustrating his famous phrase, «The magic of property turns sand to gold.» The great *seigneurs* did nothing; they received the quit rents and enforced *tailles* and *corvées* and all the other oppressive incidents of feudal tenure. He drew a severe indictment against the French nobility, and even approved of the forceful seizure of the waste land by the

French peasantry. He severely censured the higher classes for their neglect of the soil,—«Oh, if I were a Legislator of France for a day,» he exclaimed at the sight of estates left waste and only to be used for game purposes, «I would make such great lords skip again.» Young saw the commencement of violence in the rural districts and his sympathies were largely on the side of the classes suffering from excesses of the Revolution, although he was never a thorough political follower of the Revolutionists. Tocqueville recognized his work as a first-hand authority on the rural conditions of the country on the eve of the Revolution.

Young was a highly sensitive, enthusiastic, impulsive, affectionate man and a great lover of nature. His 'Travels' are deservedly famous and have earned a wide reputation and have been of great influence. No better summary of the chief characteristics of Young's writings can be given than to quote the words of R. E. Prothero in 'English Farming, Past and Present.' «His careless ease of style, his racy, forcible English, his gift of happy phrases, his quick observation, his wealth of miscellaneous material, make him the first of English agricultural writers. . . . His tours, with their fresh word-pictures, their gossip, their personal incidents, and even their irrelevancies, have the charm of private diaries.» His varied agricultural writings, thus characterized above, were by far the most important agency in disseminating the information concerning those advanced methods introduced into England by Jethro Tull, Lord Townshend and Robert Bakewell and which constituted the agricultural revolution in 18th century England.

Consult the works mentioned. 'Travels in France' were translated in 1793–94 by Soulés (new version by M. Lesage, with an introduction by M. De Lavergne, 1836). An interesting review of the latter publication, under the title of 'Arthur Young et la France de 1789,' will be found in M. Baudrillarts' 'Publicistes modernes' (2d ed., 1873). Consult also Bethan-Edwards, Matilda B., 'Autobiography of Arthur Young' (1898); Prothero, R. E., 'English Farming, Past and Present' (1912; pp. 154, 184, 195–206, 286, 313, 470).

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YOUNG WOMEN'S CHRISTIAN ASSOCIATION. The form of organization of the Young Women's Christian Association is a world-wide membership of women and girls bound together in voluntary association for the good of all and for the building of a better world. The aim of its members is to express both in deeds and words their conviction of the supreme importance of the Christian way of life both to the individual and to society. The term Young Women's Christian Association has come to be understood by most people to mean the whole movement—local, national, and world. This integration of thought and effort slowly growing over the years is the very essence of the fellowship. Through a thousand different events, meetings, letters, conferences and conventions, institutes and seminars, as well as the many face-to-face communications between individual leaders, this unity has been brought about.

In the United States, associations in the cities, colleges, and rural communities are organized into a national association called the Young Women's Christian Association of the United States of America. The National Board is the executive body of this association, chosen to carry out the policies adopted by the voting delegates at the national conventions, which are the regular business meetings of the National Association.

The name Young Women's Christian Association has been known in the United States since 1866. When the first organization bearing this title was formed in Boston, it had the same objective, the same evangelical church membership basis, the same combination of volunteers and employed working forces as obtain today. The first student association, Normal University, Illinois, dates from 1873. The student and many city associations on the evangelical basis (according to which only associations in which the right to vote was held by members of evangelical churches were received into affiliation) united in electing the American Committee with headquarters in Chicago; the Women's and Young Women's Christian Association of many other large cities holding various forms of charter united in the International Board.

In December 1906, after 18 months of constructive negotiation, the present national movement was formed of all local, city, and student associations affiliated with either body which wished to come in on their then existing basis, with the understanding that all associations in the future should have the evangelical church basis. Very few failed to avail themselves of this privilege. One hundred and thirty-two associations were represented by 392 delegates in that first convention, which voted policies for immediate action and elected the National Board. This board at once elected as president, Miss Grace H. Dodge, who had been chairman of the Joint Commission which had effected the union. Six years later, members of this board and a few other friends gave site and funds for the erection of the present national headquarters building at 600 Lexington Avenue, New York City.

The scheme of organization is as follows: The resident members of the National Board are assigned to committee work under eight departments—field work, department of method, foreign, secretarial, conventions and conferences, publication, finance, and office. Each department has an employed executive and other staff secretaries. The office department applies scientific management to the work of all the other departments. The publication department edits and publishes *The Association Monthly,* technical leaflets, Bible study texts; handles printing of the other departments; fills orders for books. The finance department makes the budget and secures the money. The secretarial department conducts a graduate training school in New York City; preparatory training centers in different parts of the country prior to this course; and a summer school with graduate courses for physical directors, house secretaries and lunch room directors. A bureau for placing association secretaries is also part of the work of this department. The foreign department co-operates with the World's Young Women's Christian

Association in sending American secretaries to India, China, Japan, South America, and Turkey. The field work department correlates the work of the 11 field committees with the work at headquarters.

If the field work department of the National Board can be called the clearinghouse, the department of method can be called the laboratory of the National Board. By visiting local associations, sharing in their work, studying other organizations of women and other Christian and social movements, a great body of information is gathered. This study and planning cover the needs and possibilities of all young women, their conditions and general environment in city, student, country and large town communities, with special emphasis at the present time upon the adolescent girls, the foreign-born young woman, the girls in business and professional life, the girls in industry, the girl at study, the girl in domestic service, the girl at home.

The National Board of the Young Women's Christian Association interests itself in the city, town and county associations throughout the United States and its territories. Through its Foreign Division it works with other members of the World's Committee of the Young Women's Christian Association in carrying on association work for women and girls in 53 countries. Permanent headquarters are in Geneva, Switzerland. In the Oriental countries work is undertaken by the association only upon invitation of the mission boards already working in the country. In its work of cooperation with other national movements, emphasis is placed on the training of national leaders so that the work in each country may grow out of the needs and desires of the women of that country and be commensurate with its developing leadership.

In the United States there are 1,008 local associations of which 590 are associations of students in colleges and universities. There are also 385 registered Y.W.C.A.'s in rural centers, 65 branches for Negro women and girls, 74 groups among the American Indians, and 18 International Institutes for foreign-born women and girls. The membership of the organization is about 500,000 of which 40,000 are student members. As membership in the organization is not necessary in order to avail oneself of its program, activities and privileges, this figure represents that interested group of women and girls who assume some degree of responsibility for the policies and maintenance of the organization. There are about 32,000 industrial girls, 55,000 business and professional girls, 293,000 younger girls, and 100,000 students sharing in the program of the association in the United States.

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YOUNGHUSBAND, SIR **Francis (Edward),** British soldier, explorer, and author: b. Murree, India, May 31, 1863; d. Lytchett-Minster, Dorset, England, July 31, 1942. A younger brother of Sir George John Younghusband (q.v.), he was educated at Clifton College and the Royal Military College, Sandhurst. Joining the 1st Dragoon Guards in 1882, he was promoted captain in 1889 and a year later transferred to the Indian Political Department. Meanwhile, in 1886 he had begun his explorations as a member of a Government of India mission to Manchuria; from Peking he returned to India via Chinese Turkestan in 1887. The neighboring Pamirs, the "Roof of the World" (now mostly comprised in the Tadzhik SSR), were first penetrated by him in 1889, when he also made a survey of Hunza which Russia was eyeing. Again on the Pamirs in 1890–1891, after British occupation of Hunza in 1892 he was political officer there. In 1893–1894, he was political officer at Chitral, and in 1895 as a correspondent of *The Times* accompanied the Chitral Relief Expedition which rescued a beleaguered British garrison. After service in the Transvaal and Rhodesia (1896–1897) he returned to India and was political agent at Haraoti and Tonk in 1898.

Russian influence in Tibet was becoming of increasing concern to the Indian government. In July 1903 Major Younghusband, resident at Indore, was sent as envoy to Lhasa with an escort of 200 Sikh pioneers. At the frontier the party waited in vain for an entry permit of the Tibetan government. Reports of continuing Russian intrigues with the Dalai Lama led the London government to reinforce the mission with a brigade under Brig. Gen. J. R. L. Macdonald. This force included 2,800 rifles, a mountain battery, machine guns, and field hospitals. In November the mission and escort crossed the frontier. After a difficult and long advance and several minor actions they marched into Lhasa, Aug. 3, 1904. A treaty, signed September 7, marked the successful accomplishment of the mission. Younghusband was rewarded with promotion to lieutenant colonel and a knighthood (K.C.I.E.). Bede lecturer at Cambridge in 1905, Sir Francis returned to India and was resident at Kashmir (1906–1909). His many books include *Heart of a Continent* (1896); *India and Tibet* (1912); *The Epic of Everest* (1927); *Life in the Stars* (1927); and *The Sum of Things* (1939).

YOUNGHUSBAND, SIR **George John,** British soldier: b. July 9, 1859; d. Crikhowell, Wales, Sept. 30, 1944. Eldest son of Maj. Gen. John William Younghusband and brother of Sir Francis Younghusband (q.v.), he was educated at Clifton College and the Royal Military College, Sandhurst. Commissioned in 1878, he was promoted captain in 1889, major in 1896, lieutenant colonel in 1900, and major general in 1911. Awarded the medal with clasp for services in the Afghan War of 1878–1880, he also received medals or was mentioned in dispatches for outstanding services in the Sudan (1885), India's Northwest Frontier (1886), the Burma War (1886–1887), Chitral Relief Force (1895), and the Philippines Campaign of the Spanish-American War. Fighting in the South African War (1899–1902) he was severely wounded, was breveted lieutenant colonel and made a Companion of the Bath (1900). Created Knight Commander of the Indian Empire (K.C.I.E.) in 1913, he received a second knighthood (K.C.M.G.) in 1915 while serving in World War I. A last tribute to his valor was the appointment as Keeper of the Jewel House, Tower of London, in 1917, a post he held until his death. His books include *The Story of the Guides* (1908); *The Tower from Within* (1918);

The Crown Jewels of England; The Jewel House; Forty Years a Soldier (1923).

YOUNGMAN, William, British botanist: b. Aug. 6, 1880. He was educated at the East Anglican School, privately, and at the University of London. He became professor of botany at Agra College (India) in 1910; and at Canning College, Lucknow, in 1911. He is a fellow of the University of Allahabad, and a member of the senate. In 1918 he was made economic botanist to the government of the United Provinces of India; and to the government of the Central Provinces in 1922. Nominated by the viceroy to be a member of the Indian Central Cotton Committee, he carried out extensive research and work for the improvement of the cotton crop in Central India. He served as a member of the legislative council of Ceylon in 1930–1931; and was director of agriculture, Ceylon; editor of the *Tropical Agriculturist;* chairman of the Rubber Research Scheme of Ceylon, and of the Coconut Research Scheme also of Ceylon, 1930–1935. His publications include various articles on tropical crops, and scientific papers on cytology in the *Annals of Botany.* He has traveled extensively in the Himalayas.

YOUNGSTOWN, yungz'toun, village, New York, on Niagara River, near its mouth on Lake Ontario, and 25 miles north of Buffalo. There is a United States Coast Guard station located here. Nearby is the site of Old Fort Niagara, restored in 1934. Pop. (1950) 932.

YOUNGSTOWN, city, Ohio, and Mahoning County seat, on the Mahoning River; 67 miles southeast of Cleveland, and 65 miles northwest of Pittsburgh; served by the Erie; New York Central; Baltimore and Ohio; Pennsylvania; Lake Erie and Eastern; and Pittsburgh and Lake Erie railroads; four airports, and airline connections at Cleveland and Pittsburgh. Youngstown is situated on a high ridge separating the waters that flow into Lake Erie and the Ohio River, and is surrounded by rolling hills that rise to 1,200 feet above sea level. The city is divided into north and south sections by the river, which is bridged at convenient points. The north section was settled first, and much of the newer southern section is residential in character. The main business street is on the north side of the river, which it parallels for three miles. The historic Public Square is 285 feet above Lake Erie, and 858 feet above sea level.

Industries.—Youngstown's growth and importance has been due to the development of the iron and steel industry. As early as 1805 a blast furnace was built with a capacity of two tons of pig iron per day. The second blast furnace in the United States to use raw block-coal and a rolling mill for making bar iron were both built here in 1846. In 1856 shipments of Lake Superior ores brought much new smelting industry to Youngstown, and blast furnaces sprang up rapidly during the next generation, using lake ore and Pennsylvania coal and coke as the native supplies became exhausted. Rolling mills were built between 1880 and 1896 and the first general steel mill in the valley was erected in 1895 by the Ohio Steel Company. The close proximity of limestone, one of the raw materials for steel making, has been a great aid to the industry. Limestone quarries nearby have a combined output of about 5,000,000 tons annually, and besides material for steel manufacture supply brick plants, agricultural lime and other by-products. During 1917 the American Iron and Steel Institute recognized the growing importance of Youngstown by creating the Youngstown District, which includes Lawrence and Mercer counties in Pennsylvania, and Mahoning and Trumbull counties in Ohio, embraces works in the Mahoning, Shenango and Beaver valleys, and adjacent territory, and produces one-sixth of the pig iron and one eighth of all the steel made in the United States. Nationally famous companies operate huge iron and steel blast furnaces, and a large number of steel works and rolling mills. Important coke plants are maintained at a number of Youngstown works, and from the by-products large quantities of tar, benzol, ammonium sulphate, toluol, xylol and solvent naphthas are made locally, while other by-products are shipped for manufacture elsewhere. In addition to the production of raw iron and steel Youngstown has extensive manufactures of finished steel products comprising mill machinery, sheets, bearings, shafting and structural shapes, seamless steel pipe and tubing, fireproof office furniture, and steel hooks. While the city is primarily known as a steel town it also has factories producing such diversified products as mechanical and moulded rubber goods, fine leathers, microphones, electric lamps and machinery, paint and varnish, brick, cement and cement blocks, airplane wood, automotive parts, mattresses, wall coverings, and chemicals.

Cultural Facilities.—Youngstown's schools stand high among those of the nation, due largely to the devotion and ability which has characterized superintendents and teachers since the beginning. Among these was Reuben McMillan (1820–1898) who with two short intermissions was superintendent from 1853–1886. The city's 72 schools include nine high schools and 20 parochial schools, with a total of over 1,200 teachers, while the student enrolment is more than 40,000. The educational system is planned on the 6-3-3 basis—comprising elementary (six grades), three junior high, and three senior high. The Ursuline Academy is a Catholic coeducational high school.

To supplement the schools the public library system is supported by taxation and under the direction of the Reuben McMillan Public Library Association of open membership. It has collections of approximately 160,000 volumes, a large staff of assistants and circulates nearly 1,000,000 volumes per year from its central building, branches and sub-branches.

The city is likewise the seat of Youngstown College, founded as a night school in 1888, organized as a college in 1908, and occupying a stone building of Tudor Gothic design completed in 1931. It is a coeducational institution of higher learning, offering courses leading to degrees in liberal arts, law and business administration and pre-professional courses in medicine, engineering, music and nursing.

The Youngstown Symphony is one of the leading organizations of its kind in this section of the country. Many famous artists are brought here through the efforts of the Monday Musical Club; and the Youngstown Players have been notably successful in promoting the Little Theater movement in the city.

Buildings.—Two of the handsomest build-

ings in Youngstown, and among the most noteworthy in the country, are the Butler Art Institute, erected by Joseph G. Butler, Jr., at a cost of $500,000, and opened in 1919; and the 3,000-seat Stambaugh Auditorium, costing $1,638,000 and modeled upon the design of the Pantheon of Paris, in which all the public community functions are held. The Butler Art Gallery is especially rich in the work of American painters. Youngstown likewise takes pride in the Mahoning County Courthouse, a classic building of Vermont granite, completed in 1911 at the cost of $1,000,000, and boasting murals illustrative of local history executed by E. H. Blashfield, C. Y. Turner, and A. E. Forenger. In 1915 Youngstown erected a $340,000 city hall, and it has a $375,000 Y.M.C.A. building, and a Y.W.C.A. building and annex costing $250,000. The Reuben McMillan Public Library (named in honor of a former school superintendent) is an Indiana limestone structure of classic style, built in 1911 at a cost of $155,000, of which $50,000 was contributed by Andrew Carnegie. Library service is given the entire city through this main library, its six branches and seven sub-branches. The Youngstown Natural History Museum is housed in the Lanterman Mill in Mill Creek Park, a structure dating from about 1845 and built on the site of the first grist mill in the Western Reserve

Parks.—Youngstown's 2,120 acre Mill Creek Park, known as "Ohio's Yellowstone," situated in the southwestern section of the city, is rated as one of the most beautiful natural parks in the country, and is largely the result of the 30 years' labor of the late Volney Rogers. The park is seven miles long, winding through a natural gorge. It has miles of drives, three large lakes with a number of islands, and three notable waterfalls. Besides this famous park Youngstown has other scenic and recreation parks, Lincoln, Crandall, Wick, Tod Memorial and Pine Hollow. There is an extensive system of playgrounds, in the city, capably supervised, for the use of children. Several of these have baseball and football fields with concrete grandstands; and there are high school stadiums for meets and sports. Privately owned and industrially sponsored playgrounds measurably increase the city's acreage devoted to athletic recreation, and there are a number of popular swimming pools, as well as the pleasure park Idora. A municipal golf course is maintained and there are excellently planned country clubs with the usual complement of sports. Altogether the park grounds open to the public embrace 2,633 acres. The park commission's funds are derived from the regular tax levy.

Newspapers.—Youngstown has one daily newspaper, the *Vindicator;* the *Legal News,* published weekdays; and the *Amerkai Magyar Hirlap,* and *Jewish Times,* weekly newspapers. *Daughters of America Magazine,* a monthly, is published here; as is *Jambar,* a semi-monthly student publication of Youngstown College.

Water Supply.—Youngstown has an ample water supply, planned to cover requirements of the city's growth for a 30-year period. Newest and most modern is the Meander Reservoir, built on Meander Creek and storing 10,000,000,000 gallons of water for domestic use. The city's industrial water supply finds its source in the Milton Reservoir, on Milton Creek, 17 miles from the city.

Government.—Youngstown holds its city elections biennially, electing a mayor, a president of council, and one councilman from each of the seven wards of the city. The clerk is appointed by the Council. A director of law and a director of finance are appointed by the mayor for a term of two years, and they with the mayor form the Board of Control which awards contracts for public work. In addition, the following department heads are appointed by the mayor: commissioner of public works, commissioner of buildings, chief of police, chief of fire department, commissioner of building inspection, plumbing inspector, electrical inspector, commissioner of water works, commissioner of streets, and sealer of weights and measures.

History.—The history of Youngstown is in a considerable measure a continuation of the story of New England. It was originally a part of the Western Reserve of Connecticut, and many of its pioneer settlers were from that state. There was a goodly proportion of college bred men among them, and many came to the valley with ample funds for the purchase of land and equipment. Their New England thrift, enterprise and industry, their high ideals of patriotism, and their appreciation of church and school left an indelible impression on those who followed them.

Youngstown was named for John Young, who came here in 1797, and bought an entire township at the junction of Mill Creek and Mahoning River, the purchase price exceeding $16,000, and the sale being consummated with the Westerr Reserve Land Company. Prominent in the early history of the settlement was Col. James Hillman, a well known Mahoning Valley trader, who greatly assisted Young in maintaining peaceful relations with the Indians still resident in the district. Within a year 10 families had established themselves at Youngstown, and a little later a gristmill was set up at the falls of Mills Creek. Early in the history of the village pockets of iron ore were discovered, and resulted in Daniel and James Heaton building the first blast furnace in the state of Ohio on Yellow Creek, east of Youngstown, in 1803, after Briar Hill block-coal, one of the most famous coals in the world, was found in the vicinity. This coal though bituminous, could be used in the raw state for making pig iron. Vast quantities of limestone, together with other substances needed to smelt iron ore, were found in the surrounding country, nature thus furnishing Youngstown with the raw materials that made it possible for the city to develop into a great iron and steel center.

The demand for speedier and better transportation created by the opening of coal mines and Youngstown's growing industries resulted in the building of the Pennsylvania-Ohio Canal, completed in 1839 and extending through the city to Cleveland and Pittsburgh. The first railroad was opened in 1853, to be followed later by the four great trunk lines that now enter the city.

Youngstown was the birthplace of Ohio's famous war governor, David Tod (1805–1868); Jesse Grant, father of President Ulysses S. Grant, grew to manhood here; John Brown, of abolition fame, lived and worked a few miles from Youngstown; William McKinley, the martyred President, was born nine miles from Youngstown; and James A. Garfield, another martyred President, once drove mules along the tow path of the old canal through Youngstown.

Youngstown was organized as a township in 1802, and in the same year the present public

square was given to the city by its founder. Incorporation as a town followed in 1848, and as a city in 1867. The county seat was removed here from Canfield in 1876, resulting in litigation that was not ended until 1879, when the court confirmed the city's claim to its new honor. Youngstown claims rank as the fifth city in the country in point of home ownership, and in the federal census of 1940 was the seventh largest city in Ohio. The city's population increased from 8,075 in 1870 to 44,885 in 1900; and 167,720 in 1940 to 168,330 in 1950.

YOUNGWOOD, borough, Pennsylvania, in Westmoreland County, 25 miles southeast of Pittsburgh. It has railroad shops and manufactures scientific instruments, especially thermostats. Pop. (1950) 2,720.

YOUNT, yŭnt, George Concepción, American pioneer in California: b. Burke County, North Carolina; d. Napa Valley, Mexico, Oct. 5, 1865. In 1818 he began the development of a farm in Howard County, Missouri, where he prospered as a cattleman. A neighbor embezzled his savings leaving him impoverished and discouraged. In 1825 he joined an expedition to Santa Fe and under the guidance of Ewing Young, trapper and guide, he too became a trapper and took part in several expeditions, extending his trips northward as far as Bear Lake. In 1830 he joined a Pacific bound expedition reaching Los Angeles, California, in February 1831. In 1834 he journeyed farther north finding employment at the missions of San Rafael and Sonoma. In 1835 he became a Mexican citizen and selected a broad and beautiful tract of land in Napa Valley, where he established himself as the lord of Caymus Rancho and as guardian of the frontier against Indian attacks. After the conquest of Mexico the influx of settlers caused him heavy losses, but by 1855 he had recovered much of his property.

YOUTH HOSTELS. See HOSTELS, AMERICAN YOUTH.

YOUVILLE, Marie Marguerite d', dyōō-vĭl′ (nee DUFROST DE LAJEMMERAIS, dü-frō′ dē là-zhàm-rĕ′), founder of the Grey Nuns of Montreal, was born Varennes, Canada, in 1701; d. Montreal in 1771. In 1722 she married M. d'Youville, but her husband died in 1730, leaving her with two children. She then began to devote herself to charity and in 1747 she was placed in charge of the Hôpital-Général in Montreal. Here she founded the order of the Grey Nuns.

YPRES, ē′pr′, commune, Belgium, in West Flanders Province. It was famous as a commercial center in medieval times. It lies in flat country, normally agricultural, overlooked by low ridges to the east and by higher hills of the Kemmel chain. It is about 36 miles by rail southwest of Bruges. Formerly one of the most important manufacturing towns of Flanders with a population of 200,000 in the 13th and 14th centuries, its chief manufactures were cotton and lace when, in World War I, it was the scene of four great battles. It was practically destroyed by German bombardment, especially heavy losses being the famous Cloth Hall (Les Halles) and the Cathedral of St. Martin. Following the war the city was rebuilt. It was again taken by the Germans during World War II. Pop. (1948) 17,073.

BATTLES

The first battle of Ypres began Oct. 19, 1914, the second on April 22, 1915, and the third on Sept. 20, 1917.

The first battle was one of the hardest fights of the entire war. It began with the advance of Rawlinson's corps towards Menin followed by advances of Pulteney's and Allenby's corps down the Lys in the same direction. At the same time the Germans began a general advance with the army of Duke Albrecht of Württemberg and the 6th German Army led by Crown Prince Rupprecht of Bavaria. By October 19 the whole front from La Bassee to the sea was engaged. The British were forced back on October 30 and on the 31st their line broke at Gleluvelt. A counterattack drove back the Germans and all ground lost was regained. The battle ended on November 12 and trench warfare began on this part of the front. The second battle (April 22-May 25, 1915) is memorable for the first gas attack of the war. It resulted in heavy casualties for the British and a reduction of the salient. In this battle the Canadian brigades were engaged and lost heavily. The total British losses were 2,150 officers and 57,125 men; the Germans reported losses of 860 officers and 34,073 men. Throughout the summer and fall of 1917 there was almost continuous fighting in the Ypres sector. Like the first and second battles little was gained by either side in the third battle and the losses were tremendous. The nature of the ground greatly hindered operations. The battle ended with the occupation on November 4 by the second Canadian Division of Passchendaele village.

In March 1919 the Belgium government intimated their desire of making Canada a grant of land in the city of Ypres for the erection of a memorial museum and shrine to the brave Canadian soldiers who in the defense of liberty had made the supreme sacrifice on the battlefields of the famous Ypres salient. It was also suggested not to rebuild the city but to leave its ruins standing as a lasting monument to unjustifiable and ruthless German aggression. See also WAR, EUROPEAN—MILITARY OPERATIONS ON THE WESTERN FRONT.

YPSILANTI, ĭp-sĭ-lăn′tĭ, a distinguished Fanariot family descended from the Comneni and of prominence as defenders of Greek liberties. Its most conspicuous members are ALEXANDER: b. Constantinople, 1725; d. 1805; hospodar of Wallachia 1774–1777, and again in 1796–1798, and of Moldavia 1784–1792. He propounded a scheme for the fusion of the Greek and Turkish people, but having incurred the suspicion of the Porte was executed. CONSTANTINE, his son: b. Constantinople, 1760; d. Kiev, Russia, July 28, 1816. He early planned the freedom of Greece, but his scheme was prematurely discovered, and he fled to Vienna. Pardoned by the sultan, he was hospodar of Moldavia 1799–1805. He then went to Russia, but returned to Bucharest with 20,000 men, in the hope of freeing Greece. The peace of Tilsit interrupting his plans, he returned to Russia. ALEXANDER, eldest son of the preceding: b. Constantinople, Dec. 12, 1792; d. Vienna, Jan. 31, 1828. He went with his father to Russia and, joining the Russian Army, served with distinction in various campaigns. In 1820 he became head of the secret association known as Hetaeria, whose aim was the independence of Greece, and in

March 1821 entered Moldavia and raised the standard of revolt among the Rumanians. He was defeated by the Turks at Dragaschen, near Galatz, June 19, 1821, fled to Austria and was imprisoned six years at Munkacs, Hungary. DEMETRIUS, brother of the preceding: b. Constantinople, Dec. 25, 1793; d. Nauplia, Aug. 16, 1832. After serving in the Russian Army, in 1821 he joined the Greek patriots in the Morea and played a brilliant part in the struggle. But though a brave and successful general, as his victory at Tripolitza and his defense of Argos show, his influence was constantly undermined by the "native" party, who never forgot that he was a Phanariot, and, therefore, a foreigner in part. In 1827, however, he was made commander in chief of the Greek Army but the ungenerous course adopted toward him by the government of Capo d'Istria compelled him to resign Jan. 1, 1830, and he then withdrew from public affairs. GREGORY, brother of the preceding: d. 1835.

YPSILANTI, city, Michigan, in Washtenaw County, altitude 713 feet, on the Huron River, 28 miles west of Detroit and eight miles east of Ann Arbor. It is on the main line of the New York Central Railroad running between Detroit and Chicago. Two well-known bus lines and numerous truck lines serve the needs of the community. The city is also connected with the Detroit Expressway.

It is the commercial center of a rich agricultural area. Manufactures include automobiles, dairy products, auto parts, oil stoves, paper, ladders, sheet metal machinery, iron castings, pressed steel, cement, and foundry and machine products.

The city is the site of the Michigan State Normal College, founded in 1849, the oldest teacher-training institution west of the Alleghenies. Cleary College, a business training school, is also located here. In addition to these institutions the city has a fine system of public schools. There is a well-equipped public library. There are 28 churches, representing 20 denominations.

History.—Ypsilanti was established in 1823 as a pioneer settlement on the Huron River by a small band of frontiersmen who were pushing their way west in search of new adventure. It was chartered as a village in 1832, and as a city in 1858. The government is the council-manager type operating under a special charter. Pop. (1950) 18,302.

YREKA, wī-rē'kà, city, California, and Siskiyou County seat; altitude 2,624 feet, about 320 miles north of San Francisco, near the Oregon line. It is served by the Southern Pacific, and Yreka Western railways, and Southwest Airways and is on state and federal highways.

It is the trading center for a prosperous agricultural and lumbering region. Stock raising and mining are also important. There are two schools, two libraries, a radio station, and two newspapers.

The city was settled in 1851 during the gold rush. In 1854 it was saved from a Klamath Indian raid by an Indian woman, Klamath Peggy, who warned the residents of the impending attack. It was incorporated in 1857. Pop. (1950) 3,227.

YRIARTE, ē-ryårt, **Charles Emile,** French journalist, artist and author: b. Paris, Dec. 5, 1832; d. there, April 10, 1898. He studied architecture as a pupil of Constant Defeux, became inspector of imperial asylums, and after this post was abolished, went on the Spanish expedition to Morocco in 1859 as correspondent and artist for the *Monde Illustré,* and in 1860 on Garibaldi's campaign in Sicily in the same capacity. From 1864 to 1870 he was editor in chief of the *Monde Illustré.* In 1881 he was made inspector of fine arts and in 1889 member of the superior council of fine arts. He wrote for the *Figaro* and for *La Vie Parisienne* over the pseudonym "Marquis de Villemer."

Among his numerous volumes of various character are *Portraits Parisiens* (1865); *Goya, sa vie et son oeuvre* (1867); *Les Tableaux de la Guerre* (1870); *Le puritain* (1875); *Venise* (1877); *Autour du Concile* (1887); and several works on the Italian Renaissance, such as *Florence* (1880); *Françoise de Rimini* (1882); *Matteo Civitali, sa Vie et son Oeuvre* (1885); *Autour des Borgia* (1890); and *Maso di Bartolommeo dit Masaccio* (1894).

YRIARTE, or **IRIARTE, Juan de,** Spanish linguist: b. Orotava, island of Teneriffe, Dec. 15, 1702; d. Madrid, Aug. 23, 1771. In 1714 he was sent to school at Paris and afterward he studied English in London and jurisprudence in Madrid, where he presently obtained a post in the royal library. In 1732 he became chief librarian and in 1742 translator for the ministry of foreign affairs. He published an important *Codices graeci manuscripti* (1769) and wrote many Latin and Spanish epigrams and proverbs, Latin poems, etc., included in his *Obras Sueltas,* 4 vols. (1774).

YRIARTE, or **IRIARTE, Tomas de,** Spanish dramatist: b. Orotava, island of Teneriffe, Sept. 18, 1750; d. Madrid, Sept. 17, 1791. He began to write in boyhood and in 1770 published his comedy, *Hacer que hacermos,* under the pseudonym, *Tirso Ymareta.* In 1870 he published a didactic poem, *La musica,* and in 1782 *Fabulas literarias,* considered the best fables in the Spanish language. He also wrote the first regular comedies in Spanish, the best being *The Spoiled Child* and *The Ill-Bred Young Lady* (1788), and published Spanish translations of French plays, Horace's *Ars Poetica* (1777), and four books of the *Aeneid.* In 1771 he succeeded his uncle, Juan de Yriarte (q.v.), as royal librarian.

YS, *ēs,* a more or less legendary city of Brittany situated on the bay of Douarnenez in Finistere and submerged in the 4th or 5th century. King Gradlon had the only key to the secret gate in its protecting dyke. His daughter stole it as a prank while banqueting with her lover late one night while her father slept, opened the gate and let the sea engulf the city.

YSAYE, ē-zà-ē, **Eugene,** Belgian violinist: b. Liége, Belgium, July 16, 1858; d. Brussels, Belgium, May 12, 1931. He studied at the Liége Conservatory and subsequently with Wieniawski and Vieuxtemps at Brussels. He made many successful European concert tours and in 1886–1898 he was professor in the Royal Conservatory of Brussels. He originated a new school of violin playing, embracing features of the German, the French and the Belgian schools.

He was considered to be one of the leading violinists of the world and was gifted

with marvelous powers of interpretation. He visited London in 1889 and established there as well as in the principal cities of the Continent a high reputation as a conductor and soloist. He first visited the United States in 1894 and toured the country repeatedly thereafter, becoming in 1918 conductor of the Cincinnati Orchestra. He returned to Belgium in 1922. He composed concertos for violin and piano, and *Suite Wallonne.* Died, Brussels May 12, 1931.

YSER, a river of Flanders, Belgium, about 48 miles long, canalized from Dixmude to Nieuport, where it is from 15 to 20 feet above the ground, a fact which proved decisive in the victory of the Allies at the Battle of the Yser (Oct. 16–31, 1914). The Germans on Oct. 16, 1914, made an attack on Dixmude, beginning the Battle of the Yser. The Germans outnumbered the Allies three to one and the campaign was going in their favor, when on Oct. 25 Joffre decided to flood the country held by the Germans, and a dam was constructed over the Yser canal. The water was slow to rise, but by the 31st, after the dikes had been cut, the Germans were caught in the flood, many were drowned and many others taken prisoners.

YTTERBIUM, a rare chemical element belonging to the yttrium group. Discovered by Marignac in 1878 in the mineral gadolinite, it was separated into two elements named neoytterbium and lutecium by G. Urbain in 1907. Also found in other minerals occurring in Siberia, Scandinavia and Greenland. Symbol, Yb.; atomic weight, 173. Its oxide Yb_2O_3 forms colorless salts with sulphuric acid, etc.

YTTRIALITE, a native silicate chiefly of thorium and the yttrium metals. It occurs in Llano County, Texas, in grayish-olive-green masses, associated with gadolinite and other minerals.

YTTRIUM, a rare chemical element discovered 1794 by Gadolin in the mineral gadolinite from Ytterby. It is always found in combination, some of the minerals containing it being gadolinite, xenotime, euxenite, yttrotantalite and polycrase. It is usually separated from the mineral by use of sulphuric acid or aqua regia. The element is obtained by heating the chloride with metallic potassium, by electrolysis of a molten mixture of the chloride and sodium chloride, or by heating the oxide with magnesium. It is a grayish-black, lustrous, metallic powder that burns in the air to the oxide Y_2O_3; soluble in dilute acids; symbol Y; atomic weight 89; valence 3. It forms a great many compounds closely resembling aluminum.

YUAN, or **YUEN,** a Mongolian dynasty which ruled in China in 1280–1367. The founder of the dynasty was Kublai Khan (q.v.), who by 1280 had conquered China and established complete jurisdiction. But while he was wise in government, a patron of literature and art, and executed public works of great importance, the Chinese was less sensible of the benefits he conferred than of the fact that he was a barbarian and placed barbarians in office to the exclusion of Chinese. He was succeeded by his grandson, Timur, who reigned in 1294–1307 as Yüan-chêng. A Mongol prince, Wu-tsung, was the third of the dynasty; and in 1312–1320, the Chinese became somewhat less resentful of the alien dynasty through the efforts of Jên-tsung, who paid honors to Confucius, replaced the Chinese in many offices, and in various ways succeeded in gaining the favor of his subjects. From his time the power of the dynasty declined rapidly in authority, and during the reign of the ninth ruler, Shun Ti, in whom were said to be all the faults and none of the virtues of his predecessors, revolts broke out all over China; the Chinese found a leader in Chu Yüan-chang, who forced Shun Ti to flee. He found refuge at Ying-chang Fu, and died there, the last of the dynasty.

YUAN SHIH-KAI, Chinese soldier and statesman: b. Hsiang Ching, province of Honan; d. Peking, June 6, 1916. Descended from a family long active in the service of the state, Yuan was destined from the beginning of his career to become a leader in military, foreign and domestic affairs. Yuan Chi-san, his grandfather, achieved distinction in suppressing the Taiping Rebellion (q.v.) and died (1864) as imperial commissioner and provincial commander in chief. Yuan qualified for a bachelor's degree and immediately attached himself to the (then despised) military profession. At the age of 20 he was appointed aide-de-camp to General Wu Chang-ching, then commanding the Chinese forces in eastern Santung. When the rebellion broke out in Korea (July 1882) Li Hung Chang, then the helmsman of China's ship of state, sent an expeditionary force, to which Yuan was attached, to the assistance of the emperor and quelled the uprising. Yuan in 1884 was given command of the Chinese garrison in Korea and the following year was appointed imperial resident. For the next nine years he was the de facto ruler, ably assisted by Sir J. McLeavy Brown. Yuan soon demonstrated his uncompromising attitude and autocratic methods, which involved him in many difficulties with the Japanese at Seoul. The Tonghak Rebellion (1893), the well-organized movement of the Nationalist Party, followed by the sinking of the *Kowshing,* first proved China's military weakness. Protected by British blue jackets Yuan escaped to the coast. After temporary peace Yuan was restored, Li Hung Chang sent 5,000 troops to Yuan and ordered them to be trained in the Western fashion. This marked the beginning of China's modern army. Yuan ruled this small force with a rod of iron, but the men were slow to accept subordination and Yuan could not instill the necessary spirit of devotion in his troops. After the coup d'état of 1898 and the subsequent resumption of power by the empress dowager, the military prowess and reputation of Yuan became an important factor. He always remained a close friend of the empress, who was able to maintain the ruling hand until her death, with the constant assistance of Yuan, by this time well versed in all important affairs of government. When at the death of the Empress Dowager Tzu Hsi (1908) Kuang Hsu came into power, he fulfilled an old grudge and caused Yuan's humiliating retirement, for it had been rumored that this close friend of the empress silently acquiesced in a plot to overthrow the state, in which Yuan's blood brother, Jung Lu, was the dominating factor. During the Boxer uprising (1900) the military experience of Yuan

became necessary and he was reinstated. Assisting the different viceroys in keeping the trouble confined to the immediate vicinity of Tientsin, at the same time he lent valuable aid to the Allied forces then in China. As viceroy of Chihli, November 1901, he was welcomed by the natives and foreigners as the best guarantee of restoration of order, and in this office he at once instituted educational and administrative reforms. His statesmanship was of a high order; he could always be trusted, and so with his appointment as administrative head of the foreign office at Peking (September 1907) and member of the Grand Council, the foreign diplomats welcomed Yuan as a statesman well liked and respected. However, on the almost simultaneous deaths of the emperor and the empress-dowager imperial politics declined and he was banished.

At this period China was in the throes of continual unrest, and lacking trained military leaders, was compelled to recall Yuan (October 1911); he was appointed president of the Council of Ministers on November 1, and prime minister two weeks later, with full power to meet conditions as he found them. His rise was rapid. The subjects in the south clamored for a republican form of government.

While the Manchu Tatar autocracy which had ruled the Celestial Empire since 1643, strove to withstand the inevitable, Yuan, fully realizing his ability to continue the actual domination of China whether it were termed republic or monarchy, consented to be proclaimed provisional president of the Republic of China (Feb. 15, 1912). Finally elected president Oct. 6, 1913, he immediately announced that China undertook to observe all treaties and obligations incurred by the Manchu regimen. He abolished the democratic opposition party, suspended Parliament, and appointed an Administration Council. The provisional constitution was completed in the spring of 1914, giving Yuan extensive powers. In November 1915 most of the provinces having voted for a return to monarchy, Yuan refused to ascend the throne as emperor; then changed his views and fixed the coronation for Feb. 9, 1916, and again abandoned the proposed idea of a monarchy. The provinces in the south again revolted, declaring that Yuan had forfeited his right by acceptance of the throne and proclaimed the vice president, General Li Yuan-hung, as president of the new republic, but he was not generally recognized. Upon the death of Yuan the appointment of General Li Yuan-hung became certain, and he stepped into office June 7, 1916.

YUBA, yōō'bȧ, a river in California formed by the junction of three rivers, North, Middle and South, which have their sources in the Sierra Nevada. The Yuba enters the Feather River just below Yuba City. In its upper course it has many picturesque gorges and several cascades.

YUBA CITY, town, California, located in Sutter County, altitude 50 feet, on the Feather River near the mouth of the Yuba; on the Southern Pacific Railroad, and on federal and state highways. It is about 42 miles north of Sacramento. With Marysville, across the Feather River, it forms one commercial community. In a fertile fruit growing region, peach packing is the main industry, which employs Mexican and Japanese labor. Pop. (1940) 4,968; (1950) 7,856.

YUCATAN, yōō-kȧ-tăn', a state of Mexico on the northern end of the Yucatan Peninsula (q.v.). Except for a range of very low mountains along the border with Campeche, the state consists entirely of a hot, sparsely inhabited plain, rarely as much as 100 feet above sea level, covered by low trees and dense thickets except where cultivated. Rainfall is limited and falls during the months of May to September. Corn is the principal crop, constituting almost 80 per cent of the people's food in one form or another. The capital is Merida (q.v.) which is linked by rail and highway with Progreso, the only port of importance, some 22 miles north of the capital. The humus is almost nowhere more than a few inches deep and consequently the cornfields must be moved every two or three years, a new section of the land being cleared and burned for this purpose. There are no rivers of importance. Cenotes or natural wells, however, are frequently found. These, and suitable well-digging sites, largely determine the habitable locations. An almost constant breeze permits the use of windmills to raise water for irrigation purposes. The chief crop is henequen from which sisal hemp is obtained for the manufacture of cordage and bags. Honey and tropical fruits are also produced in quantity. The area of the state is 14,867 square miles. Pop. (1940) 418,210; (1950) 516,899.

YUCATAN, Antiquities of. See MAYA; MAYAPAN.

YUCATAN PENINSULA, a projection of the North American continent between the Gulf of Campeche, the Gulf of Mexico, and the Caribbean Sea. It comprises the Mexican states of Campeche and Yucatan, and the Territory of Quintana Roo, British Honduras, and part of Guatemala. The extreme southerly portion is moderately mountainous and is covered with tropical rain forest. The peninsula becomes increasingly low and flat as it advances northward, the small mountains traversing the peninsula from the city of Campeche to Chetumal Bay appearing quite sizeable although almost nowhere do they exceed 300 feet in elevation. Rainfall decreases toward the north and there is an imperceptible change in flora and fauna, from that of the wet tropics to that of the dry tropics. The population consists largely of Maya Indians who are the descendents of the peoples whose civilization flourished in both the southern and northern sections of the peninsula long before the Spanish conquest. Their early capital was Mayapan (q.v.). The so-called Old Empire was at its height in the south and adjacent regions from the 4th century A.D. until the 10th century. About 1000 A.D., for reasons not entirely understood, the centers of habitation were moved northward to the present sites of the magnificent ruined cities of Chichen Itza, and Uxmal. See also MAYA.

YUCCA, yŭk'ȧ, the name of a genus of shrubs with clustered ensiform leaves, belonging to the Liliaceae family. The name is also used to designate the plants belonging to the entire family of yuccas. This includes not only the genus *yucca,* but several other genera, such as *Samuela, Clistoyucca,* and *Hesperoyucca.* The species are chiefly found in the United States, and Mexico, though they are found elsewhere. The best-known species in the United States is *Yucca filamentosa,* or the Adam's needle, which is

found in cultivation as far north as New England. The white or violet cup-shaped flowers, resembling huge lilies of the valley, are borne mostly on erect clusters or along most of the stalks; some shed a heavy fragrance when open at night. The coarse fiber of *Y. filamentosa,* called bear grass, has long been used in a small way as tie material in the South. In Mexico, however, there are several species with larger leaves that have since 1900 been exploited for their fiber, which has become known as a rather coarse substitute for the better cordage fibers. This coarse fiber is known as palma istle, pita sylvestris, and zamandoque. Yucca fiber is stiff, harsh, and brittle, and as prepared is not always of good color, and therefore can never take rank with the better fiber known as hard cordage fibers. (See FIBRE). *Yucca baccata* yields a fairly good fiber, and the parenchyma or pith, and the root possess detergent qualities, from which the name "soap plant" has been derived. The sun-cured, whitish-yellow inner leaves of *Yucca glauca* are used by the Arizona Indians for ornamental basketry, either entire or subdivided, and several other species are also employed in the domestic economy of North American Indian tribes for rude cordage, baskets, and sandals.

A very remarkable feature in the yucca is its fertilization by the aid of any of several species of small whitish moths of the tineinine genus *Pronuba.* The yucca flowers are so shaped as to be impossible of fertilization, and no other insects attach themselves to this plant. The yucca moth gathers a quantity of pollen in its jaws, then lays an egg in the pistil, and stuffs the hole in which it is laid with pollen, thus fertilizing the ovary. The caterpiller develops in the fruit pod, but does not seriously harm the plant. This extraordinary case of symbiosis was disclosed by Charles Valentine Riley in 1872.

YUCHI, a linguistic stock of North American Indians who once lived along the banks of the Savannah River. See UCHEAN.

YUECHI, yüĕ'chē', a nomad people, originally consisting of five separate tribes, who inhabited central Asia. In the 2nd century B.C. they were driven westward by the Hiung-nu (Huns), and about the year 126 B.C. they conquered and occupied the Greco-Bactrian kingdom founded by Alexander the Great, including parts of modern Afghanistan and Asiatic Russia. During this occupation the Yuechi united to form a single tribe called Kushans, from the name of the principal tribe of the combination. About 50 A.D. they invaded northwestern India where they founded the Kushan dynasty, bringing with them some of their adopted Greek and Persion culture. At the close of the 3d century A.D. they were driven out of India by the Guptas. Remnants of the Yuechi which had remained in Bactria formed a kingdom in eastern Afghanistan; but this was destroyed early in the 4th century by the Yuechi's traditional enemies, the Huns.

YUGA, yoo'gä, or **YOOGA** (Sanskrit, *Yoke,* a period of time) one of the periods into which the past history of the globe is divided in the chronology of the Hindus. There are four yugas: the Satya Yuga, containing 1,728,000 years; the Treta Yuga, 1,296,000 years; the Dwapara Yuga, 864,000 years; and the Kali Yuga, now in progress, which began about 3094 B.C., and which will extend to 432,000 years. Horace Hayman Wilson points out that these numbers originate in the descending arithmetical progressions of 4, 3, 2, 1, according to the notions of diminishing virtue in several ages applied to a cycle of 12,000 divine years, each equal to 360 years of mortals; and $12{,}000 \times 360 = 4{,}320{,}000$, the periods of the four yugas added together. This total period is a Maha Yuga or Manvantara. The close of a Manvantara is signalized by a *pralaya,* or apparent destruction of the world, which inaugurates the "night of Brahma," and endures until after a thousand cycles of time Brahma awakes and renews the cycle of the ages, or "day of Brahma." See also INDIA.

YUGOSLAV LANGUAGE, the language common to all the Yugoslavs (the Serbs, Croats, Slovenes, and Bulgars); one of the great group of Slav tongues. The Yugoslav language is subdivided into four dialects. Yugoslav scholars, who desire to promote the trend toward unity among the Yugoslavs, maintain that the form of each of these dialects has been artificially preserved in printed books, newspapers, and periodicals, whereas the Yugoslavs have a strong natural inclination to abandon their special dialects and to unify the language, just as they wish to unify their various states. The authorities attribute the continued existence of the dialects up to the end of World War II mainly to the propaganda through which the Germans largely dominated the Balkan countries to keep the Yugoslavs divided into small states, so that they (the Germans) could rule and exploit them. The unification of the dialects was attempted at the beginning of the 19th century under the leadership of Vuk Karadžić (Kardžić, 1787–1867), a Serb, Ljudevit Gaj (Gay, 1809–1872), a Croat, and Stanko Vraz (1810–1851), a Slovene. Only Gay succeeded in inducing his group (the Croats) to adopt as the Yugoslav literary language the dialect then spoken in Bosnia, Hercegovina, and Montenegro. Karadžić partly succeeded with the Serbians. They abandoned the ancient church dialect as their literary language, but adopted instead the dialect of the Belgrade (Beograd) streets, and expelled Karadžić from his native Serbia. Thus the Serbs were themselves divided. Those in Serbia adopted the Belgrade dialect as their literary language, and those outside Serbia—in Bosnia, Montenegro, Croatia, Hercegovina, and Dalmatia—joined with the Croats in using the "tristate" dialect as their literary language. This situation continued until King Alexander I (r. 1921–1934, q.v.), by proclamation, established the Belgrade dialect as the official language of the country, and prohibited the use of any other dialect within Yugoslavia, with the exception of Slovene, the use of which remained restricted to Dravska Banovina (see also YUGOSLAVIA). Vraz had completely failed to induce the Slovenes to adopt the "tristate" dialect. They had adhered to the doctrine of the Slovene scholar, J. B. Kopitar (1780–1844) that Slovene is a separate language, a doctrine in support of which he had written a grammar in 1808. In his disillusionment, Vraz, although a Slovene, refused to use the Slovene dialect, and became renowned as a Croat poet.

During the late 1860's, a group of Serbians tried to secure adoption of the "tristate" dialect, but were denounced as traitors to Serbism, and

forced to abandon their project. Many Turk, Greek, Rumanian, and French words were subsequently adopted by the Serbians, further accentuating the difference between the Serb and Croat dialects. During World War II, the Croats returned to the "tristate" dialect and declared it to be the official Croat language, while the Serbians introduced many additional foreign words, tending to create a separate Serbian language. Since the defeat of Germany, both groups have been trying to unify the language, and the move toward unity has been reflected in postliberation Yugoslav periodicals. The Serbians have been unwilling to abandon their use of the broad Magyar *e*, to which they have been accustomed for centuries. The Croats say *cijelo* (whole), *mlijeko* (milk), whereas the Serbians say *celo*, and *mleko*. This makes little difference in the language except in a few words. *Svet*, for example, can mean "holy" or "the world." But when the Croats mean "holy" they say *svet*, and when they mean "the world" they say *svijet*.

The Slovenes, like the Serbians, use the more abbreviated forms of words, but do not pronounce the *e* as broadly as the Serbians. They have many words which are not used by either the Serbs or the Croats. Their dialect has undergone a series of metamorphoses: the first, when they merged with the Celts, a second, when they were invaded by the Visigoths, a third, during the long period of German rule, which strongly influenced the dialect's development.

The language of the Serbs and Croats while still in its early days underwent an evolution through additions contributed by later Slav migrants from beyond the Carpathian Mountains. It had the best opportunity for natural development in those districts which were not under foreign rule, and which had the minimum number of newcomers, namely, the "tristate" region of Bosnia, Hercegovina, and Montenegro. The Slavs of this area, who seldom came in contact with foreigners, kept their language pure, and greatly improved it with use. Their dialect is naturally rich and rhythmical and became the source of almost all the Yugoslav folk songs and epic poems. But since its poets created their works (especially those with an historical background) from popular legend, they do not always conform to fact.

The Bulgars brought their dialect with them from their "old country" on the banks of the Volga River, where they had already mingled with tribes of a Turanian stock, retaining it in its semideveloped stage. This dialect differs widely from the other Yugoslav dialects in its lack of noun declensions and in the general poverty of its grammar. It should be called Macedonian rather than Bulgarian, since it was current in Macedonia at the time of the Slav Apostles. These innovators used it in translating the Bible, although they left in it many words which they found in the original translation written in the Glagolitic alphabet by the Croats (see CYRIL AND METHODIUS).

Apart from Bulgarian, the differences between the Yugoslav dialects are so insignificant that peasants from all parts of Yugoslavia can sit together and keep up a conversation, each speaking his own dialect. Intellectuals have sometimes preferred to use a foreign language, usually German. It is expected that, as the unity of the nation progresses, the native dialects will disappear, and that the Serbo-Croat Yugoslav dialect will become the literary language of all Yugoslavs. Characteristic differences between the dialects are illustrated in three different words—*kaj, ča,* and *što*—by which they express the English "what." The Croats, except in a very few districts, have abandoned their *kaj* and *ča* dialects for the *što* dialect. One cannot read one dialect and speak another. And since all the books are written in the *što* dialect, it is bound to prevail.

The Yugoslav language is rich in the number of its original words and in the flexibility of its grammar and word usage, which permits much exactness of description. This is especially true of the use of diminutive and augmentative forms of words. For instance, "the house" is *kuća*; but "a little house" is *kućica*; and "a big house" is *kućerina*. "The woman" is *žena,* but if one likes the woman referred to he will say *ženica;* if he dislikes her he will say *ženetina*.

The Yugoslav language has no article, and the words are grouped into three genders (masculine, feminine, and neuter) to denote their value, strength, and importance; but all the words must be pronounced according to their meaning. While iron and gold (*željezo, zlato*), for example, are both minerals, and are therefore of neuter gender, *željezo* must be pronounced hard and *zlato* soft. Every noun has both singular and plural forms, and is declined in seven cases, with changing endings. The declension of three common nouns is as follows:

	Man (Masculine)	Woman (Feminine)	Child (Neuter)
Singular			
Nominative	Čovjek (Čovek)	Žena	Dijete
Genitive	Čovjeka	Žene	Djeteta
Dative	Čovjeku	Ženi	Djetetu
Accusative	Čovjeka	Ženu	Dijete
Vocative	Čovjece	Ženo	Dijete
Locative	Čovjeku	Ženi	Djetetu
Instrumental	Čovjekom	Ženom	Djetetom
Plural			
Nominative	Ljudi	Žene	Djeca
Genitive	Ljudi	Žena	Djece
Dative	Ljudima	Ženama	Djeci
Accusative	Ljude	Žene	Djecu
Vocative	Ljudi	Žene	Djeco
Locative	Ljudima	Ženama	Djeci
Instrumental	Ljudima	Ženama	Djecom

In addition to the singular and plural forms of the noun, the ancient Slav dual form is still in use in some nouns, but invariably with a collective meaning, usually but not necessarily denoting a pair.

In contrast with the English, who have comparatively few words indicating family connections, the Yugoslavs, who for centuries lived in great families, have nearly 50 such words. Some of these have several variations to denote the approximate age of the family member referred to. While in English we say simply "son," regardless of the age of the individual, the Yugoslavs use *sučic* in referring to a child under five years of age, *sinak,* in referring to one under 10, *sinko* to one under 18, and *sin* to one older than 18.

The Yugoslavs vary the form of their verbs to indicate the character of the action described, to show, for example, whether the act lasts for a short or a long time, and whether it is re-

peated or completed. There are three past and three future tenses for each verb, according to the duration as well as the time of the act referred to.

Owing to this flexibility and to its large original vocabulary, the Yugoslav language is ideally adapted for poetry. This is believed to be the reason why the Yugoslavs developed such a rich collection of folk songs and epic poems written not by professional poets but by the people themselves. There are Yugoslav districts where the people, in carrying on their daily work, converse not in prose but verse, with regular rhythms.

While the Serbs and Croats use the same language, the Serbs use the Cyrillic alphabet. The Croats have long abandoned their Glagolitic alphabet for the more practical Latin characters, to which they have added some letters to express sounds peculiar to the Yugoslav language. In addition to the ordinary Latin alphabet, they use the following accented letters: *ć* (soft as in tune); *č* (hard as in church); *š* (as in short); and *ž* (as in azure). Because of the softness of their sounds they combine *j* (sounded like y) with the letters *d, l,* and *n.* The Serbs have a special sign for each of these sounds. An attempt has been made by some Croat authors to introduce a single letter for each of these sounds by crossing the letter required. But while these crossed letters sometimes occur in printed books, the innovation has not become popular with the masses.

The Yugoslave use *r* as a vowel in certain words, having dropped the *e* which formerly preceded it. Thus the former *perst* (finger) has become *prst,* and *kerst* (cross) now appears as *krst.* See *Bibliography* under SLAV LANGUAGES.

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YUGOSLAV LITERATURE, the literature produced by the various branches of the Yugoslavs. The Slovene and Bulgarian literatures are part of Yugoslav literature, but have to be treated separately on account of differences in the dialects. The Serb and Croat literatures, on the contrary, are identical, except that they are printed in two types, Latin and Slav (Cyrillic). Until the modern period, there was no separate Croat or Serb literature, both Croat and Serb writers of medieval times being known as Slovinian authors (Slovinski).

Early Works in the Slav Alphabet.—Yugoslav literature began with the invention of the Slav alphabet (q.v.). Before its introduction the Yugoslavs on the Adriatic coast wrote in Latin, not knowing that they could write their native language in Latin characters. The Slovenes were the first to use the Latin alphabet in writing their own language, beginning the practice in the 8th century A.D. The first attempts at literary production in Slav characters were written in Glagolitic, and consisted of religious poems and the liturgy. There were also some early translations of medieval romances, including the *Siege of Troy,* and *Alexander the Great.* Among the original works of this period (9th and 10th centuries A.D.), the most important were the *Chronicles,* written by the Priest of Duklia, which were translated into Latin and in the 14th century retranslated into the then modern Yugoslav dialect. By that time the art of writing had spread considerably, and there are many laws extant written in the Glagolitic alphabet, including those of Krk, Kastav, and Dubrovnik.

The Slavs along the Adriatic knew Latin as well as their native tongue, so that there was no great necessity for them to translate much of their literature into Slav. But the Slavs in the central Balkan area (Rascia) hated the Greeks, and having great monasteries, which provided a good opportunity to develop manuscript writing, translated many manuscripts from Greek originals for distribution among the clergy in other monasteries and in the parishes. These translations were written in the Slav alphabet as used by the church, and a rich collection of them is still preserved. The monks translated religious works and many secular manuscripts written by Greek authors. Some original works in the Glagolitic alphabet of this period have been preserved, particularly biographies of the kings of Rascia. The best known of these is the *Life of St. Sava* (first bishop of Serbia, 1219–1234), written in the 13th century by the monk Domentian (Domentijan).

Venetian and Turkish Conquests. Literature of Dubrovnik.—That many more manuscripts written in Cyrillic characters should have been preserved than of those written in the Glagolitic, is understandable. The Venetians, during the period of their control of the eastern shores of the Adriatic, destroyed everything Slav on the islands and along the coast. But the Turks, during and after their conquest, did not destroy the Slav monasteries. When the printing press was invented, the Slavs established a press in Venice (in 1468) but were compelled to move it to Senj (Segna) in 1481 and to Fiume in 1483. At that time all the Yugoslav lands were either under Turkish rule or fighting to preserve their independence of it. The only free area was the republic of Dubrovnik, and it became the center of Yugoslav literary activities. Authors from various islands and parts of the mainland under alien domination worked together there in promoting Yugoslav literature. Among the lyric poets were Šiško Menčetić-Vlahović (1457–1527), George Držić (1461–1501), Dinko (Dominik) Ranjina (1536–1607), and many others. Most prominent of the epic and dramatic poets were Marko Marulić (1450–1524), Hanibal Lučić (1485–1553), and Dominik Zlatarić (1558–1609). The great epic poem by Brno Krnarutić, published in 1587, describing the defense of Siget (1566) by the Croat Ban Zrinski (Zrinyi) against Suleiman the Magnificent, sultan of Turkey, is still extant and still read. The poet Marin Držić (1518–1567) wrote many comedies, including two said to have been used by Shakespeare as original sources in writing his *Midsummer Night's Dream,* and *Comedy of Errors.* Of all the poets which Dubrovnik produced during the medieval period, the greatest was Ivan Gundulić (Giovanni Gondolo, 1589–1638), author of *Osman,* an epic poem depicting the battles of the Slavs against the Turks, and advocating Slav unity. Gundulic's pastoral play *Dubravka* is still being staged, but of all his works *The Tears of the Returning Son* (probably autobiographical) is considered the best.

Yugoslav Renaissance.—Slovene literature was born with the Reformation. Its chief originator, Primuž Trubar (Primus Truber, 1508–1586) wrote many works in favor of the Reformation, which were printed in various types—

Gothic, Latin, Glagolitic, and Cyrillic. This period (the 16th and 17th centuries) is called the age of the Yugoslav renaissance, and marked the beginning of the movement for national unity. Such unity was first proposed not as a Yugoslav idea but as a Slav idea, so that we find many authors writing about the unity of all the "Slovinci," as they called themselves in those days. There was no separate Serb or Croat literature; authors and others of the various Slav nationalities referred to themselves as a single nation, not of Yugoslavs but of Slovinci, Vladislav Menčetić-Vlahović (1602–1666), for example, writing about them thus in his *Trublia Slovinska* (*The Slovinski Clarion*), a collection of poems published in 1676.

The Reformation had a great influence in reviving the old glagolica (works in the Glagolitic alphabet) because the friars of Istria and the Croat Littoral adhered to the Slav liturgy and had to issue new religious books for use in the churches.

This age was also the beginning of the Yugoslav folk poems. Folk songs had long existed among the Yugoslavs, but they were mainly short lyric poems, sung by girls about their love. The folk poems, on the contrary, were intended not to be sung, but to be recited or chanted. They were usually written in stanzas of 14 or 16 syllables, and depicted some historical event, local or national. To judge from the dialect used in these poems, they must have originated in southwestern Yugoslavia (Bosnia, Hercegovina, and Montenegro). Although they include historical data about the kings of the Nemanja (q.v.) dynasty, and especially about the third Battle of Kosovo Polje (1389, q.v.), they are far from presenting an accurate general historical picture, but were written and recited by the Yugoslavs mainly as they imagined the events had happened. For example, these poems picture Prince Marko (Kraljević Marko, Marko Son of the King, 1335?–1394) as a national hero and Vuk Branković (d. 1398) as a traitor, whereas Marko actually helped the Turks in their conquest of Serbia, while Branković died in a Turkish dungeon. There are many thousands of these poems; and since the Yugoslav language is well adapted for the creation of poetry, they are still being written. During World War II, when hundreds of these poems were written, it was not uncommon to see a peasant composing such a poem, about a battle or other event which had taken place the day before. Many poems of this type which are still accessible would have been forgotten if Friar Andrija Kačić-Miočić (1704–1760) had not undertaken to write them down as he heard them in his travels, as he said, "from Zara to Scutari and from Mostar to Kotor." He arranged his collection in chronological order and published them in book form under the title *Pleasant Conversations of the Slovinski People*. This book remains the best seller among the Yugoslavs, having been published in 20 editions, the first three of which were printed in Venice. Kačić specialized in collecting poems of historical value, and, as the people of the days when they were written recognized no difference between Croats and Serbs, all the kings of ancient Croatia and medieval Rascia were all known simply as "Slovinski kings."

Introduction of Yugoslav Literature in Western Europe.—The Western world became acquainted with these people's poems through Alberto Fortis, an Italian friar, who in 1774, in a description of Dalmatia, included his translation of a poem called *Hassan Aga's Wife*. This impelled the great Italian poet Nicola Tomasseo (1802–1874), whose mother was a Slav, and whom the Slavs call Nikola Tomašić, to translate many of these poems. In 1824, Jacob Grimm, the German mythologist, translated many into German, publishing three volumes of them. Goethe translated *Hassan Aga's Wife* into German, calling it a "jewel of poetry for all nations." Charles Nordier translated it into French, and Sir Walter Scott translated it into English. While this poem had a wide appeal abroad on account of its tender love story, that commemorating the building of Skadar was declared by Jacob Grimm to be "one of the most poignant poems produced by any people."

Awakening of the Yugoslav "National Conscience."—The beginning of the 18th century marked a short setback to the production of original native literary production among the Yugoslavs, most of the authors devoting themselves to the translation of works published in the Western countries or to the writing of historical works based on earlier material. Yet this age produced Dositei Obradović (1742?–1811), creator of a "national conscience" among the Yugoslavs. While still a boy, Obradović entered a monastery to gain an education. In 1760 he left the institution to travel through Europe and Asia, learning Greek, Latin, Italian, German, French, Russian, and English. He had begun to write in his youth, and wrote many books. These have a permanent place in Yugoslav literature, but his greatest work was in promoting the unity of the nation. His motivating thought is summed up in a sentence: "Who does not know that the people of Montenegro, Dalmatia, Hercegovina, Bosnia, Serbia, Croatia, Slavonia, Srijem, Bačka, and Banat speak the same identical language?" Religion made no difference to him. To Obradović "Bosnians and Hercegovinians are Turks by religion; but by race and tongue they are what their forefathers were and what their posterity will remain," namely Slavs. Obradović laid the foundation for cooperation among the Yugoslavs. Soon, in Vienna, there were three men of the pen working together for Yugoslav unification: J. B. Kopitar, a Slovene: Ljudevit Gaj, a Croat; and Vuk Karadzić, a Serb. When the French Revolution released the pent-up forces of nationalism, these men feared that each branch of the Yugoslavs might fall prey to separatist nationalism, dividing instead of uniting the nation. And so these three writers, instead of advocating Slovenianism, Croatism, and Serbianism, promoted Illyrism as a common name and program for all the Yugoslavs. The three took upon themselves to standardize Yugoslav writing, and to remold the diverse Yugoslav dialects into a unified language. Gaj and Karadžić ultimately succeeded, but Kopitar failed, since of all the Slovene authors only Stanko Vraz (1810–1851) adopted the new form, the rest preferring to retain their local dialect. This movement to unify the language and political thinking of the Yugoslavs stimulated the development of a new Yugoslav literature. The schools had just been opened to the peasants; and since Yugoslav is written phonetically, it is comparatively easy for adults to learn to read and write in a few hours. The national conscience had been awakened, and

although the Serbs preferred to use the Cyrillic alphabet, and the Croats the Latinic, there was no difference in the language. The motto was: "Brother is brother no matter what his religion." This period produced many volumes of poetry, including: *Jugoslavensko Kolo* (*A Yugoslav Wreath*), by Branko Radicević (1824–1853); *Gorski Vienac* (*A Mountain Wreath*), by Prince-bishop Petrović-Njegoš of Montenegro; *Kip Domovine* (*A Picture of the Homeland*), by Stanko Vraz; *Putnik* (*The Traveler*), by Petar Preradović; *Liepa naša domovina* (*Our Beautiful Homeland*), by Antun Mihanović (1796–1861); *Death of Smail Aga,* by Ivan Mažuranić (1814–1890); *The Resurrection of Illyria,* by Valentin Vodnik (1758–1819); *The Wreath,* by Francé Presern (1800–1849); and many others, by poets all inspired by the patriotic idea.

Contrary Trends During 19th and Early 20th Centuries.—Owing to political influences, the chief center of Serb literary activity now shifted from Novi Sad (Neusatz) to Beograd (Belgrade). This led to the development of two separate literatures, in two dialects, Serb and Croat, the fruit of the idea of a greater Serbia nurtured by successive Serbian governments. The proponents of separatism, instead of encouraging the growth of a unified literature among the Yugoslav peoples in harmony with their craving for national unity, used literature and politics alike as means of furthering their own plans. This era produced, among the Serbs, Jovan Jovanović (pseudonym Zmaj, 1833–1904), Vojislav Ilić (1862–1894), Djuro Jakšić (1832–1878), and many other writers. Among the Croats it produced Luka Botić (1830–1863), Ivan Trnski (1819–1910), Gjuro Arnold (1854–), Silvije Strahimir Kranjčević (1865–1908), and August Harambašić (1861–1911). And while the Serbs and Croats gradually separated, the Slovenes returned to literary unity with the Croats, producing many poets of whom the most important were Simon Jenko (1835–1869), and Simon Gregorčić (1844–1906). The gap between the Serbs and the Croats was artificially widened in romance and fiction as well as in poetry. While the Croat authors, August Šenoa (1838–1881), and others wrote novels with an historical background, the Serb authors, particularly Sima Matavulj (1852–1908), preferred to describe contemporary village life. Jovan Sterija-Popović (1806–1856), with his numerous plays of this period, could be called the founder of Serb drama. Laza Kostić (1841–1910) also popularized the drama with his translations of Shakespeare's works. The Croats developed the opera along with the drama, their dramatic and operatic works, like their fiction, being based upon historical events of patriotic significance.

The turn of the century was marked by a divorce of literature from politics—a development which helped to bring the Croats and Serbs together again. Books were still printed in the two types, but the Serbs now began to print the works of Croat authors in Cyrillic, and the Croats published the Serb works in Latin type, so that both groups became acquainted with the works of each other. Even the great dailies were printed partly in both types. On anniversaries, when celebrations were held in all the cultural centers, the Zrinskis (Croat heroes) were commemorated in Belgrade, and the great Serb poet Petrović-Njegoš, prince-bishop of Montenegro, was honored in Zagreb. The renaissance of the national idea had its influence on literature. The Croats, Ante Tresić Pavičić (1867–) and Srgjan Tučić (1873–1940), and the Slovenes, especially Ivan Cankar (1876–1918), wrote about Serbia with the same love as they would have written about their own districts, and the Serbians, Jovan Skerlić (1877–1914), and Milan Čurčin (1880–), glorified the Croat poets. This age brought out, among the Serbs, Jovan Dučić (1874–1943), Alexsa Šantić (1868–1924), Sinisa Stanković (1892–), Petar Kočić (1877–1916), Branislav Nušić (1864–1940), Vladimir Ćorović (1885–), and many others; among the Croats, Vladimir Nikolić (1829–1866), Vladimir Vidrić Petar (1875–1909), Vladimir Nazor (1876–), and Milan Begović (1876–); and among the Slovenes, Anton Aškerc (1856–1912), and Oton Župančić (1878–). The era also brought realism into the literature of the Yugoslavs. The leading exponent of the trend toward realism, the Croat author Eugen Kumičić (1850–1904), was followed by Ksaver Šandor (Gjalski, Djalski 1854–1939), Josip Kozarac (1858–1906), and a pleiad of others.

The picture of Yugoslav literature would not be complete without mention of the women who have participated in the production of literature as in every other phase of the movement for national unity. Women have contributed to all branches of Yugoslav literature, from the time of Cvijeta Zuzorić (Ital. Zuzzer, b. 1555). Among the women of the modern period who have found a permanent place in Yugoslav literature are: Marija Kumičić (1863–), Milka Pogačić (1860–), Maria Zagorka (1879–), Isidora Sekulić (1877–), Milica Janković (1881–), Zofka Kveder (1878–1926), Jelena Dimitrijević (1862–), and many others.

YUGOSLAVIA, a republic of southeastern Europe in the Balkan Peninsula, bordered on the north by Austria and Hungary; on the east by Rumania and Bulgaria; on the south by Greece; on the southwest by Albania; and on the west by the Adriatic Sea, the Free Territory of Trieste, and Italy. The area is 99,069 square miles. The population of Yugoslavia, according to the census of 1931, numbered 13,934,038; the census of 1953, 16,927,000. The density of population according to the census of 1953 is 171 per square mile. The capital is Belgrade (Beograd), with a population of 469,988. The basic monetary unit is the dinar (official rate of exchange since January 1952: 300 = 1 U.S. dollar). The national flag of the republic consists of three horizontal bars of blue, white, and red, with a red five-pointed, gold-bordered star in the middle.

Frontiers, Population, Political Divisions.—The total length of Yugoslavia's frontiers is over 2,600 miles, 1,000 miles of which are seacoast and islands. Boundaries have been shifted over a period of years by various treaties. (1) The Treaty of Bucharest (Aug. 10, 1913) at the conclusion of the Balkan Wars established the frontiers between Serbia and Bulgaria, and Serbia and Greece. (2) The decision of the Conference of Ambassadors (March 1913) outlined the boundaries between Serbia and Albania. (3) The Treaties of Peace of Paris (1919) established the borders between Yugoslavia and Austria, Hungary, and Rumania. (4) The Treaty of Rapallo (Nov. 12, 1920) between Italy and Yugoslavia defined the boundary between those two countries.

The frontiers between Serbia and Bulgaria, as established by the Treaty of Bucharest, were slightly changed, however, by the Treaty of Neuilly (Nov. 27, 1919) in favor of Yugoslavia, in order to give better protection to the railroad lines in the Timok, Morava, and Vardar valleys.

The establishment of the frontiers between Italy and Yugoslavia gave rise to considerable discussion during the Paris Peace Conference (1919), and this problem could not be settled at that time. The matter was not settled until one year later at the conference between Yugoslavia and Italy at Rapallo, where the Yugoslav delegation was forced to accept unfavorable terms. By this treaty, over one half million Yugoslavs remained in Italy.

After World War II, the frontiers of Yugoslavia remained unchanged except for those with Italy which were substantially altered. Italy ceded 2,950 square miles, including the whole peninsula of Istria, the islands in the Adriatic, and the cities of Zara and Fiume (Rijeka). The city of Trieste with its surrounding territory, which includes a large Slovene population, was detached from Italy and made a Free Territory with a special independent status. On Oct. 5, 1954, an agreement was initialed in London dividing this territory between Italy and Yugoslavia. (See TRIESTE, FREE TERRITORY OF.)

Approximately 90 per cent of the population are Serbs, Croats, and Slovenes, with the remaining 10 per cent composed of national minorities: Germans, 513,000; Hungarians, 472,000; Albanians, 441,000; Rumanians, 183,000; and several other small groups. (These figures are in accordance with the 1931 census.) It is estimated that 1,780,000 persons lost their lives during World War II. Also to be noted is the fact that the Jewish population was almost exterminated in Yugoslavia, either by the Nazis or by the Independent State of Croatia.

Under the Constitution of 1946, the Federal Peoples Republic of Yugoslavia was divided into six peoples republics, with populations and capital cities as follows:

Federative Unit	Population (1953)	Capital	Population (1953)
Serbia	6,527,966	Belgrade	469,888
Autonomous province Vojvodina	1,713,905	Novi Sad	83,223
Autonomous region Kosmet	809,234	Prichtina	24,199
Croatia	3,913,753	Zagreb	1,350,452
Bosnia-Hercegovina	2,843,486	Sarajevo	135,657
Slovenia	1,462,961	Ljubljana	138,211
Macedonia	1,303,906	Skoplje	121,551
Montenegro	377,189	Titograd	16,333

The Land.—There are several main mountain ranges in Yugoslavia. In the northwest the mountain belt, which is a continuation of the Alpine folding, is composed of the Julian Alps (highest peak, Triglav, 9,400 feet), the Karawanken, the Steiner Alps (highest peak, Grintovec, 8,395 feet), and some smaller ranges with a general direction of west to east. The Dinaric Alps (Karst area) and mountain region extend from Carniola south of the Ljubljana Basin through western Croatia, Dalmatia, and western Bosnia, then through Hercegovina and Montenegro to the Albanian border. They include in the northwestern part such ridges as the Velebit and Uskok Mountains. Farther inland, especially to the south in Bosnia, Hercegovina, and Montenegro, the elevation increases to such heights as the Durmitor (8,234 feet) and Majlic (7,840 feet) on the frontier between Montenegro and Hercegovina. In the far south there are parts of the Rhodope and Pind massifs which penetrate into Yugoslavia. In the northeast the Carpathian Alps slope toward the Pannonian Basin.

The lowest points above sea level are Djevdjelija, in the Vardar Valley in the south (165 feet), and the junction of the Timok with the Danube (110 feet) in the east.

These differences in elevation make the climate in Yugoslavia extremely varied, and consequently influence the variety of products of the soil. In Slovenia and in the mountains of the Dinaric system the climate is Alpine. In the central part of the country the climate is similar to that of central Europe; in the southern part, in the Vardar Valley and along the southern section of the Adriatic coast, it is Mediterranean.

In the north and northeast, the country is drained by the Danube (Dunav) and its tributaries—the Drava, Tisa, Sava, Drina, and Morava. In the south lies the basin of the Vardar.

Agriculture.—Yugoslavia is essentially an agrarian country with 78 per cent of the population occupied in agriculture. The great majority (80 per cent) are small landowners with average farms of 12.5 acres. In the kingdom of Serbia the agrarian problem was solved immediately after the country's liberation from the Ottoman Empire, when the land was divided into small farms belonging to peasants who were deeply attached to the soil which they had cultivated for generations. After World War I, the new Yugoslav state carried out an agrarian reform by breaking up the large landed estates in the former provinces of Austria-Hungary, allowing 1,250 acres as the maximum farm (except in a very few instances where the maximum of 3,750 acres was permitted). The Tito regime carried the agrarian reform still further by reducing the maximum farm allotment to 50 acres; by the law of May 22, 1953 the maximum was reduced further to 25 acres.

There are three main agricultural zones in Yugoslavia:

(1) In the central part of the country, in the Sava Valley from Zagreb to the east, embracing the Pannonian Basin, extending south to the Morava Valley as far as Leskovac (30 miles south of Niš), the main products are wheat, corn, sugar beets, and hemp. Also important is the growing of plums (Yugoslavia is the largest plum-growing country in Europe) and other varieties of fruit. The raising of cattle, horses, and especially hogs is extremely important in the national economy.

(2) In the zone extending northwestward from Zagreb through Slovenia to the Austrian and Italian borders, wheat, corn, barley, rye and oats are cultivated, though not on so large a scale as in the central part of the country. But the most important features of the economy are lumber and cattle raising, the latter being favored by the great expanses of pastureland. Bosnia, Slovenia, and Slavonia are the main sources of lumber. Western Slavonia has long been famous for its oak, while in Slovenia, prior to World War II, hops were produced on a large scale for export mainly to the United States.

(3) The third zone, comprising the Dalmatian coast and extending along the Adriatic shores southeastward toward the Vardar Valley, produces grains and a fair quantity of olives; it is

rich in tobacco in Hercegovina and southern Serbia. Along the Adriatic coast fishing is one of the main industries. South, in the Vardar Valley, there are poppy fields.

Between the mountain ranges there are several sheltered valleys which are rich in vineyards and orchards: Ljutomer in Slovenia; Vrshac in the Banat; Negotin in eastern Serbia; Mostar in Hercegovina; and Tetovo and Ohrid.

Mineral Resources.—Yugoslavia is rich in minerals but the extent of these resources has not yet been thoroughly explored. Several of the country's mines have been known since the time of the Romans and the Serbian medieval kingdom. The iron ore at Ljubija in western Bosnia (production 735,031 tons in 1939) is one of the most important of its kind in Europe. Another iron mine at Vareš is worked in conjunction with the coal mine and ore-smelting works at Zenica (central Bosnia). The Bor mines in eastern Serbia are known for their rich copper deposit (70,768 tons in 1939); the Trepča mines in southeastern Serbia produce zinc and lead (76,059 tons in 1939). Other minerals mined in Yugoslavia are coal and lignite, bauxite ore, chromite, antimony, and even gold (33,662 ounces in 1939). Several of the most important mines were foreign-owned (the Bor mines by the French and Trepča by the British); but the Tito government nationalized all mines, regardless of whether they were owned outside the country or not. The territory which Italy ceded to Yugoslavia by the Peace Treaty of 1947 contains the large mercury mine of Idria.

Industrial Development.—Since Yugoslavia is basically an agrarian country, its industries have not been highly developed. Prior to World War II, the chief industries were lumber in Slovenia and western Bosnia; textiles in Slovenia, Croatia, and Serbia; and light steel in Bosnia and Slovenia (Vareš and Jesenice).

The Tito government inaugurated in 1947 an ambitious Five-Year Plan having as its objective the industrialization of the country by utilizing the raw materials and minerals which Yugoslavia produces. This plan calls for the creation of heavy industry (steel, armament, machinery, and tools), as well as the extensive electrification of the country by harnessing many mountain streams with great hydroelectric potential.

Foreign Trade.—The total Yugoslav export in 1952 amounted to 73.96 billion dinars while import stood at 111.92 billion dinars (including 30,500,000 billion dinars representing aid from Western countries, mainly the United States).

The main articles exported were: maize, timber, lead, and copper. The principal imports were machinery, cotton goods, wool, and foodstuffs. Principal countries receiving exports were: Germany, 24 per cent; United States, 15 per cent; Great Britain, 14 per cent. Of the total imports, 20 per cent were from Germany, and 19 per cent from the United States.

Communications.—At the crossroads of the Eastern and Western worlds, Yugoslavia is neither geographically nor ethnographically a simple and united country. In its principal characteristics and general type, it is essentially a Balkan state; yet it belongs to central Europe also, especially to the Pannonian Basin with which it is connected by good lines of communication. In addition, Yugoslavia is a Mediterranean country owing to its extensive coastal area bordering on the Adriatic Sea.

The most important line of communication for Yugoslavia is the Morava-Vardar Valley which descends toward the Gulf of Salonika. The city of Thessaloníke (Salonika) offers the nearest access to the sea, and its port is the largest and most valuable on the Balkan Peninsula. The Congress of Berlin imposed upon Serbia the obligation of building a railroad line from Belgrade to Niš, and farther east toward the Bulgarian frontier; also a line from Niš toward the Turkish frontier in order to connect with the Turkish railroad system.

After the Balkan Wars, when Thessaloníke was given to Greece, the Greek and Serbian governments reached an agreement whereby Greece granted Serbia a free zone in the Thessaloníke port so that Serbian exports shipped through the Morava-Vardar Valley could reach the sea. In 1926 the Greek-Serbian agreement was expanded to assure new railroad and port facilities for Yugoslavia.

On the Adriatic Sea—before World War II the most important port was Split (Spalato); those of lesser importance were Sibenik, Gruz and Trogir. Fiume (Rijeka) was ceded to Yugoslavia by Italy after World War II, and with its excellent harbor facilities and good railroad connections, it is destined to play an increasingly important role in the economic life of the country.

Between the two world wars, Yugoslavia had to make considerable effort to adapt its railroad system to its changing economic needs. The most important rail line connecting the country with the west runs from Belgrade to Zagreb, where it branches off toward Fiume on the west, Trieste in the northwest, and Vienna via Maribor in the north. Another important railroad from Belgrade to the north runs through Novi Sad toward Budapest and Vienna. Connecting Yugoslavia with the south and east is a railroad extending from Belgrade, via Niš, to Sofia and Istanbul, and from Niš through Skoplje to Thessaloníke.

Railroad lines in northeastern Yugoslavia were greatly improved in the period between the two world wars, in order to assure better communication with Rumania and Poland. A rail line toward the Adriatic from Yugoslavia's northeastern border was under construction during that period to provide better facilities for the ports of the southern Adriatic.

Another important means of communication with other parts of Europe is the Danube River, which is Yugoslavia's cheapest means of transportation to the Black Sea. Navigable for a stretch of 1,800 miles, the Danube plays a vital role in the communications for all the countries of central Europe and the Balkans.

This importance had been recognized in 1815 at the Congress of Vienna which proclaimed the principle of free navigation of the Danube. The Congress of Paris in 1856 reaffirmed this principle as a "part of European public law," and instituted the European Commission whose duty it was to regulate navigation at the mouths of the river. The Paris Peace Conference in 1919 provided for a special commission, composed of Great Britain, France, Italy, and the riparian countries, with the object of assuring freedom of navigation on the Danube and preventing any discrimination in this respect by any riparian state. This commission, known as the Danubian International Commission, was established by a special convention in 1921.

The well-administered Danubian regime, as

created by the peace treaties resulting from World War I, proved to be not only important to Yugoslavia and other Danubian countries, but also to the whole European community.

With the signing of the peace treaties in 1946 with Hungary, Rumania, and Bulgaria, the principle of the freedom of navigation of the Danube was reaffirmed, but the practical application of this principle had not been put into effect, since the Convention of the Danube, signed in August 1948 (despite the opposition of the United States, Great Britain, and France) denies navigational rights on the Danube to any countries except the USSR and the riparian states.

Besides the Danube, which is of international as well as national importance, certain other rivers of Yugoslavia play an important role in the internal communications of the country. The most important of these is the Sava, which flows entirely through Yugoslavia, across the fertile plains of Croatia, Slavonia, and Srem, and is navigable from Sišak (a city 30 miles east of Zagreb) to its confluence with the Danube at Belgrade. Two other rivers, the Tisa and the Drava, which also flow through the rich Pannonian Basin, converge toward Belgrade, making that city the primary communications center of the country and its real capital.

Situated on a hill overlooking the junction of the Sava and Danube, and near to where the Drava and Tisa merge with the Danube, Belgrade dominates a great part of the Pannonian Basin —the Banat, Bačka, Srem, and farther up, Slavonia. This position gives the city a strategic importance which was recognized as early as Roman times. It was the terminal of the most important road in the Balkans which stretched from Stamboul (Constantinople) to Belgrade. In Roman days it was known as Via Militaris, then as the Imperial Road (Carski Put) of the Serbian medieval kingdom, and later as Stambouldjol, the principal road of the Ottoman Empire during the Turkish occupation of Europe. From Belgrade roads extend in all directions. Before the outbreak of World War II, an important highway was completed between Belgrade and the Hungarian frontier as a part of the great international road from Paris to Istanbul, which was to make use of the Imperial Road in its southern course. The Tito government achieved the construction of a modern highway to connect Belgrade and Zagreb (270 miles), to be known as the Highway of Fraternity and Unity.

Yugoslavia's system of roads lags behind Western standards, but is nevertheless sufficient to assure communication between the most important centers. One road of strategic value during the Ottoman Empire was known as the Bosnian Road, and connected Skoplje and Kosovo, continuing thence from Mitrovica to Novi Pazar, and farther northwest to Sarajevo. At that period it was a first-class road used for military and commercial purposes. Other roads are those connecting Sarajevo with the Adriatic over Ivan Planina, and the transversal roads from Kotor and Dubrovnik (Ragusa) through the Neretva Valley to Split, which were important during the Roman Empire. From Zagreb a system of roads connects the capital of Croatia with Fiume and Ljubljana, and in the northwest and north with Austria and Hungary.

A nearly perfect line of communication, which also constitutes a wonderful geographic unity, is the Morava-Vardar Valley. The watershed of these two rivers (the Morava running north and the Vardar south) is not, as is usually the case, mountainous territory, but comprises the gently rolling terrain of the Presevo-Kosovo Basin —old lake beds where the water flow is so slow that its direction can hardly be detected at first glance.

At Niš, the Nišava-Maritsa Valley leads easterly through Bulgaria toward Istanbul and has been utilized in the construction of a railroad from Niš to Sofia and farther on to Istanbul.

From Belgrade toward the north several lines connect the capital with the rich province of Vojvodina. The most important is the Belgrade-Novi Sad-Subotica line, as it is the most direct and shortest way to Budapest and other points in central Europe.

Belgrade is also the starting point of a narrow gauge rail line which runs through southwestern Serbia and joins the Bosnian railways at Višegrad. The railroad system in Bosnia was almost entirely—except for the Banja Luka-Sunja line —composed of narrow gauge roads. Austria-Hungary, which occupied Bosnia and Hercegovina by the decision of the Congress of Berlin in 1878, deliberately built narrow gauge railroads having no connections outside the provinces in order to prevent closer contact between Bosnia and Hercegovina and Serbia. Although the kingdom of Serbia, whose railroads were for the most part standard gauge, built a narrow gauge line in southwestern Serbia toward Bosnia, Austria-Hungary never permitted the final junction between the Serbian and Bosnian lines. It was only after World War I that a narrow gauge line was built between the Bosnian terminal at Višegrad and the Serbian terminal at Užice, thus assuring direct communication between Belgrade and Sarajevo (capital of Bosnia), and thence south to the Adriatic Sea.

The total railroad mileage is 7,223, of which about 2,000 are narrow gauge lines. After World War II, the Tito government built two railroads— Banoviči-Brčko (60 miles), and Samac-Sarajevo (180 miles). Both are of standard gauge in order to connect the capital of Bosnia and the rich coal basin around Banoviči with the trunk line running from Belgrade to Zagreb. The construction of those lines was widely publicized by the regime as being built by voluntary work of the youth of Yugoslavia as their contribution toward the reconstruction of the country.

Revenue and Expenditure.—Before World War II the official rate of exchange was 50 dinars to the dollar. The 1939 budget of Yugoslavia was 12,942,000,000 dinars of revenue with the same amount for expenditure.

Religion.—According to the census of 1931, nearly half the population are Serbs of the Orthodox faith (6,785,500); Croats and Slovenes of Catholic faith, 5,217,800 (Slovenes: 1,107,155); Moslems, mainly of Slav descent, 1,561,200; Protestants, 231,000; and Jews, 68,500. The Tito regime, asserting that it was necessary to take steps which would prevent religious passions from threatening national unity, has broken with prewar tradition and separated church and state. Marriage and divorce have thus been placed under the exclusive authority of the state, although the civil marriage which is required by law may be followed by a religious ceremony. According to the census of 1953, 25 per cent of the population was listed as religionless; of the remainder, 46 per cent are Orthodox, 36 per cent Catholics,

YUGOSLAVIA
CONIC PROJECTION
SCALE OF MILES
0 25 50 75 100 125
SCALE OF KILOMETRES
0 25 50 75 100 125
CAPITALS
National
Federal Republics
Autonomous Provinces
Canals
BOUNDARIES
Railroads
YUGOSLAVIA is a federation of six republics. The Serbian republic includes an autonomous province (Voyvodina), and an autonomous region (Kosovo-Mitohiyan).
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75124
Longitude East of Greenwich
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SLOVENIA
CROATIA
VOYVODINA
BOSNIA I HERCEGOVINA
SERBIA
MONTENEGRO
KOSOVO-METOHIYAN
MACEDONIA
ALBANIA
GREECE
BULGARIA
RUMANIA
ITALY
ADRIATIC SEA
IONIAN SEA
Villach
Klagenfurt
Maribor
Varaždin
Nagykanizsa
Kaposvar
Pécs
Baja
Subotica
Békéscsaba
Hódmezővásárhely
Szeged
Nádlac
Arad
Timişoara
Udine
Gorizia
Monfalcone
Trieste
Ljubljana
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Bjelovar
Virovitica
Sombor
Kikinda
Senta
Kanjiža
Novi Sad
Zrenjanin
Sremska Mitrovica
Vršac
Pančevo
Beograd (Belgrade)
Smederevo
Požarevac
Turnu Severin
Craiova
Slatina
Karlovac
Sisak
Osijek
Vukovar
Vinkovci
Brod
Rijeka (Fiume)
Sušak
Kastav
Opatija
Pula (Pola)
Cres
Rab
Pag
Krk
Senj
Zadar (Zara)
Nin
Skradin
Šibenik
Trogir
Split
Makarska
Dubrovnik (Ragusa)
Lastovo (Lagosta)
Korčula
Hvar
Brač
Vis
Mljet
Pelagruž (Pelagosa)
Pianosa I.
Herceg Novi
Kotor
Titograd
Cetinje (Podgorica)
Bar
Ulcinj
Shkodër
Durrës
Tiranë (Tirana)
Kavaje
Elbasan
Banja Luka
Bihać
Bosanska Krupa
Prijedor
Bos. Kostajnica (Bos. Novi)
Bos. Dubica
Bos. Gradiška
Bos. Brod
Bos. Šamac
Modriča
Brčko
Bijeljina
Tuzla
Zvornik
Loznica
Sabac
Valjevo
Kragujevac
Kraljevo
Čačak
Titovo Užice
Višegrad
Srebrenica
Kladanj
Vareš
Travnik
Zenica
Donji Vakuf
Jajce
Drvar
Livno
Gornji Vakuf
Prozor
Konjic
Sarajevo
Rogatica
Foča
Gacko
Nevesinje
Stolac
Ljubinje
Čapljina
Metković
Trebinje
Mostar
Pljevlja
Priboj
Prijepolje
Novi Pazar
Tutin
Sjenica
Kruševac
Raška
Kosovska Mitrovica
Leskovac
Prokuplje
Niš
Pirot
Dimitrovgrad (Caribrod)
Knjaževac
Zaječar
Paračin
Aleksinac
Svetozarevo
Prijeljina
Rankovićevo
Lapovo
Čuprija
Bor
Negotin
Bryagovo
Vidin
Călăraşi
Bailești
Caracal
Lom
Oryakhovo
Byala Slatina
Pleven
Lovech
Vratsa
Berkovitsa
Sofiya
Trŭn
Brezniko
Surdulica
Dimitrovo (Pernik)
Panagyurishte
Samokov
Pazardzhik
Blagoevgrad (Gorna Dzhumaya)
Kyustendil
Marek (Dupnitsa)
Radoviš
Štip
Titov Veles
Gostivar
Tetovo
Skopje
Kumanovo
Kičevo
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Bitola
Ohrid
Prespa
Struga
Kavadarci
Strumica
Petrich
Sidérokastron
Dráma
Serrai
Kavalla
Kilkis
Djevdjelija
Idomenè
Peshkopi
Prizren
Djakovica
Peć
Priština
Gnjilane
Vranje
Preševo
Titograd
Ivangrad
Plav
Rožaje
Novi Pazar
Sjenica
Tara
Neretva
Drina
Sava
Una
Vrbas
Ibar
Morava
Lim
Ohrid
Prespa
Skadar
Scutari
Testa del Gargano
G. of Manfredonia
Foggia
Ancona
Pescara
Jesenice
Bled
Kranj
Tržič
Kamnik
Škofja Loka
Celje
Trbovlje
Radeče
Krško
Kostanjevica
Novo Mesto
Postojna
Kočevje
Karlovac
Petrinja
Grubišno Polje
Nasice
Našice
Požega
Novska
Kostajnica
Ogulin
Gospić
Karlovac
Rovinj
Buje
Piran
Koper
Lošinj
Rab
Pag
Gračac
Knin
Drniš
Glamoč
Bugojno
Fojnica
Kornat
Dugi Otok
Omiš
Sulet
Korčula
Ploče
Metković
Neretva
Durmitor
Komovi 7,058
Mokra Gora 4,920
Ruen 7,388
Korab 9,068
Solunska 8,298
Midzhur 7,114
Rajinac 5,672
Ivančica 8,480
Kopřivnica
Križevci
Đurđevac
Čazma
Drava
Mura
Sava
Tisa
Danube
Timiş
Mureş
Krka
Cetina
Vardar
Struma
Mesta
Nestos
Delchev (Nevrokop)
Iskŭr
Yantra
Lim
Ibar
Morava
Drina
Una
Vrbas
Bosna
Tara
Neretva
Sava
Tisa
Danube
Timiş
Mureş
Drava
Mura
L. Balaton
L. Scutari
L. Ohrid
L. Prespa
Pelagosa
Lagosta
Ragusa
Pianosa I.
Testa del Gargano
G. of Manfredonia
Foggia
Ancona
Pescara
Durrës
Tiranë
Bitola
Ohrid
Prespa
Skadar
Scutari
Kavalla
Kilkis
Serrai
Dráma
Siderókastron
Petrich
Strumica
Kavadarci
Prilep
Kičevo
Debar
Peshkopi
Struga
Djevdjelija
Idomenè
Elbasan
Kavaje
Shkodër
Ulcinj
Bar
Cetinje (Podgorica)
Titograd
Kotor
Herceg Novi
Trebinje
Mostar
Čapljina
Metković
Ploče
Korčula
Vis
Hvar
Brač
Sulet
Omiš
Split
Trogir
Šibenik
Skradin
Zadar (Zara)
Nin
Dugi Otok
Kornat
Rab
Pag
Krk
Senj
Cres
Pula (Pola)
Lošinj
Rab
Gospić
Karlovac
Sisak
Petrinja
Grubišno Polje
Našice
Požega
Novska
Kostajnica
Ogulin
Rovinj
Buje
Piran
Koper
Kastav
Opatija
Rijeka (Fiume)
Sušak
Karlovac
Ljubljana
Bled
Kranj
Tržič
Kamnik
Škofja Loka
Celje
Trbovlje
Radeče
Krško
Kostanjevica
Novo Mesto
Postojna
Kočevje
Monfalcone
Gorizia
Udine
Jesenice
Maribor
Ptuj
Čakovec
Varaždin
Koprivnica
Križevci
Đurđevac
Čazma
Bjelovar
Zagreb
Virovitica
Sombor
Apatin
Osijek
Vukovar
Vinkovci
Brod
Sremski Karlovci
Novi Sad
Bačka Topola
Kikinda
Senta
Kanjiža
Subotica
Baja
Pécs
Kaposvar
Nagykanizsa
Hódmezővásárhely
Szeged
Nádlac
Arad
Timişoara
Zrenjanin
(Vel. Bečkerek)
Bečej
Novi Vrbas
Bela Crkva
Pančevo
Beograd (Belgrade)
Smederevo
Požarevac
Turnu Severin
Craiova
Slatina
Negotin
Bryagovo
Vidin
Călăraşi
Bailești
Caracal
Lom
Oryakhovo
Byala Slatina
Pleven
Lovech
Vratsa
Berkovitsa
Sofiya
Trŭn
Brezniko
Surdulica
Dimitrovo (Pernik)
Panagyurishte
Samokov
Pazardzhik
Blagoevgrad (Gorna Dzhumaya)
Kyustendil
Marek (Dupnitsa)
Radoviš
Štip
Titov Veles
Gostivar
Tetovo
Skopje
Kumanovo
Kičevo
Debar
Prilep
Bitola
Ohrid
Prespa
Struga
Kavadarci
Strumica
Petrich
Sidérokastron
Dráma
Serrai
Kavalla
Kilkis
Djevdjelija
Idomenè
Peshkopi
Prizren
Djakovica
Peć
Priština
Gnjilane
Vranje
Preševo
Titograd
Ivangrad
Plav
Rožaje
Novi Pazar
Sjenica
Tutin
Kruševac
Raška
Kosovska Mitrovica
Leskovac
Prokuplje
Niš
Pirot
Dimitrovgrad (Caribrod)
Knjaževac
Zaječar
Paračin
Aleksinac
Svetozarevo
Prijeljina
Rankovićevo
Lapovo
Čuprija
Bor

YUGOSLAVIA

Aleksinac, 7,383 E 4
Apatin, 13,537 D 3
Bačka Topla, 14,177 D 3
Banja Luka, 33,191 C 3
Bar, 3,168 D 4
Bečej, 22,923 E 3
Bela Crkva, 9,373 E 3
Belgrade (Beograd) (capital), 388,246 E 3
Beograd (Belgrade) (capital), 388,246 E 3
Bihač, 8,330 B 3
Bijeljina, 13,830 D 3
Bijelo Polje, 3,587 D 4
Bileća, 1,115 D 4
Bitola, 31,131 E 5
Bjelovar, 13,147 C 3
Bled A 2
Bor, 12,261 E 3
Bosanska Dubica C 3
Bosanska Gradiška, 5,573 C 3
Bosanska Kostajnica B 3
Bosanska Krupa, 3,829 C 3
Bosanski Brod, 4,789 D 3
Bosanski Novi, 4,003 C 3
Bosanski Petrovac, 3,515 C 3
Bosanski Šamac, 2,251 D 3
Bosna (river) D 3
Bosnia Hercegovina Rep., 2,561,961 C 3
Brač (island), 14,641 C 4
Brčko, 9,305 D 3
Brežice B 3
Brod, 15,176 D 3
Bugojno, 2,523 C 3
Čacak, 14,413 E 4
Čakovec, 7,209 C 2
Čaplјina, 2,114 C 4
Cazin, 2,780 B 3
Celje, 22,048 B 2
Cesma (river) C 3
Cetinje, 9,109 D 4
Cres (island) B 3
Croatia Rep., 3,749,039 C 3
Čuprija, 9,819 E 4
Čurstnica (mt.) C 4
Debar, 4,628 E 5
Derventa, 9,085 C 3
Dinaric Alps (mts.) B 3
Djakovica, 14,497 E 4
Djakovo, 8,942 D 3
Djevdjelija, 5,149 F 5
Dimitrovgrad (Caribrod), 4,430 F 4
Doboj, 7,289 D 3
Donji Vakuf C 3
Drava (river) C 3
Drina (river) D 3
Drvar, 2,116 C 3
Dubrovnik (Ragusa), 16,060 C 4
Dugi Otok (island) B 3
Dunav (river) E 3
Durmitor (mt.) D 4
Ercegnovi (Herceg Novi), 3,053 D 4
Fiume (Rijeka), 72,130 B 3
Foča, 3,327 D 4
Fojnica, 2,036 C 4
Gacko, 1,393 D 4
Glamoč C 3
Gnjilane, 8,287 E 4
Gornji Vakuf C 4
Gospič, 5,287 B 3
Gostivar, 7,561 E 5
Gračac, 2,581 B 3
Gračanica, 5,651 D 3
Gradačac, 4,282 D 3
Grubišno Polje, 2,780 C 3
Gusinje, 5,777 D 4
Herceg Novi (Ercegnovi), 3,053 D 4
Hvar (island), 12,564 C 4
Ibar (river) E 4
Ivancica (mt.) C 2
Ivangrad, 3,894 D 4
Jajce, 5,177 C 3
Jesenice, 13,458 A 2
Kamenjak (cape) A 3
Kamnik, 4,950 B 2
Kanjiža, 12,404 D 2
Karlovac, 23,885 B 3
Kastav B 3
Kavadarci, 6,053 E 5
Kičevo, 7,099 E 5
Kikinda, 28,070 E 3
Kladanj, 2,851 D 3
Ključ, 1,716 C 3
Knin, 2,737 C 3
Knjaževac, 5,107 F 4
Kočevje, 3,425 B 3
Komovi (mt.) D 4
Konjic, 2,507 D 4
Koprivnica, 9,105 C 2
Korab (mt.) E 5
Korčula, 2,012 C 4
Korčula (island), 25,862 C 4
Kornat (island) B 4
Kosovo—Mitohiyan Aut. Reg., 727,176 E 4
Kos. Mitrovica, 13,947 E 4
Kostajnica, 2,725 C 3
Kostanjevica B 3
Kotor, 5,402 D 4
Kragujevac, 32,528 E 3
Kranj, 15,640 B 2
Križevci, 5,248 C 2
Krk, 2,745 B 3
Krk (island), 17,689 B 3
Krsko, 1,961 B 3
Kruševac, 13,788 E 4
Kulen Vakuf B 3
Kumanovo, 19,798 E 4
Kvarner (gulf) B 3
Lagosta (Lastovo) (island) C 4
Lapovo, 7,512 E 3
Lastovo (Lagosta) (island) C 4
Leskovac, 21,763 E 4
Lim (river) D 4
Livno, 3,286 C 4
Ljubinje D 4
Ljubljana, 120,944 B 3
Ljubuški C 4
Lošinj (island) B 3
Loznica D 3
Macedonia Rep., 1,152,054 E 5
Maglaj D 3
Makarska, 3,101 C 4
Maribor, 66,498 B 2
Midzhur (mt.) F 4
Mladenovac, 5,159 E 3
Mljet (island) C 4
Modriča, 2,932 D 3
Mokra Gora (mt.) E 4
Montenegro Rep., 376,573 D 4
Morava (river) E 3
Mostar, 23,239 D 4
Mur (river) B 2
Našice, 3,048 C 3
Negotin, 6,633 F 3
Neretva (river) D 4
Nevesinje, 1,658 D 4
Nikšič, 6,686 D 4
Nin B 3
Niš, 50,692 F 4
Nova Gradiška, 5,852 C 3
Novi Pazar, 12,196 E 4
Novi Sad, 77,127 D 3
Novi Vrbas, 15,562 D 3
Novo Mesto, 5,404 B 3
Novska, 4,130 C 3
Ogulin, 7,624 B 3
Ohrid, 11,419 E 5
Ohrid (lake) E 5
Omiš C 4
Opatija, 11,737 A 3
Osijek, 50,398 D 3
Pag B 3
Pag (island) B 3
Palanka Smederevska, 8,662 E 3
Pančevo, 30,816 E 3
Paračin, 10,120 E 4
Peč, 17,175 E 4
Pelagosa (Pelagruž) (island) C 4
Petrinja, 5,261 B 3
Pirot, 13,033 F 4
Plav, 5,961 D 4
Pljevlja, 6,728 D 4
Ploče C 4
Podgorica (Titograd), 12,206 D 4
Postojna, 3,651 B 3
Požarevac, 16,108 E 3
Požega, 8,854 C 3
Preševo, 9,011 E 4
Prespa (lake) E 5
Priboj, 1,510 D 4
Prijedor, 8,152 C 3
Prijeljina E 4
Prijepolje, 2,545 D 4
Prilep, 25,996 E 5
Priština, 19,822 E 4
Prizren, 19,838 E 4
Prokuplje, 9,842 E 4
Prozor, 1,042 C 4
Ptuj, 7,906 C 2
Pula (Pola), 22,714 A 3
Rab, 881 B 3
Rab (island), 16,374 B 3
Rača, 6,335 E 3
Radeče B 2
Radoviš, 4,740 F 5
Ragusa (Dubrovnik), 16,060 C 4
Rajinac (mt.) B 3
Rankovićevo (Kraljevo), 12,503 E 4
Raska E 4
Rijeka (Fiume), 72,130 B 3
Rogatica, 2,003 D 4
Rovinj, 9,438 A 3
Ruen (mt.) F 4
Ruma, 14,049 D 3
Šabač, 18,238 D 3
Sanski Most, 3,427 C 3
Sarajevo, 118,158 D 4
Sava (river) D 3
Šavnik, 3,550 D 4
Scutari (lake) D 4
Senj, 2,572 B 3
Senta, 24,916 D 3
Serbia Rep., 6,523,224 E 3
Šibenik, 16,015 C 4
Sisak, 12,334 C 3
Škofja Loka A 2
Skopje, 91,557 E 5
Skradin B 4
Slavonski Brod (Brod), 15,176 D 3
Slovenia Rep., 1,389,084 B 2
Smederovo, 15,455 E 3
Solunska (mt.) E 5
Sombor, 34,321 D 3
Split, 49,885 C 4
Srebrenica, 5,751 D 3
Sremska Mitrovica, 13,671 D 3
Sremski Karlovici, 5,670 D 3
Stara Kanjiža (Kanjiža), 12,404 D 2
Stari Majdan C 3
Štip, 11,519 F 5
Stolac, 2,287 D 4
Ston C 4
Struga, 5,243 E 5
Strumica, 10,649 F 5
Subotica, 112,551 D 2
Sulet (island) C 4
Surdulica F 4
Sušak B 3
Svetozarevo, 10,007 E 4
Svilajnac, 5,398 E 3
Tara (river) D 4
Tešanj, 2,849 C 3
Tetovo, 16,919 E 5
Timok (river) F 3
Tisa (river) E 3
Titograd (Podgorica), 12,206 D 4
Titov Veles, 14,866 E 5
Titovo Uziče, 11,266 D 4
Travnik, 8,132 C 3
Trbovlje, 13,743 B 2
Trebinje D 4
Trogir C 4
Tržič B 2
Tuzla, 28,916 D 3
Ulcinj D 5
Una (river) C 3
Valjevo, 15,091 D 3
Varaždin, 16,620 B 2
Vardar (river) E 5
Vareš, 2,203 D 3
Velika Kikinda (Kikinda), 28,070 E 3
Veliki Bečkerek (Zrenjanin), 40,517 E 3
Vinkovci, 15,558 D 3
Virovitica, 10,161 C 3
Vis (island), 7,468 C 4
Višegrad, 1,776 D 4
Voyvodina Aut. Prov., 1,661,632 D 3
Vranje, 12,404 F 4
Vrbas (river) C 3
Vršac, 24,571 E 3
Vukovar, 14,813 D 3
Žabari E 3
Zadar (Zara), 14,847 B 3
Zagreb, 290,714 C 3
Zaječar, 12,300 E 4
Zara (Zadar), 14,847 B 3
Zenica, 16,827 C 3
Zepče D 3
Zrenjanin (Vel. Bečkerek), 40,517 E 3
Zvornik, 3,974 D 3

11 per cent Moslems, 7 per cent Protestants, Jews, and minor denominations.

Education.—Elementary education is free and compulsory. In 1950–1951 there were 13,031 elementary schools with 1,524,987 pupils; 1,696 secondary schools with 485,876 pupils; 1,449 technical schools with 198,478 students, while colleges and the three principal universities (Belgrade, Zagreb, and Ljubljana) had a total enrollment of 60,395 students.

HISTORY

As a result of the Allied victory in World War I, and in pursuance of the principle of self-determination proclaimed by President Woodrow Wilson in his famous Fourteen Points Declaration, there arose out of the ruins of the Austro-Hungarian Empire several national states, one of which was the Kingdom of Serbs, Croats, and Slovenes, later renamed Yugoslavia. Actually it was not an entirely new state. Serbia and Montenegro, which became part of Yugoslavia, had already existed as independent countries. Serbia, whose medieval kingdom was destroyed by the Turks in the Battle of Kosovo on June 28, 1389, remained under the Turkish rule for more than four centuries. In 1804, under the leadership of George Petrović, called Karageorge (Karadjordje or Black George), founder of the Karageorgevich dynasty, the Serbs rose in revolt against the Ottoman Empire for the restoration of their independent state. Gradually, during the 19th century, Serbia's rights were increased by successive diplomatic acts, until in 1878 she was recognized by the Congress of Berlin as a sovereign state. On Feb. 22, 1882, the Serbian Parliament proclaimed the independent principality of Serbia, a kingdom whose territory extended over 48,300 square kilometers (18,648 square miles), with a population of less than 2,000,000. (See also SERBIA.)

Serbia was further enlarged after the Balkan Wars (1912–1913, q.v.) when she liberated her brothers in the southern parts of the Balkan Peninsula from the Turkish yoke. This acquisition of what is the present province of Yugoslav Macedonia almost doubled Serbia's territory and raised the population to 4,600,000.

At the same time the area of the tiny kingdom of Montenegro, which, protected by its impenetrable mountains, had never completely lost its independence to the Ottoman invaders, was nearly tripled, expanding from 6,000 to 15,300 square kilometers (2,316 to 5,907 square miles).

When Serbia was attacked by Austria-Hungary in July 1914, her Parliament (Skupština) proclaimed on December 7 [1] of that same year that Serbia was fighting for her dearly won independence and "for the liberation and unification of all our still enslaved brethren, the Serbs, Croats, and Slovenes, from the Austro-Hungarian Empire."

During World War I, the Yugoslav Committee (Yugoslovenski Odbor) was organized in London, in May 1915. This committee was composed of Serbs, Croats, and Slovenes who were political émigrés from Austria-Hungary, and who represented those populations.

On July 20, 1917, the government of Serbia and the Yugoslav Committee issued, on the island of Corfu, a declaration affirming the decision of the Serbs, Croats, and Slovenes to be united, according to the principle of self-determination, in a free, national, and independent state. The declaration further stated that the new state was to be a constitutional, parliamentary, and democratic monarchy, ruled by the Karageorgevich dynasty. The National Assembly was to be elected by general, direct, equal, and secret ballot, and must draw up the new constitution and pass it by a qualified majority and with the consent of the crown. The new state, the name of which was to be the Kingdom of Serbs, Croats, and Slovenes, was bound to assure the complete equality of all the three principal religions (Orthodox, Catholic, and Moslem), as well as that of the two alphabets (Cyrillic and Latin).

At the first sign of disintegration of the Austro-Hungarian Empire, the Serb, Croat, and Slovene delegates from all the Yugoslav ethnographical territory in Austria-Hungary founded (Sept. 23, 1918) the Peoples or National Council (Narodno Vijeće) at Ljubljana—later moved to Zagreb. This council was to represent all the political parties and groups. On October 6, the National Council asked the "union of all our people into one single, absolutely sovereign state." On October 16, the Croatian Parliament (Hrvatski Sabor) broke relations of Croatia, Slavonia, and Dalmatia with the Austro-Hungarian Empire, and on the 29th proclaimed their union with the sovereign state of the Serbs, Croats, and Slovenes.

On November 7, an agreement was reached in Geneva between the representatives of the National Council of Zagreb and the representative of the Serbian government, providing for the formation of a common government, composed of six members (three to be appointed by the Serbian government and three by the council). This common government was to conduct, until the meeting of the Constituent Assembly, the foreign policy, national defense, and the preparatory work for the meeting of the Constituent Assembly. All other business was to remain under the competence of the local governments.

The Geneva agreement was never put into effect, as a few days later, Nov. 11, 1918, the National Council of Zagreb voted to unite with Serbia. On November 12, the National Council of Vojvodina (northern province of Yugoslavia) passed a resolution to unite with Serbia. On November 26 [2] the Montenegrin National Assembly met in Podgorica and voted a union of Montenegro with the kingdom of Serbia.

Kingdom of the Serbs, Croats, and Slovenes.—On Dec. 1, 1918, a delegation of the National Council of Zagreb presented to the regent of Serbia, later King Alexander I, its decision to unite the Serbs, Croats, and Slovenes formerly under the Austro-Hungarian Empire with the two independent Serbian states, the kingdoms of Serbia and Montenegro. In his answer, the regent, in the name of King Peter I, accepted the union of Serbia with the territories of Serb, Croat, and Slovene states represented by the Peoples Council.

The first government of the new kingdom was formed on December 20, and the flag and coat of arms were instituted. The government decided that, pending the election of the Constituent Assembly, a provisional assembly, composed of representatives of Serbian and Montenegrin parliaments and of the Peoples Council should act in lieu of a Parliament.

[1] New calendar; old calendar, November 24.

[2] New calendar; old calendar, November 13.

Elections for the Constituent Assembly were held Nov. 28, 1920, and the government, presided over by the veteran Serbian statesman, Nikola Pašić, was able to steer the drafting of the new constitution which was adopted on June 28, 1921, by 223 votes against 35, and 161 abstentions. The passage of the constitution was secured by the votes of the two largest Serbian parties, the Radicals and the Democrats, together with the Moslems. The constitution provided for a unicameral system and divided the country into 33 districts.

The majority of the Croat and Slovene political parties abstained from voting on the constitution, while the largest political party of the Croats refused from the beginning to take a part in the work of the Constituent Assembly. They objected to the centralistic principles of the constitution, as well as to the rule of the Constituent Assembly that the constitution was to be adopted by a simple instead of a two-thirds majority.

Problems Within the Kingdom.—The consolidation of the new kingdom was fraught with difficulties from its inception, difficulties resulting both from the internal problems of the kingdom and from the hostile attitude of its neighbors. Furthermore, the new union was made still more difficult by the fact that despite the consanguinity and similar social structure existing between the Serbs, Croats, and Slovenes, they had never before lived in a common state. Moreover, even those dwelling in the Austro-Hungarian Empire had lived under different regimes and did not join the new kingdom as a unit. Slovenia had previously been divided between two Austrian provinces. Croatia, an independent state, had been bound to Hungary since 1102 in such a manner that her independence was purely nominal. Dalmatia was part of the Austrian monarchy. Bosnia and Hercegovina, after an occupation of 30 years, had been annexed to Austria-Hungary in 1908 and granted a special status, while the Serbian province of Vojvodina had belonged to Hungary. This diversity in regimes and variety of administrations sharpened the differences existing between kindred peoples. On the other hand, the cultural life of the Slovenes and Croats was influenced by Vienna and Budapest, while the Serbs looked to France for moral and cultural guidance.

Difficulties were further increased by the activity of the newly formed Communist Party, which in the elections of the Constituent Assembly polled 14 per cent of the electorate and held 58 out of 419 seats in the assembly. At the first congress of the Yugoslav Communist Party held in Vukovar, it adopted a program emphasizing the need to attain "the dictatorship of the proletariat by revolutionary methods and the organization of the state on the pattern of the Soviet Republic."

In the Constituent Assembly, and throughout the country, the Communist leaders, young, able, and aggressive, encouraged by their unexpected electoral success, used all their strength to break down democratic institutions and set up a totalitarian regime patterned after the Bolshevik system in Russia. By every means—strikes, local disorders, sabotage of utilities and transportation—they tried to impede the consolidation of the new state and to prevent the economic recovery of the country which had been deeply affected by the war. Profiting from the new freedom assured by the democratic institutions, they so threatened to wreck the new-born state that the government finally outlawed their party. The Communist members of the Constituent Assembly were deprived of their mandates, the party was dissolved, its publications suppressed, and party funds seized for the benefit of the state (Dec. 29, 1920).

The political life in Yugoslavia between the two world wars continued to be dominated by the strained relations existing between the Serbs and Croats. The Serbs entered the new state with a political philosophy formed through their centuries-long struggle for independence. Serbia was a homogeneous state without national minorities and without religious problems. For the Serbs it was inconceivable that a political party—no matter how radical its program might be—could take a stand of opposition against the state itself. From their struggle for independence they had acquired the conviction that only a centralized government, with strong local autonomies, would best serve the interest of the state and assure for it the maximum stability. By temperament and tradition an intensely democratic people, politically conscious, and a nation of sturdy, independent peasants attached to their soil, the Serbs were not moved in their attitude by desire for leadership over the Croats and Slovenes whom they outnumbered. They considered that in the new state they had the right to take the role due them on account of their abilities, their economic and numerical importance, and the contribution they had made toward the state's formation.

The Croats, on the other hand, strongly opposed the centralistic organization of the country, looking upon it as inimical to their determination to preserve their national individuality. After World War I this attitude came to the fore with almost explosive force. Before the war, Croatia had not exercised any great amount of influence in the general policy of Hungary or the Austro-Hungarian Empire, but nevertheless she had enjoyed satisfactory autonomies in local government. With the end of the empire and their ties with Hungary, the Croats engaged in a struggle for the recognition of their national individuality.

As stated previously, the Croat representatives (except a minority who belonged to the Serbo-Croat coalition formed in 1907) forcibly opposed the Constitution of 1921. Members of the strongest political party—the Croat Republican Peasant Party, led by an able but temperamental politician, Stefan Radić—refused even to take their seats in the Constituent Assembly. This party, which before the war had only a few members in the Croat Assembly, polled 70 per cent of the votes for the Constituent Assembly. Instead of going to Belgrade, party members met in Zagreb (capital of Croatia) and drafted their own constitution for a "peace-loving, independent Croat Republic." At each subsequent election (1923, 1925, and 1927) the Croat Republican Peasant Party maintained and even increased its position while continuing to abstain from taking part in the proceedings of the Yugoslav Parliament.

Radić went to both France and Great Britain in 1923 to plead against an organization of the country in which the Croat national independence was suppressed by the Serbs. He also journeyed to Moscow for the same purpose, but gained

Above: A view of the bridge over the Neretva River at Jablanica, a tourist center.

YUGOSLAVIA

Right: Peasant women of Croatia, one of the federated republics of Yugoslavia.

Below: The headquarters of the central committee of Yugoslavia's Communist Party in Belgrade.

(Above) Alice Shalek from Three Lions; (right and below) Dr. Paul Wolff & Tritschler and Omnia Bern from Black Star

Above: Montenegro, one of the federated republics of Yugoslavia, is a highly mountainous region, where agriculture is meagerly developed.

Left: The old fortress city of Dubrovnik on the eastern shore of the Adriatic.

Below left: Yugoslavian men in the market place of Belgrade.

Below: Regional folk dances are studied at the University of Belgrade. Two students are shown in the Fight for the Girl dance from Kosovo.

(Top and below left) Fenno Jacobs from Black Star; (others) United Press

little encouragement from the Bolshevik leaders who were deeply engaged in consolidating their own power and did not show much sympathy for Radić's appeal for Slav solidarity.

Meanwhile, the strongest Serbian political group, the Radical Party, under the leadership of Nikola Pašić, remained faithful to its centralistic conception of the state. On the other hand, the Serbian party second in importance, the Democratic Party, under the leadership of Ljubomir Davidović, worked to ease the tension in the Serbo-Croat relations. A short-lived Cabinet, presided over by Davidović (August to November 1924), failed to induce the representatives of the Croat Republican Peasant Party to take part in the proceedings of the Parliament.

Davidović was succeeded by Pašić, whose government jailed the Croat leader Radić upon his return to Zagreb, for his subversive activities while abroad. The Pašić government in coalition with the Independent Democratic Party (composed mostly of Serbs from Croatia under the leadership of Svetozar Pribičević) carried out new elections in February 1925 and obtained a workable majority. When the new Parliament met, the representatives of the Croat Peasant Party made their first appearance in spite of the fact that Stefan Radić and others of the party leaders were still in prison. Unexpectedly Radić's nephew, Pavle Radić, acting in behalf of his imprisoned uncle, made a startling declaration in Parliament, embodying the new policy of the party. After five years of stubborn opposition, the party recognized the Constitution of 1921 and the monarchy, dropping from its own title the word "Republican." It was known thereafter as the Croat Peasant Party.

Soon afterward another government was formed under the premiership of Pašić, and was composed of the Serbian Radical Party and the Croat Peasant Party, heretofore seemingly irreconcilable opponents. Radić, liberated from prison after the charges against him were abandoned, joined the new government a few months later. This government, now made up of the two largest Serbian and Croat parties, gave rise to the hope that relations with the Croats would now be solved in a manner satisfactory to all and would bring about the desired consolidation of the state; but this hope founded on the new coalition was not fulfilled. Radić, by his unpredictable actions, several times endangered the very existence of the government, and when the old statesman Pašić died in December 1926, the coalition government continued to function for only a few months longer. It finally expired in April 1927.

The new government under the premiership of a Radical, Velja Vukičević, was formed of dissident Radicals, the Slovene People's Party, Democrats, and Moslems from Bosnia. Radić, whose party was strengthened once more at the elections of 1927 (carried out by the Vukičević government), continued to take part in the National Assembly where, with his former arch enemy Svetozar Pribičević, he formed a powerful opposition group.

The relations between the Serbs (all of whose major political parties were represented in the new government) and the Croats grew worse. The tension climaxed in the Parliament on June 20, 1928. A Radical deputy from Montenegro, Puniša Račić, killed Radić's nephew, Pavle, and another leader of the party, George Basariček, while Stefan Radić himself was gravely wounded and died two months later.

The Croat Peasant Party and its ally, the Independent Democratic Party (headed by Pribičević), withdrew from the Parliament and left for Zagreb. After the death of Radić, the leadership of the Croat Peasant Party was assumed by Dr. Vladimir Maček.

Personal Regime of King Alexander I.—After the assassinations in the Parliament, the Vukičević government resigned and was succeeded by another coalition government, composed of the same groups but presided over by the Slovene leader, Dr. Anton Korošec. But relations between the Serbs and the Croats had almost reached the breaking point. On Jan. 6, 1929, King Alexander, believing that any parliamentary solution was impossible and that the unity of the state was endangered, abolished the Constitution of 1921 and formed a government under the premiership of the commander of the Royal Guards, Gen. Petar Živković. The king also feared that a continuing parliamentary crisis would greatly encourage Mussolini and his hostile policy toward Yugoslavia. In his manifesto, the king promised that the constitution would be restored as soon as the government had achieved the objectives of safeguarding the national unity and improving the administration. The king's personal regime had the support of several leaders of the major Serbian political parties, which brought about the split in those parties. The Slovene People's Party leader, Dr. Korošec, was vice president of the new government with which Dr. Mehmed Spaho, leader of the Bosnian Moslems, was also associated. But the Croat Peasant Party refused to support a government in which the Croats were represented by men who, though distinguished personalities themselves, had little political influence in Croatia.

On Oct. 3, 1929, the king took a most important step by substituting a new name—Yugoslavia—for that of Kingdom of the Serbs, Croats, and Slovenes. The new kingdom was divided into nine banovinas (instead of the 33 provinces as provided by the Constitution of 1921), named after the principal rivers flowing through them. The governors, or bans, of the various banovinas were to be appointed by the crown.

On Sept. 3, 1931, the king proclaimed a new constitution under the name of Yugoslavia. This constitution provided for a bicameral system: the House (Skupština), elected by general vote but open ballot; and the Senate, one half the members of which were elected by a special type of ballot and the other half appointed by the crown.

The elections carried out under the new constitution returned a majority to the newly formed Yugoslav National Party which supported the king's regime. The opposition refused to take part in the elections, this abstention being particularly heavy in the Croat parts of the country.

Continuing his efforts to fulfill his promise that the constitutional life should be restored, the king in April 1932 substituted for premier, in place of General Živković, one of the leaders of the Democratic Party, Dr. Vojislav Marinković. The latter resigned three months later, however, on account of ill health. Marinković's successors, Milan Srškić and Nikola Uzunović, in addition to their difficulties with the Croats, were beset by a serious crisis resulting from the general economic collapse in central Europe after 1931.

In Croatia itself a constantly strengthening radical group calling themselves the Ustaši was led by Ante Pavelić (who in 1941 was to become the head of the Axis puppet state, Independent Croatia). This movement was directed toward the destruction of Yugoslavia, and was accompanied by many acts of terrorism. It was supported by Italy and Hungary, where the Ustaši had training camps at Borgotaro and Janka Puszta, while their leader Pavelić enjoyed the hospitality of Mussolini.

Assassination of Alexander I; the Regency.—In 1934, the king, after a visit to Sofia, Bulgaria (which marked improved relations with that country), went to France for the purpose of discussing with French statesmen a common policy to oppose the increasing aggressiveness of the Nazis and Mussolini. He landed at Marseille on Oct. 9, 1934, and a few minutes later was killed by a Macedonian terrorist, Vlada Crnozemski. Louis Barthou, the French foreign minister, who had come to greet the king, was also a victim of the assassin. The conspiracy had been planned by Pavelić and had the full approval of Mussolini.

The death of Alexander was a heavy blow for Yugoslavia. He was a powerful personality, enjoying great prestige with the Serbs, as well as the confidence of the French and of his partners in the Little Entente and the Balkan Entente. Alexander was succeeded by his young son, Peter II, during whose minority the royal prerogatives were vested in a regency, consisting of three men named by Alexander in his last will: Prince Paul, Alexander's cousin; Dr. Radenko Stanković; and a Croat, Dr. Ivo Perović. It was Prince Paul, however, who actually assumed the powers of government, the other two regents taking little part in state affairs.

During the regency (Oct. 10, 1934–March 27, 1941), Prince Paul continued the personal regime of Alexander but with considerably less authority. Two elections were carried out (May 1935 and December 1938). In both, despite the electoral laws which greatly favored the official list, the governments of the successive premiers, Bogoljub Jevtić (Yevtić) and Milan Stojadinović, were nearly defeated. The united opposition of the Serbian parties (Radical, Democrat, and Agrarian) made repeated efforts to come to an agreement with the Croat Peasant Party. As a result, the united Serbian opposition and the Croat Peasant Party presented a common list of candidates, headed by Dr. Vladimir Maček. Despite this joint electoral action, Maček and the members of the Croat Peasant Party refused to take their seats in Parliament, and the united Serbian opposition failed to reach a definite agreement with Maček.

In February 1939, the regent, having lost confidence in Stojadinović (who had held the premiership since June 1935), replaced him with Dragiša Cvetković, leader of a minority in the Serbian Radical Party. Under pressure of events abroad which forecast the coming of World War II, the government of Cvetković, with the full approval of the regent, reached an agreement with Maček on Aug. 26, 1939.

By this agreement (*sporazum*), Croatia enjoyed complete autonomous status under the name of the Banovina of Croatia. The ban, or governor, of Croatia had to be appointed by the crown after being proposed by the Croat Diet. While Croatia was granted full autonomy, the rest of Yugoslavia continued under the unitaristic and centralistic system. Dr. Maček joined the government as its vice president, and several members of the Croat Peasant Party were appointed to important posts in the central government. The agreement (*sporazum*) did not solve the problem of Serbo-Croat relations, however, and was particularly opposed by the Serbs as having been reached without participation of their political parties; also as having included several Serbian districts in autonomous Croatia.

The Cvetković-Maček regime continued until March 27, 1941, when the regency and the government were overthrown by a popular uprising of the Serbs in protest over the signing of the Tripartite Pact with Germany.

World War II.—In the beginning of World War II, Yugoslavia was spared involvement in the conflict, preserving a precarious neutrality for 20 months. But after his conquest of western Europe, Hitler turned toward the Balkans. By increasing diplomatic pressure, he forced Yugoslavia to sign the Tripartite Pact in Vienna on March 25, 1941, but promised not to ask for passage of Axis troops or war material through that country. This situation differed from that of Rumania, Bulgaria, and Hungary, who, after signing the pact, had to permit the presence of German troops on their soil. The Serbs, in a violent popular reaction, overthrew the regency and the government two days later, thus practically repudiating the Tripartite Pact. Hitler's reaction to what he considered a personal affront was swift; on April 6 he launched a powerful attack on Yugoslavia from three sides, preceded by a merciless bombardment of Belgrade. The Wehrmacht, far superior in mechanized armament, broke the organized resistance of the Yugoslav Army in 10 days. The king, Peter II (who had ascended the throne after the coup d'état of March 27, 1941), accompanied by the new government presided over by Gen. Dušan Simović, went into exile in London to continue to fight on the side of the Allies.

Yugoslavia was divided between the Axis and their satellites, Bulgaria and Hungary, which at the time created the "Independent State of Croatia" whose head (*poglavnik*) was Ante Pavelić, and which included more than 2,000,000 Serbs. Serbia was reduced practically to its pre-Balkan War frontiers, but without the attributes of an independent state. The occupation of Serbia was marked by acts of extreme cruelty on the part of the Germans; but even these were surpassed by the atrocities committed in Pavelić's Independent Croatia. The official policy of the Pavelić Ustaši, which was publicly announced in the Pavelić Ustaši parliament, was the extermination of the Serbs in Croatia. Those who escaped murder were either forcibly evicted from Croatia, or forced to embrace the Roman Catholic faith. The unofficial estimate made by the government in exile of Serbs killed by the Ustaši reached the appalling figure of 600,000 men, women, and children.

When Yugoslavia surrendered to Germany on April 16, 1941, many of the officers and men refused to accept the surrender order and several small groups took to the mountains to continue an underground resistance. Out of these groups there soon emerged a man who was recognized as the leader of the resistance. He was General Staff Colonel Draža Mihajlović, later (January 1942) to become minister of war in the govern-

ment in exile. With the Nazi attack on Russia (June 22, 1941), a second resistance movement appeared in Yugoslavia under the leadership of the Communist Party.

Mihajlović tried to reach an agreement with this Communist-led movement in order to unite all forces fighting the enemy. In the autumn of 1941 such an agreement was reached between Mihajlović and Tito (Josip Broz), the mysterious leader of the Communist-dominated resistance, but it proved of very short duration. A resulting struggle between the two groups (Mihajlović's Četnici [Chetniks] and Tito's Partisans) developed gradually into actual civil war, all the more bitter as it was fought under enemy occupation. The official policy of the Allies, which at first had supported Mihajlović, shifted slowly in favor of Tito until, at the Teheran Conference (November-December 1943), the Allied leaders decided to extend their full material and moral support to Tito, as well as help him with Commando operations.

Mihajlović, whose action was mainly concentrated in the Serbian part of Yugoslavia (western Serbia and eastern Bosnia and Hercegovina), though abandoned by the Allies, continued his resistance to the enemy as well as to Tito and his Partisans. Tito's forces, on the other hand, were centered chiefly in western Yugoslavia, and he was unable to penetrate into Serbia until the autumn of 1944 when the Red Army entered this key state of Yugoslavia.

One of the features of Mihajlović's action against the enemy was his indirect assistance to the British offensive in North Africa in November 1942. On the vital railroad line from Belgrade to Salonika, he sabotaged the Nazi transports bound for the German Afrika Korps. For this action Mihajlović received telegrams of warm thanks from the Allied High Command in Cairo. Another Mihajlović contribution to the Allied cause was the rescue of more than 500 American airmen who, while returning from bombardment missions against enemy objectives in central Europe, parachuted from damaged planes onto territory under the Mihajlović control. Those rescued airmen were later safely evacuated to Allied bases in Italy.

To Tito the Allies extended their political as well as their military support. Under Allied pressure (particularly that of British Prime Minister Winston Churchill), King Peter dismissed, on June 1, 1944, the last government in exile (presided over by Dr. Božidar Purić, with Mihajlović as minister of war), and entrusted to Dr. Ivan Šubašić, the governor of Croatia, the task of forming a new government which would collaborate with Tito. Šubašić met Tito on the island of Vis in the Adriatic and reached an agreement (June 16) whereby the new prime minister recognized "the provisional administration established by the National Liberation Committee of Yugoslavia and by the AVNOJ (Anti-Fascist Council for National Liberation, Tito's provisional assembly). Tito, on his side, agreed that he would collaborate with the new government in exile and not raise "the question of the final organization of the country during the war." King Peter was even induced to make a radio appeal, on Sept. 12, 1944, to the peoples of Yugoslavia, asking them to rally under the command of Marshal Tito.

Abandoned by the Allies and repudiated by the government in exile, Mihajlović continued his fight against the Germans, but with the advance of the Red Army into Serbia (October 1944), after the Russians had refused his offer of collaboration, he retreated into Bosnia in order to avoid fighting against them. Mihajlović was finally captured by Tito's forces in March 1946 and tried by a Communist-packed court which sentenced him to death on July 15, 1946. On July 17 the death sentence was carried out.

Installation of Tito's Regime.—The Red Army took Belgrade on Oct. 20, 1944, and Tito immediately installed his regime as government de facto of Yugoslavia. The Allies at the Yalta Conference (February 1945) made specific provisions for the new provision government of Yugoslavia which should include both the members of the government in exile and Tito's Committee for National Liberation. The agreement of the Allies recommended full political freedom, and free and unfettered elections for the Constituent Assembly of the country. The provisional government was formed on March 6, 1945, with Tito as prime minister and Šubašić as foreign minister.[1] It soon became apparent that the government was exclusively dominated by the Communists, and that the solemn engagement concerning free elections and political freedom remained without effect. Šubašić and the other members of the government in exile resigned in the early fall of 1945.

No opposition newspaper was permitted to be published, nor were any political meetings allowed except in the parties composing the National Front, who were entirely dominated by the Communist Party. Under those conditions the opposition decided not to take part in the elections which were held on Nov. 11, 1945, with only one list of candidates presented to the electorate.

The Federal Peoples Republic.—The Constituent Assembly, in which the Communists held an overwhelming majority (425 members out of 563, composing both assemblies), met on Nov. 29, 1945, and the same day proclaimed Yugoslavia a Federal Peoples Republic, thus abolishing the monarchy without a plebiscite. On Jan. 31, 1946, the assembly voted a constitution for Yugoslavia patterned almost entirely on the Soviet constitution.

On Jan. 13, 1953, a new constitution was adopted by the National Assembly according to which the Federal Peoples Republic (FPRY) of Yugoslavia is a socialist democratic federal state of sovereign peoples equal in rights, composed of the Peoples Republics of Serbia, Croatia, Slovenia, Bosnia-Hercegovina, Macedonia, and Montenegro (the Peoples Republic of Serbia includes the autonomous Province of Vojvodina, and the autonomous region of Kosovo-Metohija).

The social ownership of the means of production and the self-government of producers constitute the basis of social and political organization of the country.

The federal authorities are: the Federal Peoples Assembly, the president of the Republic, the Federal Executive Council, and the Federal Supreme Court.

The Federal Assembly is composed of two houses: the Federal Council, and the Council of Producers. The Federal Council is composed: (1) of deputies elected by citizens on the basis

[1] The king remained in exile pending a popular decision on the question of the monarchy, and appointed a regency of three men to act on his behalf.

of universal equal and direct suffrage, one deputy for 60,000 inhabitants; (2) deputies elected by the republics among the members of their respective assemblies. (Each republic elects 10 deputies: the autonomous Province of Vojvodina 6, and the autonomous region of Kosovo-Metohija 4.). The Council of Producers is composed of peoples deputies elected by those engaged in production, transport, and commerce in proportion to the respective economic sectors in the total production of the FPRY. There is one deputy for every 70,000 producers. Both councils are elected for four years. The voters have the right to recall their deputies by secret vote.

Members of the Federal Council elected by the peoples republics and autonomous regions render decisions separately as the Council of Nationalities in matters of constitutional changes and economic plans or changes in relations between the several peoples republics.

The president of the republic is elected among the members of the assembly by the Peoples Assembly in joint session of both houses. He represents Yugoslavia within the country as well as internationally and proclaims laws by decree. He is the president of the executive council, supreme commander of the armed forces, appoints and dismisses admirals and generals, and presides over the Council for National Defense.

The Federal Executive Council is composed of from 30 to 45 members elected among the deputies of the Peoples Assembly; each of the six republics must be represented in the Federal Executive Council, and the presidents of the executive councils of peoples republics are ex-officio members of the Federal Executive Council which is responsible for its work to the Federal Assembly. There are six federal secretaries: foreign affairs, national defense, internal affairs, national economy, budget administration, and state administration. The secretaries of foreign affairs and national defense are appointed by the Federal Executive Council from among their members.

The organs of justice are the Supreme Court of the Federal Peoples Republic, the supreme courts of the republics and the autonomous provinces, the departmental and district courts. Peoples committees are the highest organs of state authority in the municipalities, towns, and districts.

The constitution guarantees personal freedom, free association, free press, freedom of speech, and right to work. Suffrage is guaranteed to all citizens regardless of sex, nationality, and creed. Women have equal rights with men and the same pay as men for the same work.

In actual fact the whole political life of the country is controlled by the Communist Party which, at the last congress of the party held in Zagreb in November 1952, was renamed Communist Union. Its membership in June 1952 stood at 780,000. The only political organization authorized to conduct political activities is the Socialist Alliance of the Working Peoples of Yugoslavia, a mass organization of nearly 8,000,000 members. This organization is entirely dominated by the Communist Party; its directing body and executive officers are the same as those of the Communist Union. At the elections in November 1953, 98 per cent of the deputies elected were members of the Communist Party, and the Socialist Alliance polled 95.7 per cent of the votes, while 4.3 per cent were void ballot papers. The list of the Socialist Alliance was the only one presented to the citizens. The constitution also guarantees private property as well as private initiative. In spite of this provision of the constitution, however, the government has nationalized by the law of April 28, 1948, all private enterprises and industries, the greater part of which had already been nationalized by the decree of Dec. 20, 1946.

The whole economic life of the country, as well as the foreign trade, is controlled by the government. On April 28, 1947, the Peoples Assembly voted a Five-Year Plan for the development of the national economy for the period from 1947 to 1951. The plan called for the increase of the national income from 132 billion dinars in 1939 to 255 billion in 1951. It provided for the investment of 278 billion dinars in the national economy during the period of 1947–1951, and for the increase in the value of the total production from 116 billion dinars in 1939 to 266 billion in 1951. It contained special provisions for building up the electrical industry and the electrification of the country, as well as the heavy industries—particularly metallurgy and engineering—and for the development of the country's mines.

Several laws enacted in 1951 and 1952 transferred control over heavy industry, farming, public utilities, etc., to the six peoples republics. The management of the various units is directed by individual councils of enterprise.

On April 29, 1948, at the end of the first year of the Five-Year Plan, the vice premier, Edvard Kardelj, admitted the difficulties which the government had encountered in carrying out this plan which was already behind the proposed schedule.

Since the split with the Cominform, July 1948, Yugoslavia has been reorienting its foreign trade toward the Western countries owing to the economic boycott of the USSR and its satellites. Prior to this event, the Yugoslav economy had been integrated in the Soviet bloc and, in conformity with Soviet policy, Yugoslavia refused in June 1947 to participate in the Marshall plan. The most important step in the new policy has been the trade agreement with Great Britain, signed at Belgrade on Dec. 26, 1949, which provided for an exchange of goods between the two countries up to $616,000,000 over a five-year period. In 1949, Yugoslavia was granted a credit in the United States of $3,000,000 for a steel mill; a loan from the American Export-Import Bank of $20,000,000, and a credit of $25,000,000 from the International Bank for Reconstruction and Development.

In December 1950, Tito received a grant from the United States of $70,000,000 for emergency relief assistance to save the country from starvation. In March 1951 he received another grant of $29 million for the purchase of industrial and raw material, and later in the same year an additional one of $60,000,000 in which France and Great Britain participated. By the end of 1952 the total amounts of those grants, credits, and loans from Western democracies exceeded $1 billion, including the initial assistance given by UNRRA in 1945–1946. On Nov. 14, 1951, the United States signed an agreement with Tito under which they supplied military material and services, the amount of which was not made public.

In spite of this economic, financial, and military assistance, Tito has refrained from including Yugoslavia in the system of collective security built up by the Western democracies.

On Feb. 27, 1953, Tito concluded a treaty of friendship with Greece and Turkey which provided only for political and military consultations without any specific engagement for a common action in case of aggression.

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YUGOSLAVS (Slav Jugoslaveni, or Južni Slaveni, meaning the Southern Slavs), a name applied to all the Slavs of the Balkan area in southeastern Europe. The name Yugoslavs was coined by Prince-bishop Peter II (Petrović-Njegoš, r. 1830–1851) of Montenegro, in 1848, and embraces Serbs, Croats, Slovenes, and Bulgars, who in turn break up into many local groups. The inhabitants of Yugoslavia are called Yugoslavians.

The Yugoslavs migrated to the Balkan area from the cradle region of all the Slav peoples, north and east of the Carpathian Mountains (see Slavs). Their migrations continued for more than two millennia, the first occurring about 1500 B.C., the last about 640 A.D. The Slavs migrated in tribes, and lived under the tribal system, each tribe being a small nation in itself. Throughout their long history, the Slavs have never been a political unit, although several attempts have been made to unite them in a single state. This unity was always prevented, whether by the desire of individual tribes to remain independent, or by numerous invasions—by the Romans, Byzantines, Huns, Goths, Avars, Tatars, Magyars, Franks, and others. Certain of the tribes managed to unite and create small states, some of which gained recognition from their neighbors as semi-independent or independent territories, playing a significant role in medieval times. The most important of these states were Slovenia, Croatia, Dalmatia, Serbia, Rascia, Bosnia, Zeta (Montenegro), Macedonia, Bulgaria, Slavonia, Carinthia, Hercegovina, and the republic of Dubrovnik (qq.v.).

As members of the Slav family, the Yugoslavs speak a Slav dialect, which has become diversified into several subdialects.

The first known Slavs, the Sarmatians and Scythians (qq.v.), migrated in prehistoric times to the region which has become known as the Balkans, from the name applied to its mountains by these early settlers. (See also Balkan Mountains.) It is believed that they came up the Danube and then moved southward through the Morava Valley to settle in the neighborhood of Lake Ohrid. Whether any of them went further south and mixed with the Mediterranean peoples, is a matter of speculation. See also Yugoslav Language; Yugoslavia.

YUIT, the Eskimos of extreme northeastern Asia, inhabiting the area from East Cape to Cape Chukotski across Bering Strait from Alaska. They have also settled on Saint Lawrence Island in the Bering Sea. The Yuits migrated from America, probably in modern times, and their customs are similar to Alaskan Eskimos. A few of them follow the custom of wearing chips of wood or stone in perforations of their lips. Their language is different from their kinsmen across the straits, and then can be separated linguistically into four groups: the Noökalit of East Cape, the Aiwanat of Indian Point, the Wuteëlit of Cape Ulakhpen, and the Eiwhuelit of Saint Lawrence Island.

YUKIAN FAMILY, a linguistic stock of North American Indians, almost extinct, who lived in the small territory of northern California called Yuki. They were separated into several tribes, each of which had a different dialect. As they did not have a tribal name, they are referred to as the Yukian Family. They fished and hunted, although vegetables made up most of their diet. In appearance they were short, fat, and broad, and Yuki women decorated themselves by tatooing their faces, on the cheeks and chin. They were much like the Pomo tribe in living habits and beliefs. They thought that the world had been created by a being called Taikomol ("He who travels alone"), who was human in form and appearance. The Yuki have a reputation for being fighters, as they had periods of war with several different tribes. They also fought with the white invaders. The Ashochimi, or Wappo (Sp. *guapo,* "brave") were a detached portion living chiefly in the mountains between Geysers and Calistoga in Sonoma County.

YUKKEL, yŭk'ĕl, in England, the green woodpecker; United States, the flicker.

YUKON, yōō'kŏn, town, Oklahoma, in Canadian County, located 13 miles west of Oklahoma City and 13 miles east of El Reno. It was founded in 1891 by the Spencer brothers who owned 160 acres of land in the vicinity. The town is a small agricultural center and has some large flour mills which are its most important commercial enterprise. Pop. (1950) 1,990.

YUKON, the fifth largest river in North America, located mainly in the Territory of Alaska. It rises as the Lewes River in British Columbia, about latitude 59° N, and after a tortuous course of 2,300 miles, flows into the Bering Sea, on the southern shore of Norton Sound, through a many-channeled delta from 80 to 90 miles wide. The northernmost channel of the delta, the Aphoon Mouth, is the only one navigable. The Yukon has a drainage area of 330,000 square miles, most of which is in Canada. The main stream of the Yukon is formed at Selkirk, Yukon district, in latitude 63° N, by the junction of the Lewes and the Pelly rivers, about 120 miles east of the Alaska-Canada border. The Lewes River is constituted by the junction of the Big Salmon and the Teslin flowing from Teslin Lake and draining a group of small lakes in the region around Mounts Lansdowne and Lorne. The Lewes is navigable from its source northward for about 100 miles where it is obstructed by a canyon. Then it is navigable again from White Horse rapids to its junction to form the Yukon. From Selkirk, the Yukon flows northwest with many windings, passing through the famous Klondike gold field, receiving from the right the Stewart River, and at Dawson the Klondike, and from the left

the White River, Sixty Mile Creek, and Forty Mile Creek. It enters Alaska in about 65° N., and continues its northwestern course until the Arctic Circle is reached, when at the abandoned Fort Yukon it is joined on the right by the Porcupine River, bends suddenly, almost at right angles, and thenceforward has a general southwestern trend to its mouth.

The chief Alaskan tributaries of the Yukon are the Koyukuk on the right bank, and the Birch and Tanana on the left bank. Its whole course of 1,260 miles through Alaska is navigable by large stern-wheel steamers, and to Dawson in Canada; since the discovery of gold throughout the region in 1897, a regular summer service has been maintained; the first impracticable obstruction to navigation is at Miles Canyon, 1,866 miles from the mouth. In its lower course the Yukon is a broad, muddy stream flowing mostly through a marshy plain, and for nearly nine months of the year, from October to April, frozen over; its upper course is through the grand scenery of narrow mountain valleys and rocky gorges. The Yukon is the largest American river flowing into the Pacific; it is the 17th river of the world as to length, the seventh of the Western Hemisphere, the fifth of the North American continent, and the third in the United States. This last assertion is based on its whole length of 2,100 miles, however, but taking only that portion which is in the United States, or Alaska, 1,260; it is the fifth river of the United States, the Mississippi, Missouri, Arkansas, and Ohio rivers being longer. There are but four rivers in the world with a greater capacity: the Amazon, the Mississippi, the Missouri, and the Saint Lawrence.

YUKON GOLD FIELDS. See ALASKA; KLONDIKE, THE; NOME.

YUKON TERRITORY, Canada, is bounded on the north by the Arctic Ocean; on the east by the Mackenzie District (Northwest Territories), part of the boundary consisting of the watershed of the Selwyn Mountains; on the south by the Province of British Columbia, the boundary line being the 60th parallel of latitude except at the southwest corner of the territory; and on the west by Alaska. The territory is roughly a right-angled triangle of which the hypotenuse (the eastern boundary) runs in a northwesterly direction. The estimated area is 207,000 square miles. Population (1950 est.) 8,000.

Topography and Communications.—The central area consists of the Yukon Plateau, dissected by the Yukon River and its many tributaries. To the north and east are the British Mountains, the Richardson Mountains, and the Selwyn Mountains; to the southwest, the St. Elias Mountains, which extend into Alaskan territory and in which Mount Logan (19,850 feet high) and Mount St. Elias (18,008 feet high), two of the giant mountains of North America, are to be found, surpassed in the area only by Mount McKinley, in Alaska, which rises to 20,300 feet. The Peel River finds its way to the east, entering the Mackenzie River. The Peel and the Porcupine rivers (the latter a tributary of the Yukon) drain the Porcupine Plateau in the northern neck of the territory.

The Yukon River (q.v.), one of the great navigable rivers of the world, rises only 25 miles from tidewater at Skagway as the Lewes River and is navigable for over 2,000 miles from Whitehorse to the Bering Sea. It dissects the Yukon Plateau (elevation 4,000 feet) and has as its main tributaries the Lewes (now known as the Yukon), the Pelly, the Stewart, and the Porcupine. The best-known tributary is one of the smallest—the Klondike (q.v.), the placers of which made Yukon history. The Yukon is the artery of travel through the territory, with a railway from Skagway to Whitehorse giving access to the river immediately below the Whitehorse rapids. Dawson, at the confluence of the Klondike with the Yukon, is reached by river boat down the Yukon from Whitehorse. The silver lead mines at Mayo on the Stewart have placed that river among the arteries of traffic, for the concentrates are shipped down the Stewart, and up the Yukon to Whitehorse, there to be shipped by rail to smelters. Another traffic line has been added in the Alaska Highway, which enters from the south at Watson Lake, passes through Teslin and Whitehorse, and proceeds northwestward to Fairbanks in Alaska. The Haines cutoff connects with Skagway. The Alaska Highway was built by the United States government for defense purposes, and has been turned over to the Canadian government for administration and general upkeep.

Climate.—The climate of Yukon Territory is extremely variable. To the south lies the Pacific Ocean, which is warm; to the north, the Arctic Ocean, which is cold. The climate varies with the outcome of struggle between these two large air masses. There has been recorded a temperature of 81.4°F. below zero, and one of 95°F. above zero. February has had averages of 40°F. below. From mid-June to mid-August, frosts are rare. Rainfall is abnormally small; annual total precipitation is from 9 to 13 inches, about half of which is in rain. The volume of water in the Yukon is not so large as might be expected, for the central Yukon Plateau has very small precipitation. This is apparently not a recent climatic change. A large part of Yukon is unglaciated. It would appear that in Pleistocene time the precipitation was so limited that ice sheets did not form. Had they done so, much of the placer deposits with their gold would have been swept away by the icecap as it moved forward. In June, Dawson has 24 hours of daylight in a day; Whitehorse, 20. In midwinter there are only 5 or 6 hours of daylight.

Resources.—Minerals, furs, fish, forests and waterpower are the resources that contribute to the national revenue. The fur trade was the early attraction; over 100 years ago, Hudson's Bay Company officers came into the territory from the southeast and the northeast and established forts on the Yukon River for the purpose of trading in furs. In 1950 there was still a yield of $250,000 a year in furs. Fur farming gives very little to this total, which comes almost entirely from trapped animals. Sawn lumber is used in the Yukon for building and general construction purposes, and in value is a little over $20,000. Fishing is even smaller, giving a yield of $5,000. These figures are for 1946 and 1945, respectively. Waterpower is as yet practically untapped, though water as such is extensively used for hydraulicizing the frozen gravels preliminary to being scooped up by giant dredges.

As in Alaska, so too in the Yukon big game has become an attraction for hunters from far

YUKON

Philip Gendreau, N.Y

Two Indian boys at Carcross, halfway between White Horse and Skagway. Alaska.

The National Film Board, Canada

An isolated trading post at Bear Creek north of White Horse.

Mines and Resources photograph by H. Holman

The Yukon River passes Dawson City on its way to Alaska and the Bering Sea.

Canadian National Railways

Two- and three-story log homes are a striking feature of house construction at White Horse.

afield. Black and grizzly bears, wolf, moose, caribou, mountain sheep and goats abound. Canadian nonresidents pay $75 for a hunting license. Alien hunters pay $100. This brings in some revenue, for the Yukon has become reasonably accessible. But these animals are pale shadows of the former denizens of the land. During mining operations, bones and tusks of mastodon and mammoth, relics of a bygone age, have been scooped up with the gravel. The tusks form useful material for carved mementos for visitors to the Yukon.

The development of placer mining is an integral part of the history of the Yukon. The old method of hand mining with fire softening and sluice-box separation gave place in 1905 to dredging on a large scale. But the old method was responsible in the one year of 1900 for a recovery of $22,000,000 worth of gold in the Yukon. The day of the poor man has now gone, for dredging outfits require much capital. They can work over ground much too poor for sluice-box operations. The romance, such as it was, has also gone. Now mining is big business.

Lode mining has become important in the Mayo district, on the Stewart River 200 miles by Yukon and Stewart rivers from Dawson, and available by large river-boat transportation. The silver lead deposits at Mayo have been worked since 1913, and the ore, some of which is very rich, is concentrated and sent out by boats and train, to the smelter. Copper ore was worked intermittently in the Whitehorse district until 1920, when the mines were closed. Native copper in nugget form has been found in the Kluane Lake district; tungsten and tin at Mayo. Coal was mined for 30 years near Carmacks in the Lewes River to the extent of 10,000 tons a year. It served a local market.

Agriculture.—Probably half a million acres are capable of cultivation, half of which are possibly better classed as forest land. The major economic crop is grass, used as feed for livestock which supply the local market with milk, butter, and beef. It is planned that the agricultural station at Pine Creek will assist in the wise development of the agricultural possibilities of the area.

Government.—The territorial government consists of a commissioner (J. E. Gibben in 1949), and an elective Legislative Council of three members having a three-year term. The territory is represented in the Dominion Parliament by one member (J. A. Simmons, elected in 1949).

Finance.—Revenue for the fiscal year ending March 31, 1949, amounted to $636,982.37; expenditures were $704,522.11.

Education.—In 1948, the territory had 13 schools, enrolling 500 pupils and employing 20 teachers. Expenditure for education amounted to $114,858.20.

History.—It was the old route that was taken by Robert Campbell of the Hudson's Bay Company in 1840; he crossed the divide from the Liard and discovered a large river flowing west, which he named the Pelly. Another Hudson's Bay Company man, John Bell, crossed from the lower Mackenzie to the Porcupine in 1842, followed down to the Yukon, and established Fort Yukon at the junction of the Porcupine and the Yukon, now in Alaskan territory. Campbell reached the same spot in 1850, having already established Fort Selkirk at the junction of the Pelly and the Lewes. It was known in the 1860's that there was gold in the river gravels, and by 1873 many miners had come north from California and from the Cariboo and the Cassiar gold camps. In 1896 the famous gold strike was made at Bonanza Creek in the Klondike region, and gold seekers poured in from all quarters of the globe and by half a dozen routes. From 1897 until 1904 over $100,000,000 in gold was washed out of the gravels. From 1904 until the mid-20th century almost the same amount has been obtained. Dawson became a city overnight. It is now a shell of its former self, while Whitehorse, at the foot of the rapids and at the head of the railway, is the chief city of the Yukon, with a population (1950) of over 4,000 and the largest airport in the Northwest. The commissioner sits in Dawson, still the capital of the Yukon Territory.

ROBERT C. WALLACE,
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YULAN, a Chinese tree. See MAGNOLIA.

YULE, yōōl, SIR **Henry,** British geographer and Orientalist: b. Inveresk, Midlothian, Scotland, May 1, 1820; d. London, Dec. 30, 1889. He was educated at Addiscombe and in 1840 was appointed to the Bengal Engineers, serving in both Sikh wars. He retired from the army with rank of colonel in 1862, and in 1864 took up his residence at Palermo, Sicily, in order to continue and extend the researches which led to the publication of his great work, *The Book of Ser Marco Polo, the Venetian* (1871), which gained him the Founder's Medal of the Royal Geological Society. In 1875 he returned to England, and from that year until 1889 was a member of the Indian Council. His other works include *Narrative of a Mission to the Court of Ava in 1855* (1858); *Cathay and the Way Thither* (1866); *Notes on Hwen Thsang's Account of the Principalities of Tokharistan* (1872); *Hobson-Jobson: a Glossary of Anglo-Indian Colloquial Words and Phrases, and of Kindred Terms,* (1886), with A. C. Burnell; *The Diary of William Hedges* (1887), edited for the Hakluyt Society, of which he was for many years president.

YULE, the old English name for Christmas, still used provincially and in poetry or poetic phrases. See also CHRISTMAS.

YULE LOG, a log burned with traditional ceremonies during the medieval celebrations of Christmas, perhaps a survival of an ancient pagan festival of the winter solstice, in which fire represented the sun. The log was often lighted with a fragment of the last year's log, and remnants of it were believed to have magic powers. The yule log survived long after the Middle Ages in many parts of Europe.

YULEE, David Levy, American politician: b. St. Thomas, West Indies, June 12, 1810; d. New York, Oct. 10, 1886. In boyhood he came with his father, whose name was Levy, to Richmond, Va., where he was educated. Sent to Florida in 1824, he there studied law, became a planter, and being elected to Congress, served from 1841 to 1845, changing his name at this time from David Levy to David Yulee. He was United States senator from Florida 1845–1851, taking a prominent part

in senatorial debates, and again 1855–1861, when he resigned on account of the Civil War. He was then made a member of the Confederate Congress. After the war he became president of the Atlantic and Gulf Railroad and was interested in the commercial development of Fernandina and Cedar Keys, Florida.

YUMA, city, Arizona, seat of Yuma County, on the Colorado River, at the mouth of the Gila River, 160 miles southwest of Phoenix. It is served by the Southern Pacific Railway and Western Airlines, and is on a main highway.

Yuma is the center of a vast irrigation project which under the federal reclamation service and the All-American Canal System has turned what was once desert area into rich fertile land. The principal crops are lettuce, carrots, pecans, citrus fruits, cantaloupes, alfalfa, bermuda grass seed, flax, and small grains.

Early missionaries to the area were Fathers Eusebio Francesco Kino and F. T. H. Garcés but there was no white settlement until Fort Yuma was built in 1850. Platted in 1854 as Colorado City, it was renamed Arizona City in 1862 and Yuma in 1873. The city was incorporated in 1871. It has mayor and council government. Pop. (1950) 9,145.

YUMAN STOCK, an important family or linguistic stock of North American Indians, the tribes composing it being scattered from the Colorado River region of Northern Arizona to the southern extremity of Lower California and even into the Mexican state of Sonora. The most important tribes of the stock are the Cochimi, Cocopa, Comeya, Cuchan, Diegueño, Havesupai, Maricopa, Mojave, Yavapai, Pericu, Seri, Tonto, Waikuru and Walapai. Of these, the Maricopa, or Coco-Maricopa, formerly inhabited the region around the confluence of the Gila and Colorado rivers. Their descendants and the Pimas, with whom they subsequently confederated, are now to be found in the Gila River Reservation to the number of about 400. They were an agricultural people and raised large crops by irrigation. Under missionary influence they have been civilized and are now noted for their industry, their efforts at self-improvement, and their manufactures of cotton cloth, baskets and pottery.

The Seri Indians (Opata, "Spry") speak a distinct language and live on Tiburon Island, in the Gulf of California, and the adjacent mainland of Sonora, Mexico. Their houses are flimsy bowers of cactus and shrubbery, sometimes rudely shingled with turtle shells and sponges. They make graceful balsas of canes lashed together for use in navigating the strait between their island and the mainland. They also manufacture a very light pottery and some basketry. The modern Seris are loosely organized into a number of maternal groups or clans in which polygamy prevails. They manifest implacable hatred toward aliens whether Caucasian or Indian and regard the shedding of alien blood as a great virtue. The population of the tribe was several thousands but by constant warfare this number was greatly reduced.

The name Tonto (Spanish, "foolish") has been inappropriately applied by the Spanish colonists of Arizona in the 19th century to a number of Indian tribes, namely: (1) To the Tulkepaia, a tribe of the Yuman stock settled in 1875 on San Carlos Reservation, Arizona. (2) To the Eoyotero Apaches, an Athapascan tribe. (3) To the Pinal Apaches of the same stock. (4) To a mixture of Yavapai (Yuman) men and Pinal women who have intermarried. The name has been especially applied to the last-mentioned body, who formerly occupied Tonto Basin and the Pinal Mountains of central Arizona, whence some 500 of them were removed to the Rio Verde Reservation and later to the San Carlos Reservation. They number about 700, and speak a mixed Yuman-Athapascan language.

The Mojave Indians reside in Arizona and California in the region of the Colorado River. There were in 1896 upward of 2,000 Mojaves remaining, 600 of whom live on the Colorado River Reservation in Arizona. They are an agricultural people, rank high physically and are expert makers of pottery and baskets. They practised tattooing and cremated their dead. The Yuma reside in the valley of the lower Colorado River in Arizona and California. Pop. about 655. The Cochimi were formerly the most populous of the tribes of Lower California but only a few are now extant. They live mainly about Loreto Mission. The Cocopa formerly occupied the valley of the Colorado River up to the Gila junction, but the remaining members now live mostly in Mexican territory. The Havesupai occupy the gorge of Cataract Creek, a branch of the Colorado River, in northwestern Arizona. The Mojave Yavapai left the main tribe in the Colorado valley and migrating to the Rio Santa María district in 1873 were removed to the Camp Verde agency; but since 1875 they have been under the San Carlos agency. The Walapai originally occupied the territory above the Mojaves on the Colorado River. The total number, 20,000, who originally inhabited the United States, has been greatly depleted and at present there are not more than 6,000 living within the limits of the United States on reservations.

YUNG LO, yo͝ong′ lŭ′ (dynastic name CH'ENG TSU), Chinese emperor, third of the Ming dynasty: b. 1359; d. 1424. He was the eldest son of Emperor Hung Wu, but was absent at the time of the emperor's death in 1398 and was superseded on the throne by a nephew Kien Wên. He conquered Cochinchina and Tongking, and made successful war against Tartary. He was a famous patron of literature, particularly as sponsor of the *Lo lo Ta Tien—The Standard of Yung Lo,* a collection of all the literary work known to the Chinese down to that period. It was completed under the supervision of three scholars who were assisted by 2,166 literary workers, and when finished there were 22,877 books with a table of contents filling 60 books. The work was never printed, but three complete copies were made. Of these all have perished except about 11,000 books of one set.

YUNG WING, yŭng′ wĭng′, Chinese diplomatist and scholar: b. Nanping, Province of Kwangtung, Nov. 17, 1828; d. April 21, 1912. After graduation from Yale in 1854, he was in the silk and tea trade until 1864, and then entered the governmental service of China. The China Steam Navigation Company was established on his initiative, as was also the Chinese Educational Mission, for the education of Chi-

nese in America. Yung Wing was made chief commissioner of this enterprise, for which an appropriation of $1,500,000 was made by the Chinese government. He was granted the rank of mandarin of the second grade, and appointed intendant of Kiangsu Province; and was for four years associate resident minister to the United States, where he took up his residence in 1902. He is the author of *My Life in China and America* (1909).

YUNGKI, yŏŏng'jē', city and treaty port, Manchuria, the Japanese official name of which was Kirin (q.v.).

YUNGKIA, yŏŏng'jĭ'ä (formerly WENCHOW), city and treaty port, China, in the southwestern part of Chekiang Province, at the mouth of the Wu River, 160 miles south of Hangchow and 150 miles north by northeast of Minhow. It was founded in the 4th century and has many old buildings.

It is a shipping point for timber and bamboo. Manufactures include leather goods, straw mats, paper umbrellas.

The city was opened to foreign trade in 1876 by the Chefoo Convention. During World War II it was occupied by the Japanese but was retaken by the Chinese in 1945. In 1949 it came under Communist control. Pop. (1949) 732,447.

YUNNAN, yün-nän', province, China, bounded on the north by Sikiang and Szechwan, on the east by Kweichow and Kwangsi, on the south by Indochina and Burma, and on the west by Burma. Its area is 123,539 square miles. It is very mountainous in the north and west, and has a general slope toward the southeast. The central part is a plateau about 6,500 feet above sea level, dotted with lakes and diversified by hills of red sandstone. In the south the elevation of the land is much less.

The province is traversed by several large rivers—the Yangtze, Mekong, Salween, Si, and the Songkoi (Coi or Red River). The north course of the first three flow through great gorges.

The chief occupation is agriculture. The principal crops are rice, maize, wheat, tea, sugar, and cotton. The chief wealth of the province, however, lies in its immense mineral resources which include iron, coal, copper, gold, silver, lead, tin, zinc, cinnabar, and precious stones.

A large part of the population consists of Miaos, Lolos, Shans, and other non-Chinese elements. Mohammedanism has many adherents.

The capital is Kunming, in the eastern part of the province, a trade center for the province. Other towns of importance are Tali, Mengtsz, Szemao, Likiang.

History.—The history of Yunnan can be traced back to the 3d century B.C. Owing to its distance from the seat of the central authority and its mountainous character this province long remained practically independent. It was conquered by Kublai Khan but was not incorporated in the empire until the 17th century. It was the scene of the great Panthay (Mohammedan) revolt of 1855, which was not suppressed by the Chinese authorities until 1873; and from the effects of which the province was long in recovering. Trade routes through the province were long sought by the British but the physical features delayed this objective until the Burma Road was opened in 1939. Part of the Burma Road and the southern section of the province were seized by the Japanese in 1942. The province passed to the Communists in 1950. Pop. (1940 est.) 10,000,000.

YUPANQUI PACHECUTEC, yōō-päng'-kē pä-chä-kōō-tĕk', ninth Inca sovereign: b. about 1380; d. about 1440. He was one of the greatest of the Inca rulers. He was the second son of the Inca Viracocha and after deposing or superseding his imbecile elder brother, Urco, he defeated the Chancas in a great battle, annexed their territory to his own and continued his successful career till the Inca kingdom included nearly all of what is now the republic of Peru. In order to relieve the congested condition of Peru he developed a system of colonies called mitimaes. Yupanqui figures largely in Quechuca tradition and various national institutions have been traced to him. He was grandfather to Stahualpa, ruler of Peru at the time of its conquest by Pizarro.

YUROK. See WEITSPEKAN INDIANS.

YURUARI, river, Venezuela, Bolívar State, rising in the north outliers of the Guiana Highlands. It flows 145 miles east and south to a minor affluent of the Cuyuni River, three miles west of El Dorado. There are important gold placers along its course.

YURUCARE, yōō-rōō-kä-rē', or **YURUCARI**, Indians of Bolivia occupying the forest plains on the eastern slope of the Andes between the rivers Mamoré and Beni. They include several tribes, are tall and shapely, and are almost white. They plant maize and manioc but are hunters and warriors for the most part. They are said to give complete liberty to their children, never punishing them but sometimes killing them in order to be rid of them. They dress in a bark cloth which they print with figures by means of engraved blocks; engage in duelling with bows and arrows; and make an intoxicating liquor from maize which is imbibed freely in their festivities. Their mythology is intricate and confused.

YUSUF, yōō'sŏŏf, or **YUSSUF, Abu Amru,** Arabic historian: b. Cordova, about 976; d. Xativa, 1070. He was profoundly versed in the traditions of the Oriental Mussulman countries and wrote *Behedjet-Almodjalisyn,* a collection of tales relating to Mohammed; *Tamhyd,* a commentary on one of the chief Mussulman works of religious and civil law; *History of the Opinions and Doctrines of the Principal Mussulman Sects; History of the Wars Against the Christians.*

YUSUF, or **YUSUF IBN-TASHFIN,** Moorish prince: b. Velad, Sahara; d. 1106. He was the second prince of the Almoravide line and in 1086 aided the emir of Seville, Al-Mo'tamid, to gain the victory over Alfonso VI at Zalaca near Badajoz. In 1090 he again invaded Spain, at the call of the emir of Seville, and taking advantage of Mohammedan dissensions, gradually acquired the sovereignty of the kingdoms of Malaga, Grenada, Murcia, Cordova, Seville, Almeria, Badajoz and Valencia, which he united to the kingdom of Morocco. Notwithstanding his power, Yusuf never assumed a higher title than that of emir, and in 1103 his son Ali was acknowledged heir of both

his Spanish and Moorish possessions. Consult Freeman, 'History and Conquests of the Saracens' (1856); Yonge, 'Story of the Christians and Moors in Spain' (1878); Coppée, 'History of the Conquest of Spain by the Arab-Moors' (1881).

YÜTERBOG, yu-tĕr bōg, a town and district capital in Brandenburg, Prussia, about 26 miles south of Potsdam. Commercially and industrially it is of some local importance, possessing woolen mills, cigar factories and an export business in wines, wool, flax and constituting itself an excellent market centre for a considerable extent of country. It possesses a number of interesting old buildings, dating back to the 15th century. Pop. about 8,000.

YVERDON, ē-vĕr'dôṅ (German, *Ifferten*), Switzerland, a town in the canton of Vaud, at the southwestern extremity of Lake Neuchâtel and an outlet of the Orbe, 17 miles north of Lausanne. Its castle, built in 1135, was used by Pestalozzi (q.v.) as an educational establishment in 1805–25, and now contains a library and museum, devoted to Roman and Celtic antiquities. The town has also an excellent townhouse, a hospital and a memorial of Pestalozzi. Among the manufactures are railway wagons and materials, beer, etc. The town has also an extensive system of wharves. Yverdon was the *Eburodunum* of the Romans, and there are remains of the ancient walls. Its residents are mostly French-speaking Protestants. Pop. about 8,600.

YVES D'EVREUX, ēv dāv-re, **Pierre,** Franco-Brazilian historian: b. Evreux, Normandy, France, about 1577; d. after 1620. He became a member of the Capuchin order in 1595 and was sent in 1612 with four missionaries as their superior, to Maranhao, Brazil, where a French colony had been established. He returned in 1614 and wrote 'History of the Most Memorable Things that Happened at Maranhao in the Years 1613 and 1614' (Paris, 1615; 2d ed. 1864), a continuation of the history of Claude d'Abbeville, a work of great historical value.

YVETOT, ēv-tō, France, a town in the department of Seine-Inférieure, on an elevated plain, 23 miles northwest of Rouen. It has manufactures of calico, hosiery, linen, leather and baskets. Antiquaries have been much puzzled by an ancient chronicle, and still earlier edict, which gave the title of king to the lords of Yvetot. This edict was formally abrogated in 1681. 'Le Roi d'Yvetot,' the well-known song by Béranger, translated by Thackeray, was a satire on Napoleon, which has immortalized the ancient dignity. It was the scene of the defeat of the troops of the League by Henry IV in 1592. Pop. about 7,133.

YVON, ē-vōṅ, **Adolphe,** French historical painter: b. Eschwiller, Moselle, 1, Feb. 1817; d. Paris, 11 Sept. 1893. He studied under Paul Delaroche, traveled in Russia in 1843, and brought back with him a series of designs exhibited in Paris in 1847–48. He obtained the medal of honor at the Salon of 1857; 10 years later he became an officer of the Legion of Honor. In 1855 he was commissioned by the French government to accompany the army to the Crimea. Among his most important works are 'The Remorse of Judas' (1846); 'The Battle of Kolikova' (1850); 'The First Consul Descending the Alps' (1853); 'Marshal Ney Supporting the Rear Guard in Russia' (1855); 'The Seven Deadly Sins,' designed after Dante (1855); The Capture of the Malakoff' (1859); 'Battle of Solferino' (1861); and an allegorical picture of 'The United States of America' (1870), executed for A. T. Stewart. He was an artist of remarkable power and holds a prominent place among the historical and religious painters of France.

Z the twenty-sixth of the letters of the English alphabet, is a vocal or sonant consonant, as distinguished from *s*, which is the corresponding fricative sibilant. It was adopted into the Latin from the Greek alphabet in the time of Cicero: in the Latin alphabet, as in our own, it holds the last place; but in the Greek its place is sixth, and in the Phœnician, Hebrew and other Semitic alphabets seventh. Its earliest Phœnician and Greek form was I. The name of the Greek letter is Zeta, that of the Phœnician Zayin. The Greek name is either derived from that of the Phœnician letter Zade, or has been assimilated to Eta and Theta. In German and Italian it represents the sound of *ts;* in our language and in French it represents one simple sound. In Latin it was used only in words derived from the Greek. The exact value of zeta in Greek is not known with certainty; but beyond any question it stood for a double sound, not a simple sound like our *z;* this is conclusively inferred from Aristotle's remark that *xi* (ξ), *psi* (ψ), and *zeta* (ζ) are like in sound; and the inference is strengthened by the fact that in Greek prosody a vowel short by nature is made long by position when it occurs next before the zeta. The sound of the zeta, however, is in doubt — whether it was *dz* or *zd* or both. The name of Z in Great Britain is *zed,* in the United States *zee. Z* is often related to palatal sounds as *zealous, jealous,* etc. Though *z* is the alphabetic representative of the sonant sibilant, the special *z*-sound is in English and many other languages oftener represented by *s* than by *z*. In *azure* and some other words *z* is the sonant corresponding to *sh*. See ALPHABET.

Z-BARS. See RAILS AND STRUCTURAL SHAPES.

ZABERN, or **SAVERNE** (anc. *Tres Tabernæ*), Alsace, a town in lower Alsace, on the Rhine-Marne Canal, at the foot of a pass over the Vosges Mountains, 24 miles northwest of Strassburg, and on the railway to Avricourt. There is an episcopal palace, rebuilt in 1779, and under German rule used as a barracks; a church dating from the 15th century, and many ruined castles. The town was of importance in the time of the Romans, was destroyed by the Alemanni in 357, and was rebuilt by the Emperor Julian. It suffered greatly in the Thirty Years' War. It came prominently into public notice in 1913 through the "Zabern Incident." The 99th Infantry was garrisoned there and it was said that the soldiers were encouraged by their officers in maltreating the Alsatians. Affairs came to a climax when a young nobleman of the German army. Lieutenant von Forstner, offered 10 marks to any soldier who would bayonet an Alsatian, then further compromised himself by striking with his sword a lame shoemaker. The incident aroused a furore of indignation, not only in the French press, but in Germany. In the Reichstag it reached such importance that a vote of no confidence was passed against the government, 293 to 54. This, however, had no result except as an expression of disapproval, the chancellor announcing that he held his office through imperial appointment and subject to no other control. Von Forstner was upheld by his superior officers, and although subjected to the form of a court-martial was acquitted. The emperor's decision regarding the matter was that the honor of the army must be upheld with neither compromise nor apology. Pop. 8,643.

ZABIANS, a term not identical with Sabæans, but properly meaning certain non-Christian Gnostics, predecessors of the peculiar sect called Mandæans, still surviving in South Babylonia. The Cyrian Zabians were the survivors of the ancient Syrian heathen who, being under Mohammedan rule, took the name of Zabians in order to share the toleration which the followers of Mohammed extended to the real Zabians. This sect became extinct about the 12th century. See MANDÆANS.

ZACATECAS, tzä-kä-tā'käs, a Mexican city and a state of the same name bounded by Coahuila, San Luis Potosi, Aguascalientes and Durango. The city of Zacatecas is 439 miles from Mexico City and 785 miles from El Paso, Tex., and is situated at an elevation of 8,044 feet above sea-level. It lies in a narrow and deep ravine, and is surrounded and closely abutted on three sides by mountains or high hills. It possesses a chain of mines many of which are among the oldest in the Republic and have produced enormous quantities of precious metals. Not all these are now worked, a number having seemingly become exhausted in so far as satisfactory returns are concerned. A public library containing some 20,000 volumes is maintained by the local government. The most notable buildings are the historic old Cathedral, with its front wall a mass of artistic carving, and the Theatre, a very imposing structure of modern design. In the heart of the city is the Market House, an iron building admirably adapted to its uses and of pleasing appearance. A few minutes' ride southward toward a broad valley is the little village of Guadalupe, where there was a Chapel of Gold, built by a devout woman and ornamented throughout in solid gold gilt at great cost, estimated at not less than $1,000,000. Here, also, is located the State Industrial School for poor boys, in which shoe-making, tailoring, cabinet-making, and other trades are taught, together with the rudiments of a common school

education. Other outstanding institutions are the School of Arts, the Benito Juárez School, and the Civil Hospital. There are two theaters, the González and the Calderón. Pop. city (1940) 21,846; state (1950) 664,394.

ZACCHEUS, zăk-kē'ŭs, in the New Testament, a tax gatherer at Jericho when Jesus entered and passed through that town (Luke 19:1-10). A rich man and chief among the publicans, "he was little of stature." In order to see Jesus, surrounded by a great throng, he climbed a sycamore tree along the way. Jesus approaching bade him "come down; for to-day I must abide at thy house." This evoked murmurs that Jesus had accepted the hospitality of a "sinner," publicans being so regarded in the strict caste system of the Jews. Tradition states that Zaccheus gave up his riches, became a companion of Peter, and eventually was appointed bishop of Caesarea in Palestine.

ZACHARIA, tsä'kä-rē'ä, **Just Friedrich Wilhelm**, German poet: b. (Bad) Frankenhausen, Thuringia, Germany, May 1, 1726; d. Brunswick, Germany, Jan. 30, 1777. After studying at the universities of Leipzig and Göttingen, he became professor of belles-lettres in the Carolinum, Brunswick. He achieved a reputation for his *Der Rennomist* (*The Brawler*, 1744), the first burlesque heroic poem that had appeared in German.

ZACHARIA VON LINGENTHAL, tsä-kä-rē'ä fŏn lĭng'ĕn-täl, **Karl Salomo**, German jurist: b. Meissen, Saxony, Germany, Sept. 14, 1769; d. Heidelberg, March 27, 1843. After studying jurisprudence at Leipzig and Wittenberg, he was appointed professor of law at the latter university, teaching there from 1797 to 1807, and holding the same position at Heidelberg from 1807 to 1843. He was active politically as a conservative member of the Baden Parliament in the years 1820 to 1829. His writings covered practically every branch of jurisprudence, dealing with Roman, Canon, German, English, and French law and opening up new fields in juristic literature. Among his works are *Einheit des Staates und der Kirche mit Rücksicht auf die Deutsche Reichsverfassung* (1797); *Vierzig Bücher vom Staate* (1839–1842); and *Handbuch des französischen Zivilrechts* (8th ed., 1894–1895).

His son, Karl Eduard Zachariä von Lingenthal (1812–1894), was also a prominent jurist, who traveled widely in Europe and the East, making exhaustive researches in Roman and Byzantine law.

ZACHARIAS, zăk-à-rī'ăs, spelling in the Douay Bible for Zechariah (q.v.), minor Hebrew prophet.

ZACHARIAS or **ZACHARY**, zăk'à-rĭ, **Saint**, pope: b. of Greek extraction in Calabria, Italy; d. Rome, Italy, March 14, 752. Succeeding St. Gregory III in the papal chair in 741, he was followed at his death by Stephen II. He exercised a powerful influence over several of the Lombard kings, obtaining the restoration to the papacy of various cities and territories which had formerly been subject to it, and he gave his consent to the setting aside of the Merovingian Childeric III in favor of the elevation of Pepin the Short to the French throne at Soissons (752). His day is commemorated on March 15.

ZACHARIAS, father of St. John the Baptist and husband of St. Elizabeth. A priest of the temple of Jerusalem, he was stricken dumb on refusing to believe the announcement, made by the angel Gabriel, that a son should be born unto him; but he recovered his speech at the birth of St. John. Zacharias is supposed to have been put to death by Herod (Luke 1:5-79).

ZACHER, tsä'kĕr, **Ernst Julius August**, German philologist: b. Obernigk, Silesia (now Oborniki Slaskie, Poland), Feb. 15, 1816; d. Halle, Germany, March 23, 1887. Educated at the universities of Berlin and Breslau (now Wrocław), he was professor of German philology in Halle, 1856–1859 and 1863–1887. His scholarly works include *Die Deutschen Sprichwörter-Sammlungen* (1852); *Das Gotische Alphabet Vulfilas und das Runenalphabet* (1855); and *Pseudocallisthenes* (1867).

ZACYNTHUS. See Zante.

ZADAR, zä'där, seaport, Yugoslavia. See Zara.

ZADKIEL, zăd'kĭ-ĕl. (1) According to Jewish legend the angel of the planet Jupiter. (2) A pseudonym adopted by William Lilly (q.v.), the 17th century astrologer. (3) The name assumed by Richard James Morrison (b. June 15, 1795; d. Feb. 5, 1874), compiler of an astrological almanac, begun by him in 1830, and which reached an annual sale of from 100,000 to 200,000 copies.

ZADOK, zā'dŏk. (1) A high priest of Israel, contemporary with David, to whom he remained loyal when Absalom rebelled against his father. See also Sadducees. (2) A personage in John Dryden's *Absalom and Achitophel*, intended as a portrayal of Archbishop William Sancroft.

ZADOKITE FRAGMENTS, zā'dŏk-īt. The Zadokites are mentioned in the book of Ezekiel as the true upholders of the worship of Jehovah when Israel as a nation had deserted it. By some it is thought that their descendants settled in Damascus some time in the 1st century A.D. Some fragments discovered in the Cairo Genizah or Jewish Congregation, now in possession of Cambridge University Library, have been attributed to them with a date between 70 and 80 A.D. Considerable controversy arose concerning them among scholars in regard to their interpretation and implication. Rabbi Solomon Schechter published them under the title *Documents of Jewish Sectaries*, 2 vols. (Cambridge 1910). The best account of the history of the manuscripts and sect is in an article in *The Biblical World*, December 1911, by James A. Montgomery entitled "A Lost Jewish Sect."

ZAFARIN ISLANDS, an alternate name for the island group, Chafarinas (q.v.).

ZAFFER or **ZAFFRE**, zăf'ĕr, in chemistry, an impure oxide of cobalt containing some arsenic and made by roasting speiss cobalt. The residuum consists of a grayish oxide of cobalt, usually mingled with sand and other impurities. It is used in the manufacture of smalt and in other ways, but its importance in furnishing "cobalt blue" has been lessened by the discovery of methods of making artificial blue.

ZAGAZIG, zăg'ə-zĭg, (Arab. ZAQAZÎQ), city, Egypt, the capital of the Province of Sharqîya, in the delta of the Nile, and on the Ismailia Canal, is in southeastern Lower Egypt. It is connected by rail with Cairo, Alexandria, and Suez, and lies 40 miles north-northeast of Cairo. Zagazig is a rail and canal center with an important cotton and grain market, nearly all of the cotton ginning being done here. Two miles southeast of here are the ruins of the ancient city of Bubastis, now called Tell Basta. Pop. (1947) 82,912.

ZAGHLUL PASHA, zăg-lo͞ol' pä'shä, **Saad,** Egyptian statesman: b. Gharbiya Province, Egypt, ?1860; d. Cairo, Egypt, Aug. 23, 1927. He was educated at the University of al Azhar. In 1882 he was arrested for taking part in the rebellion of Arabi Pasha (Ahmed Arabi), but was shortly released and in 1884 commenced to practice law. He became a judge in the native court of appeal, 1893, and was appointed minister of public instruction, 1906, and of justice, 1910. Compelled to resign from the last post on failing to prove charges of corruption which he had brought against the khedive, Abbas Hilmi Pasha, he began to show anti-British tendencies. He became the leader of the Nationalist Party, and after World War I led the movement for Egyptian independence. Rioting resulted in his deportation to Malta in 1919, and recurred after his release and return to Cairo in 1921. Arrested once more, he was sent to Aden and thence to the Seychelles, from which islands he was transferred to Gibraltar. He was permitted to return to Egypt in 1923, and following victory for the Nationalists at the general election in January 1924 he became prime minister. The assassination in Cairo, the following November, of Sir Lee Stack, governor general of the Anglo-Egyptian Sudan, forced his resignation from office; thereafter he served as president of the Chamber of Deputies.

ZAGOSKIN, zŭ-gô'skyĭn, **Mikhail Nikolayevich,** Russian novelist and dramatist: b. in Penza Region, Russia, 1789; d. 1852. He became director of the Imperial Theatre in St. Petersburg in 1817, and three years later was made director of a Moscow theater; in 1831 he was appointed director of the Court Theatre in Moscow. Many of his own plays were lacking in originality, though his comedy, *The Scapegrace,* won considerable praise. He wrote several volumes of essays, notably *The Muscovites,* and historical fiction.

ZAGREB, zä'grĕb, city, Yugoslavia, capital of the Peoples Republic of Croatia, near the river Sava, 230 miles west-northwest of Belgrade; the German name for the city is Agram. Notable buildings in the older part of Zagreb include a 17th century Gothic cathedral and an 18th century archiepiscopal palace. It is an important cultural center, and contains a university founded in 1669. Industries include the manufacture of carpets, tobacco, leather, linen, chemicals, and machinery. Of Roman origin, Zagreb was made the see of a bishop in 1093. It was ravaged by the Mongols in 1242, but after their expulsion it was rebuilt and created a royal free city; it was made the capital of Croatia in 1867. Earthquakes in 1880 and 1901 did considerable damage. It is the second largest city of Yugoslavia and has an airport. Pop. (1953) 354,000.

ZAHAROFF, zŭ-kä'rôf, SIR **Basil,** international armament contractor: b. Muğla, Turkey, Oct. 6, 1849; d. Monte Carlo, Monaco, Nov. 27, 1936. The son, supposedly, of a Russian father and Greek mother, he was surrounded by considerable mystery during his early years. He was educated in London and Paris and about 1875 he became associated with the Anglo-Swedish munitions firm of Nordenfeldt. In the late 1880's, he was appointed agent in Spain of Vickers-Armstrong, a British firm manufacturing munitions, and eventually rose to become chairman of the company. It was rumored that he was also associated with the Krupps in Germany, with Schneider-Creusot in France, and with Skoda in Austria-Hungary, and he had large interests in petroleum, shipping, banking, and other concerns. Critics attributed his great wealth to the conduct of international intrigue and the warfare which followed; an inquiry by the United States Senate in 1934 linked Zaharoff with the activities of an American firm of armament manufacturers. In 1919 he was decorated in Great Britain with the Grand Cross of the Order of the Bath, and from France he received the Grand Cross of the Legion of Honor. He endowed at Oxford University the Foch chair of French literature and at Paris the Haig chair of English literature; and he founded professorships of aviation at the universities of Paris, Leningrad, and London.

ZAHM, zäm', **John Augustine,** American Roman Catholic priest, scientist, and author: b. New Lexington, Ohio, June 14, 1851; d. Munich, Germany, Nov. 11, 1921. After graduating from the University of Notre Dame, Ind., he joined in 1871 the Congregation of the Holy Cross. Continuing to study and teach, he was appointed to the chair of physics at Notre Dame. He entered the priesthood in 1875. Besides writing copiously on scientific subjects and the relation of science, particularly the theory of evolution, to faith and dogma, he took a keen interest in South America, thus gaining the friendship of Theodore Roosevelt, whom he accompanied on an expedition. Other voyages took him to Alaska, Hawaii, and Europe. Zahm served for years as the curator of the Notre Dame Museum and lectured widely. Several of his travel books, such as *Along the Andes and Down the Amazon* (1911), as well as the volume, *Women in Science* (1913), were published under the pseudonym J. H. Mozans.

ZAHN, tsän', **Ernst,** German-Swiss novelist: b. Zurich, Switzerland, Jan. 24, 1867. He inherited from his father the railroad restaurant at Göschenen, at the entrance to the St. Gotthard Tunnel, and managed it for many years. The town of Göschenen made him a town councilor, and one of his first acts in office was to cause the erection of a monument for the constructor of the St. Gotthard Tunnel and for the many laborers who met their death during its construction. In 1902 he became judge of the Uri Criminal Court, in 1904 a member of the cantonal Council of Uri, and in 1908 its president. He received the honorary degree of Ph.D. from the University of Geneva in 1909. He has written an unusual quantity of stories of Swiss local life, which are very attractive in form and correct in technique. Some of his short stories seem like faultless works of art, especially *Stephan der Schmied* and *Verena Stadler.* In his larger works, however, he has not devoted his atten-

tion chiefly to the difficult task of analyzing serious conflicts of character but rather to superficial problems. Consult 'Gesammelte Werke' (10 vols., Stuttgart 1910); 'Herzenskämpfe' (1893); 'Die Clari-Marie' (1904); 'Die Helden des Alltags' (1905; 20th ed., 1912); 'Firnwind' (1906); 'Der Apotheker von Klein Weltwil' (Stuttgart 1913). A translation of 'Stephan der Schmied' is given in 'German Classics' (Vol. XIX, New York 1914); 'Der Sinkende Tag' (1920); 'Die da Kommen und Gehen' (1922); 'Die Frauen von Tanno' (1922); 'Das Licht' (1922); 'Was das Leben Zerbricht' (1922); 'Die Hochzeit des Gaudenz Orell' (1927). JACOB WITTMER HARTMANN.

ZAHN, Johann Karl Wilhelm, German architect, painter and art critic: b. Rodenberg, Schaumburg, 21 Aug. 1800; d. Berlin, 22 Aug. 1871. He became professor in the Academy of Arts, Berlin, 1829. He superintended excavations at Herculaneum and Pompeii; cast the finest bronzes and silver vases for the Museum Borbonico; and was architect of many fine houses and villas in Pompeiian style in England and America. Author of 'The Most Beautiful Ornaments and the Most Notable Pictures from Pompeii, Herculaneum and Stabiæ' (1828–30); 'Ornaments of All Classical Periods of Art' (1832–39).

ZAHN, Theodor, German theologian: b. Mörs, Prussia, 10 Oct. 1838. After studying at Basel, Erlangen and Berlin he became professor of theology in the University of Göttingen in 1871. He filled a similar chair at Kiel in 1877, at Erlangen in 1878, at Leipzig in 1888 and in 1892 returned to Erlangen. He became a foremost authority on the New Testament. Among his works may be named 'Marcellus of Ancyra' (1867); 'The Shepherd of Hermas' (1868); 'Ignatius of Antioch' (1873); 'The Acts of Saint John' (1880); 'Cyprian of Antioch and the German Story of Faust' (1882); 'Researches Into the History of the New Testament Canon' (1881–93); 'The Gospel of Peter' (1893); 'Introduction to the New Testament' (1897); 'Das Evangelium des Lucas' (1913), etc. He died 15 March 1933.

ZÄHRINGEN, tsā'rĭng-ĕn, the house from which the former grand-ducal family of Baden (q.v.), Germany, took its origin. The name is derived from the castle of Zähringen, now in ruins, in the village of that name, about two miles north of Freiburg in Baden. The founders of the family were from the 8th to the 10th century Counts of Breisgau, but the history of the house really began with Duke Bertold I, "the Bearded," d. 1078, who began to rule in the first third of the 11th century. Bertold II took the title of Duke of Zähringen in 1090. The main line of the family became extinct in 1218 and their territories, which included lands in Burgundy and Switzerland as well as Baden, were divided. A portion passed through a younger branch of the house to the Counts of Kyburg and thence to the Hapsburgs, to whom they are related. The remaining lands descended to the former reigning family of Baden.

ZAIMIS, Alexander, Greek statesman: b. Athens, 1855. He was educated at the universities of Athens, Leipzig, Berlin, Heidelberg and Paris. He was elected to the Chamber of Deputies in 1885; served as Minister of Justice in 1890–92, and was president of the Chamber of Deputies in 1895–97. He was Premier in 1897–99, under King George, and again in 1901–02. He was High Commissioner of the Powers in Crete in 1906–11 and was successful in securing the annexation of that island to Greece. He was appointed Premier to succeed Venizelos in October 1915, but resigned a month later when his government failed to receive a vote of confidence. He was again appointed Premier in June 1916, but was succeeded by Lambros before the end of the year, only to succeed Lambros in May 1917. Upon the abdication of King Constantine, however, he was asked to resign, and was succeeded by Venizelos 25 June 1917. He was generally supposed to favor neutrality for Greece in the World War. He was president of Greece in 1929–35. D. Vienna, 15 Sept. 1936.

ZAIRE, zä-ē'rā, Africa (a Portuguese variant of the Bantu word, *nzari*), the name by which the Kongo River was known before the possession of the banks of its lower course by the Kongo tribe, and still much used until the last quarter of the 19th century.

ZAKAZIK, zä-kä-zēk', Egypt. See ZAGAZIG.

ZALESKI, zä-lĕs'kĭ, **Bohdan,** Polish poet: b. Bohaterka, in the Ukraine, 14 Feb. 1802; d. Villepreux, near Paris, 31 March 1886. He studied at Warsaw and being obliged to leave his country after the revolution of 1830, he went to France. Many of his poems depict in the most vivid manner the scenery of Poland, as well as its history and legends, in which he was well-versed. His chief works are 'The Spirit of the Steppes' (1842); 'The Most Holy Family' (1851), and collections of shorter poems.

ZALEUCUS, zä-lū'kŭs, the legendary lawgiver to the Epizephyrian Locrians, the Greeks who colonized Magna Græcia, the southwest extremity of Italy. He is supposed to have flourished in the middle of the 7th century B.C. and his code is said to have comprised the first written laws of the Greeks. According to tradition his laws were exceedingly severe.

ZALINSKI, zä-lĭn'skĭ, **Edmund,** American soldier and inventor: b. Kurnich, Prussian Poland, 13 Dec. 1849; d. 10 March 1909. Coming to the United States in 1853 with his parents, who settled at Seneca Falls, N. Y., he was educated at the Syracuse High School, and entered the army in 1864 as volunteer aid on the staff of Gen. N. A. Miles. He was appointed second lieutenant Fifth United States Artillery in 1866, and captain in 1887. He was professor of military science at the Massachusetts Institute of Technology 1872–76, and was appointed second lieutenant Fifth United States Artillery School at Fort Monroe and the School of Submarine Mining at Willett's Point, N. Y. From 1883 to 1889 he devoted himself to the development and perfecting of a pneumatic dynamite torpedo gun. Among his inventions are an intrenching tool, a ramrod bayonet, a telescopic sight for artillery and a system of range and position finding for sea-coast and artillery firing. He retired from active service in 1894 and was promoted major in 1904. See ORDNANCE.

ZALINSKI GUN. See ORDNANCE.

ZALOKOSTAS, Georgios, Greek poet: b. Syrrhako, Epirus, 17 April 1805; d. Athens, 3 Sept. 1858. An ardent patriot, at 16 he fought in the insurrection at Missolonghi. Greek children are taught his songs, and among his best-known poems are 'Missolonghi'; 'Armatoles and Klepts'; 'The Entrance of Prevesa'; 'Hours of Leisure'; 'Marco Bozzaris,' etc. Several of his verses have been translated into Italian, Spanish, English, German, French and Russian. His 'Poetical Works' were published at Athens in 1860.

ZALUSKI, zä-loos'kē, **Josef Andrezei,** Polish prelate and scholar: b. Poland, 1702; d. 9 Jan. 1774. After serving for three years at Rome as ambassador to Pope Clement XII he was made bishop of Kiev, but was banished to Kaluga and imprisoned there in 1766–73 for his opposition to the Dissidents. He is chiefly remembered for the service he did in awakening Polish literature. He spent his fortune in collecting a great library, which he bequeathed to Poland, but which was taken by Russia after the partition, and formed the nucleus of the Imperial Public Library. He was a great scholar and while in prison wrote from memory a versified account of the Polish histories in his collection. He was not a great writer but his works have a high historical and bibliographical value. Author of 'Biblioteka historyków' (1832); 'Specimen historiæ Poloniæ criticæ (1733).

ZAMA, zā'mą, North Africa, the name of two ancient cities about 30 miles apart, 100 miles southwest of Carthage, now represented by Djiama and Sidi Amor-Djedidi. Both claim to be the scene of the victory of Scipio Africanus over Hannibal, which decided the fate of Carthage 202 B.C. It led to an ignominious peace which closed the Second Punic War 201 B.C. The Romans lost about 2,000 killed and wounded, while the Carthaginians lost in killed and prisoners over 40,000.

ZAMACOIS, thä-mä-kō'ēs, **Eduardo,** Spanish artist: b. Bilbao, Vizcaya, 1842; d. Madrid, 14 Jan. 1871. He was a pupil in Madrid of Balaca, Federico de Madrazo, and the Academy; in Paris, of Meissonier and the Beaux-Arts; and has been ranked as second to only Fortuny among Spanish genre-painters of the 19th century. His subjects were drawn largely from the 16th and 17th centuries, and were frequently treated in a satirical vein. His technical finish has been described as «almost as perfect as Meissonier's.» Among his paintings are 'The Hunchback'; 'Spanish Recruits'; 'The Bull Fighters'; 'Indirect Taxes'; 'A Court Jester of the 16th Century'; 'The King's Favorite' (1867); 'Cervantes as a Recruit'; 'The Rival Confessors' (1868); 'Return to the Convent' (1869); 'The Education of a Prince' (1870); 'The Puzzled Musician.' Many of his works are in private collections in the United States.

ZAMBALES, thäm-bä'lās, Philippines, a province of Luzon, in the southwestern part of northern Luzon; bounded on the west by the China Sea; on the north by the province of Pangasinán: on the east by the provinces of Pangasinán, Tárlac, and Pampanga; and on the south by Bataan and Subig Bay; length, 80 miles; width, 28 miles in the southern part, 25 miles in the nortern part, and 12 miles in the central part; area, about 1,650 square miles. The Zambales Mountain range near the eastern boundary parallels the coast, and has several points of high elevation, High Peak being 6,683 feet in height, Mount Pinalobo, 5,524 feet and Mount Guadradro 5.443 feet; there are also two groups of peaks but a few miles inland from the coast. There are numerous short rivers, and several thermal springs in the province. The chief industry of the province is agriculture; rice and wheat of superior quality are the special products; sugar, cotton, tobacco and coffee are also extensively cultivated. Next to agriculture in importance is the raising of cattle, horses, carabaos and hogs. The mechanical industries are very limited and primitive; copper and coal are mined; and there are indications of iron. The forest products are valuable, and amber is collected in considerable quantities on the coast. There are but few roads, and these are mostly impassable in the rainy season; a road and telegraph line parallel the coast for the greater part of the distance. Civil government was established in August 1901, and the provincial governor reported the province in a peaceful and prosperous condition in January 1902. The chief town and capital is Iba, a seaport (Pop. 4,482). Until 1904 the province extended north to Lingayen Gulf, but a re-division of territory then gave the territory north from Dasol Bay to the province of Pangasinán. Pop. 83,620.

ZAMBESI, zăm-bē'zē, or **ZAMBEZI,** South Africa, a river rising in Portuguese West Africa, in lat. 11° 21′ 3″ S., and long. 24° 22′ E., and reaching the Indian Ocean at Chinde and Conceiçao in Portuguese East Africa, opposite Madagascar, after a total course of 2,200 miles, of which the middle part belongs wholly to Rhodesia. The Victoria Falls and the Kebrabasa Rapids, the former in the west of Rhodesia and the latter in Portuguese East Africa, above Tete, are regarded as dividing the river into three sections, the Upper, Middle and Lower Zambesi. The neighborhood of the source has an altitude of about 5,000 feet, and the river has its origin in a deep depression at the base of steep undulations, where the water oozes from a black marshy bog and quickly collects into a well-defined stream. Another head-stream of the Zambesi is the Kabompo, which rises in the northwest of Rhodesia, about lat. 11° 34′ S., and long. 25° 17′ E., also at an altitude of 5,000 feet, and in a region of open grassy downs. The former stream, at first known as Yambeshe and then as Liambai (Liambeshe), flows at first west with a southward trend, and then turns south-southeast. Ten miles of rapids precede the Sapuma cataracts (13° 7′ S.), where the river flows «through a narrow rocky fissure into a pool of considerable extent.» At about 14° S. it is joined by the Kabompo from the northeast, and the remaining course of the Upper Zambesi has a south and southeasterly direction through the low-lying, grassy Marotse country, and is marked by various cataracts and rapids. Sesheki is a place of some importance on the left bank, near where the river begins to be wholly in British territory; and a short distance farther down, opposite Kazungula, it receives

from the west the waters of the large tributary Kuanda. In about 18° S. there are the celebrated Victoria Falls (q.v.), discovered by Livingstone in 1855. Here the broad river suddenly plunges into a transverse chasm 400 feet deep amidst a scene of tremendous grandeur. The gorge just below (eight miles long) and in full view of the falls is spanned since 1904 by a lofty bridge on the Cape to Cairo Railway. The Middle Zambesi, whose direction is east, northeast and again east, receives the Guay-Shangani and Sanyati from the south; the Kafukwe and Loangwa from the north, the latter at Zumbo, where the river leaves British territory; and is interrupted by various rapids and rocks, especially at low water, the Kebrabasa Rapids being the first impassable obstacle to navigation from the mouth. The remaining course of the river (Lower Zambesi) has been described as, except for the Lupata Gorge, «merely a broad expanse of sand, three to five miles wide, with low, reed-fringed banks, and intersected by numerous shallow streams.» It passes the town of Tete, below which it is joined on the right by the Mazoe, and after passing Sena it receives from the left the Shiré from Lake Nyassa, the waterway to British Central Africa. It enters the Indian Ocean by several mouths, of which the Chinde one is the most practicable. The delta covers an area of about 25,000 square miles, and begins about 90 miles from the coast, a little below the confluence of the main stream with the Shiré. The river drains an area estimated at 600,000 square miles. Its basin is separated from that of the Orange River on the southwest by a slight watershed, and from that of the Limpopo on the south by a mountain range. The valley of the Zambesi is capable of immense development in the way of trade. The Portuguese government has long exercised sway for 300 miles from the mouths of the river, and by the international arrangement of June 1891 the river from the coast to the confluence of the Loangwa is recognized as being in Portuguese territory. The Zambesi and its affluents are now free to the flags of all nations. The Upper Zambesi was first explored by Livingstone, who reached the Liambai in 1851. Consult Coillard, 'On the Threshold of Central Africa' (1897); Gibbons, 'Africa from South to North' (1904); Livingstone, 'Narrative of an Expedition to the Zambezi and its Tributaries' (1865).

ZAMBESIA, zăm-bē'zhĭ-ą, one of the three districts of Portuguese East Africa, divided into the sub-districts Quilimane and Tete; also a name popularly applied to the regions in Rhodesia divided by the Zambesi, known respectively as North and South Zambesia, and sometimes called British Zambesia. See East Africa, Portuguese; Rhodesia.

ZAMBOANGA, thăm-bō-ăn'gä, Philippines, (1) town, seaport and capital of the District of Zamboanga, Mindanao Is., 600 miles south of Manila. It was founded in 1635 as a base of operations against Moro pirates; shortly before the American occupancy of the islands it was almost entirely destroyed by fire, partly by the Spaniards and partly by the Filipinos; since then it has been rebuilt. Many of the houses are of stone, and the town contains a fort, the Castle of San Felipe, a cathedral, a public hospital, the provincial capitol, completed in 1908, and a customs house. Since the American occupation the streets have been improved, public parks established and docking facilities have been extended. It is connected with Manila by steamer, and is the chief market in the southern part of the archipelago for hemp, copra and gutta percha. Pop. 43,832. (2) A District of Moro province, forming the western peninsula of the island of Mindanao, bounded on the north by Dapitan and Misamis, on the south by the Celebes Sea and Basilan Strait, on the east by Lanao and on the west by the Sulu Sea; area, with dependent islands, 6,085 square miles. The district was increased in size by the act of the Philippine Commission 1 June 1903. The main mountain range extends west and then southwest from the northeastern boundary; another range traverses the Bañganinan or Flecha peninsula. The climate is the best in the Philippines, the temperature varying but a few degrees. Agriculture and stock raising are the more important industries; rice, hemp, cotton, coffee, sugar, cocoanuts are cultivated; and cloves and nutmegs and vegetables are also among the valuable products of this province. Cattle, horses and hogs are raised. There is an abundance of valuable woods, particularly teak and juniper; deposits of coal at the head of Sibuguey Bay and at other places, and gold also is found in the western portion. Pop. 147,991.

ZAMBONI'S DRY PILE, *in electricity,* a dry voltaic pile or battery invented by Zamboni. Paper silvered on one side is damped and coated on the other with manganese dioxide; half a dozen of these sheets being superimposed to save time, discs are punched out, and 1,000 to 2,000 single sheets are compressed in a glass tube with metal caps and knobs at the ends. Such a pile will charge a Leyden jar, though it will not give shocks or sparks.

ZAMIA, a genus of plants of the family *Cycadaceæ.* (See Cycadales). In aspect the species partly resemble palms, and partly tree ferns; in affinity they are nearer the latter than the former, but rise considerably above them in organization. They are natives of tropical America, tropical Asia, the Cape of Good Hope and Australia. The stems of *Z. tenuis* and *Z. furfuracea,* and the seeds of *Z. pumila,* in the West Indies, yield arrowroot. The Florida Indians call the last «coontie,» and manufacture flour from the rhizomes. It grows in the everglades of Florida, and has large tubers of the shape and size of parsnips, which are rough and gray on the outside, but are white internally. The tubers are pounded to a pulp, in a log mortar, and washed in a straining cloth, the abundant starch of the coontie passing through and settling in a deerhide. This process rids the plant of an acrid poisonous principle which is carried away by the water. The Federal armies lost a number of men during the Civil War, who ate the root in its crude poisonous state. The sediment, or starch left in the deerskin after straining, is fermented and dried, and becomes a yellowish-white flour ready for use, which has long been a staple food of the Seminoles. The coontie starch, when extracted in proper mills, is finer and whiter than the

Indian product, and is called Florida arrow-root. It is nutritious, and makes excellent puddings, and the like.

ZAMOJSKI, zä-moi'skē, **ZAMOYSKI**, or **ZAMOSC**, an ancient family of Poland, whose most distinguished members have been JAN ZAMOJSKI, statesman and general: b. Skokow, palatinate of Chelm, 1 April 1541; d. near Skokow, 3 July 1605. He was educated at Paris, Strassburg and Padua, and in 1564 was elected rector of the university at Padua. In 1565 he returned to Poland, and upon the death of King Sigismund Augustus in 1572, succeeded in so organizing the equestrian order, that in the diet of 1573, held at Warsaw, Henry of Anjou (afterward Henry III of France) was chosen king of Poland. Upon the abandonment of Poland by Henry, a party of nobles elected Maximilian II of Austria, and he was proclaimed king by the primate; but the party hostile to the house of Austria, led by Zamojski, chose Stephen Bathory (q.v.), who marched rapidly to Cracow, and was there crowned. Zamojski was made grand chancellor of the kingdom and became a power in Polish affairs. He was afterward married to Griselda, a niece of the king. In 1580, during the war with Russia, Báthori appointed him commander of the principal army, with the title of hetman; and in 1582 he negotiated the peace by which Livonia, Esthonia and Novgorod were ceded to Poland. After the death of Báthori in 1586, he might have secured the crown for himself; but he used his influence in favor of Sigismund III, son of the king of Sweden, defeated the army of the opposing claimant, the Archduke Maximilian, at Cracow, pursued him into Silesia, and took him and his forces prisoners. From 1590 to 1597 he was engaged in a constant series of wars; and while often at variance with Sigismund, with whom he was no favorite, he remained a dominant figure in the state. fighting successfully against the Turks, Tartars and Cossacks, and oftentimes supporting the army from his private fortune. Zamojski was not only a great statesman and general, but a munificent patron of literature and the sciences. He founded New Zamosc, which came to be regarded as one of the strongest fortresses of Poland, and established there a university and a famous printing press. He wrote 'Testamentum Joannis Zamori' (1606), and many letters of his are to be found in Lunig's 'Literæ Procerum Europæ.' JAN ZAMOJSKI, general, grandson of the preceding: b. 1626; d. Warsaw, 2 April 1665. He participated in the campaign of 1651 against the Cossacks, was made palatine of Sandomir, and was conspicuous in the wars that followed. In 1659 he was at the head of the army which acted in the Ukraine against the tsar of Russia. ANDRZEJ ZAMOJSKI, statesman: b. Biezun, 1716; d. Zamosc, 10 Feb. 1792. He entered the military service of Saxony, returned to Poland in 1754 and was made marshal of the palatinate of Smolensk. In 1760 he emancipated his serfs, and on the accession of Stanislas, Augustus was appointed grand chancellor in 1764, an office he resigned rather than sign the partition treaty. In 1776, at the request of the diet, he drew up a code of laws, which was printed under the title of 'Zbiór praw sadowych' (1778). The liberal character of the code, especially its provision for a general measure of emancipation, aroused against it so great a hostility, that in the diet of 1780 it was not permitted to be read, but it was adopted in 1791. ANDRZEJ ZAMOJSKI, statesman, grandson of the preceding: b. 2 April 1800; d. Cracow, 29 Oct. 1874. He studied at Geneva and Edinburgh, entered the Polish civil service in 1823 and was Minister of the Interior of the revolutionary government in 1831. He later introduced steam navigation on the Vistula, but as the head of an important agricultural association incurred the suspicion of the Russian government. The association was suppressed in 1862. At the request of the viceroy, Grand Duke Constantine, Zamojski drew up a statement of the claims of Poland, a document which displeased the Russian government and caused Zamojski's banishment.

ZAMORA, thä-mō'rä, **Antonio de**, Spanish dramatist: b. Madrid, about 1660; d. there, before 1744. He was a court officer during the reign of Philip V and also held a secretaryship in the department of Indian affairs. He wrote many dramas which were highly esteemed by his contemporaries, some 40 of which are extant. He imitated the style of Calderon, but rarely attained the poetic beauty of that author. To modern taste his plays are slow and over-loaded with stage directions which were probably necessary in their day, and they lack the brilliant invention of the dramas of Calderon and Lope de Vega. Yet they are the best of their age. The best of his dramas, however, show skilful development of character. Among the most noteworthy are 'Mazariegos y Monsalves'; 'Cada uno es Linaje Aparte'; 'El hechizado por fuerza,' a comedy produced in Spain in modern times; and 'El Convidado de Piedra,' on which is based the libretto of the opera of 'Don Juan.'

ZAMORA, Spain, a city and capital of a province of the same name, 140 miles northwest of Madrid, on a rocky hill on the right bank of the Douro which is here crossed by a fine bridge. It has interesting mediæval buildings, and is the see of a bishop; the cathedral is a Gothic structure, completed about 1174, but partially modernized in the Corinthian and Doric styles. Zamora as a fortified town played an important part in early Spanish history, and it is renowned for the successful defense which it made against the Moors in 939 A.D. Pop. 16,447. The province of Zamora is divided into eight departments and has a population of about 280,000.

ZAMORA, Venezuela, an interior northwestern state bounded by Lara, Miranda, Bolivar and Los Andes. It has not been very much developed and possesses many natural resources. The capital is Barinas. Pop. 57,341. Area of province, 25,212 square miles. Pop. 246,676.

ZAMORA Y CORONADO, ē kō-rō-nä'thō, **José Mariá**, Central American jurist: b. Cartago, Costa Rica, 1785; d. Cuba, after 1846. He was educated in Spain and on his return from there held important judicial and civil posts in both Porto Rico and Cuba. He published 'Registro de la legislación ultramarina' (6 vols., 1844–48), a work of much historical value on account of its being a collection of laws and regulations pertaining to the Spanish-American colonies. For this reason it has been

largely consulted by students of Latin American law and institutions.

ZAMORA Y TORRES, Niceto Alcala, president of the Spanish Republic: b. Priego, Spain, July 7, 1877; d. Buenos Aires, Argentina, Feb. 18, 1949. Following his father in the legal profession, he obtained his doctorate at 20. A deputy in Parliament, at the age of 40 he became minister of public works, and later was minister of war. In 1930 with other opponents of Primo de Rivera he began working for a republic, was imprisoned briefly before his trial in 1931 and, though sentenced to a six-month term, was paroled. Alfonso XIII yielding the throne quitted Spain, and Zamora was immediately installed as provisional president, soon after being elected first constitutional president of the second republic. In April 1936 he was removed from office on a Socialist motion, charged with having illegally dissolved Parliament the previous January. A Roman Catholic, his downfall was due to the enmity of the Leftists, especially the Communists, disgruntled at his moderate policy. He soon left Spain, eventually settling in Argentina. In 1941 the Franco government confiscated his property, fined him $2,000,000 and sentenced him to 15 years exile. He never returned to Spain.

ZAMOSC, zä'môshch (Zamostye, in Russian), city, Poland, in the province of Lublin, on the Wieprz, 45 miles southeast of Lublin. Founded in 1579 by Jan Zamoski on an Italian model, and reconstructed similarly in 1937, all its houses have arcades. Its fine castle, the four churches, the arsenal, and the town house are the chief buildings. Furniture manufacture is the principal industry. It has an airport. Pop. (1946) 20,899.

ZAMPA, zän-pä, **Ou la Fiancée de Marbre,** an opera comique by the French composer, Louis Joseph Ferdinand Hérold (q.v.), first produced in 1831.

ZANARDELLI, dzä-när-dĕl'ē, **Giuseppe,** Italian statesman: b. Brescia, Oct. 29, 1826; d. Modena, Dec. 20, 1903. After study at Pavia, he was a volunteer in the war of 1848, then was for a time a journalist and lecturer on law. Elected deputy in 1859, he held various administrative posts, in 1876 became minister of public works, and in 1878 of the interior. From 1881 to 1883 he was minister of justice, and from 1887 to 1891 again held that portfolio. During the latter period of service he issued the penal code and began a reform in the magistracy. He was president of the Chamber of Deputies in 1894, in 1896 was again chosen, in December 1897 accepted the portfolio of justice for a third time, but withdrew in 1898 to resume the presidency of the Chamber. This post, too, he relinquished, to identify himself with the opposition. On the fall of the Saracco cabinet in February 1901, he formed an administration with the aid of the extreme left. A brilliant orator, he was a steadfast Liberal and the recognized leader of the constitutional left.

ZANDEH. See Nyam-Nyam.

ZANE, zān, **Ebenezer,** American pioneer: b. Berkeley County, Va., Oct. 7, 1747; d. Martin's Ferry, Ohio, Nov. 19, 1812. Of Pennsylvania Quaker stock, he and his brothers Silas and Jonathan founded Wheeling, W. Va., in 1770. Their settlement, called Zanesburg, became the Ohio River terminus of the road from Cumberland, Md., used by many Ohio settlers. During the revolution, as a Virginia militia colonel Zane helped repel British-Indian besiegers of Fort Fincastle (renamed Fort Henry) at Zanesburg, in 1777 and 1782. In 1796 Congress granted him in the Ohio county three lots, each a mile square, under stipulations of payments of United States bounty warrants, provision of roads, ferrys, and surveys of the tracts at his expense, and that he also blaze a road from Zanesburg to Limestone, Ky. before Jan. 1, 1797. On one of these tracts Zanesville was platted in 1799 and on another Lancaster in 1800.

ZANELLA, dzä-nĕl'lä, **Giacomo,** Italian poet: b. Chiampo (Vicenza), Sept. 9, 1820; d. Vicenza, May 17, 1888. After studying for the priesthood at the Vicenza Seminary, he became professor there of philosophy and Italian literature. Having held posts in lyceums at Venice, Vicenza, and Padua, he was made professor of Italian literature in the University of Padua in 1866, and in 1871–1872 was rector of the university. Zanella's work is noted for beauty of style and mastery of form; his most popular poem is *La Conchiglia Fossile* (*The Fossil Shell*).

ZANESVILLE, city, Ohio, Muskingum County seat; altitude 720 feet; at the confluence of the Licking and Muskingum rivers; about 50 miles east of Columbus; on the Baltimore and Ohio; New York Central; Pennsylvania; and Nickel Plate railroads. It has river connections and a municipal airport. Local industries specialize in pottery and glass, but there are also iron and steel works, shoe and electrical apparatus factories. With a well-stocked public library and a handsomely housed art museum, Zanesville is satisfactorily equipped in the cultural field of community life. The art institute includes collections of historical objects and specimens of wares locally produced.

The history of Zanesville begins in 1799, when Ebenezer Zane (q.v.), marked out the site, in fulfillment of his part of the agreement by which the federal government permitted him to build Zane's Trace, a highway to Kentucky originating at Wheeling, W. Va. In 1804 Zanesville became county seat, and in 1810 it was named capital of the state, a distinction it lost to Columbus two years later. Incorporated in 1800, it became a city in 1850. Pop. (1950) 40,517.

ZANGWILL, Israel, British author: b. London, Eng., Feb. 14, 1864; d. Sussex, Eng., Aug. 1, 1926. Educated at the Jews' Free School, Spitalfields, and the University of London, in 1888 he published *The Premier and the Painter,* and in 1890 established *Ariel,* or the London *Puck,* a brilliant but short-lived periodical. However, he soon achieved note by his essays, works in fiction, and plays. His department of literary causerie, "Without Prejudice," in the *Pall Mall Magazine,* became well known in Great Britain for its able critiques. Some of these essays were gathered into a volume of that title in 1896. Some of Zangwill's best fiction deals with Jewish types and subjects, as in *Dreamers of the Ghetto* (1898), with its semihistorical pictures of Heine, Spinoza, Uriel (Gabriel) Acosta and others. He lectured in Great Britain, Ireland,

Palestine, Holland and the United States, and, as a prominent Zionist, gave addresses in connection with that movement and the application to it of the Baron de Hirsch millions; and is president of the Jewish International Territorial Association. His literary work is in a style of much distinction, with frequent touches of irony. He is author of 'Children of the Ghetto' (1892); 'Ghetto Tragedies' (1893); 'They That Walk in Darkness' (1889); 'The Mantle of Elijah' (1900); 'Ghetto Comedies' (1907); 'Italian Fantasies' (1910); 'The War for the World' (1916); 'The Principle of Nationalities' (1917); 'Chosen Peoples' (1918); 'Jimmy the Carrier' (1919); 'The Voice of Jerusalem' (1920); 'Ibn Gabriol's Poems from the Hebrews' (1923). A play which he constructed (under the same title) from his 'Merely Mary Ann' (1893), was more successful (1904) than the dramatization (1899) of 'Children of the Ghetto' or the one-act 'The Moment of Death' (1900). 'Six Persons' (1892) was well received in England and later plays include 'Plaster Saints' (1914); 'Too Much Money' (1918); 'The Cockpit' (1921); 'The Forcing House' (1922); 'We Moderns' (1923).

ZANGWILL, Louis, English author, brother of I. Zangwill (q.v.): b. Bristol, 25 July 1869. At first a journalist he later took up literature as a profession, using for a while the pseudonym «ZZ.» He published 'A Drama in Dutch' (1894); 'The Beautiful Miss Brooke' (1897); 'One's Womankind' (1902); 'An Engagement of Convenience' (1908); 'Monograph on Richard Cumberland' (1911); 'Quest of Spiritual Truth' (1926). Died, 31 May 1938.

ZANKOFF, zän'kŏf, **Dragan,** Bulgarian politician: b. Sistova, 1827; d. Sofia, 24 March 1911. He studied at the universities of Odessa, Kiev and Vienna, and entering the service of Turkey, became secretary to the Pasha of Rustchuk, Bulgaria. In 1880 he was made Premier of Bulgaria and Minister of Foreign Affairs by Prince Alexander, and again held the post of Premier 1883–84. Later he became the enemy of Alexander and the head of the pro-Russian party. On the night of 20 Aug. 1886 Zankoff with a party of fellow-revolutionists broke in Prince Alexander's palace and forced him to resign. Zankoff then became a member of the provisional government. Upon the restoration of the prince he was banished, but was subsequently permitted to return. He again became the leader of the Russophile party and in 1902–03 he was president of the Sobranje.

ZANOTTI, dzä-nōt'tē, or **CAVAZZONI ZANOTTI, Giovanni Pietro,** jō-vän'nē pē-ā'-trō, Italian artist: b. Paris, 1674; d. Cortona, 1765. He was a pupil of Lorenzo Pasinelli at Bologna, and became a good designer and colorist, and an adept in chiaroscuro. For churches at Bologna he executed several altar-pieces, among the chief that of 'The Incredulity of Saint Thomas' in the church of that saint. There is also in the Palazzo Pubblico a large picture by him of 'The Ambassadors of Rome Swearing Fidelity to the Bolognese.' At Cortona, where he long resided, he distinguished himself by such pictures for churches as 'Christ Appearing to Mary Magdalene' and 'Christ Carrying His Cross.' He was a careful writer on art, the most important of his works being the 'Storia dell' Accademia Clementina di Bologna' (2 vols., 1739).

ZANTE, zän'tĕ, Greece (anc. *Zacynthus*), one of the Ionian Islands, in the Mediterranean, between eight and 10 miles south of Cephalonia and 15 miles from the nearest point of Greece. It is about 24 miles long, 12 miles broad, and 60 miles in circuit; area, 277 square miles. It has the form of an irregular oblong, indented with a deep bay at its southeast extremity. The western half is hilly, rising to 2,500 feet, and the west coast exhibits limestone cliffs. The east coast has a harbor, within which is situated the town of Zante (pop. about 13,501), a thriving and well-built place, the see of a Greek protopapas, and of a Roman Catholic bishop. Part of the island consists of an extensive fertile plain, having the appearance of one continuous vineyard, with a few parcels under cereals or pasture. The prevailing rocks are calcareous; gypsum appears in various parts, and its pitch-wells are famous. Earthquakes frequently occur. The staple export of Zante is the dried «currant» of commerce, the fruit of a dwarf grape. The other chief exports are oil, soap and a little wine; pomegranates, melons, peaches, oranges, citrons and other fruits are also grown, but the corn raised scarcely supplies three months' consumption. Goats are the only livestock. The island forms a department of the kingdom of Greece since 1864; it is mentioned by Homer, and was formerly an independent state which successively came under Macedonian, Roman, and finally Greek rule. Pop. 42,502.

ZANTHOXYLUM, a genus of the family *Rutaceæ,* composed of erect or climbing shrubs or trees, often with prickly branches. The leaves are compound, pinnate, sometimes reduced to three, or rarely, to one, leaflet, usually pellucid-dotted. The flowers are small, in axillary or terminal panicles, and are from three- to five-parted. The fruits split in two. with one or two shining black seeds. *Zanthoxylum* is a large genus, found in both the Eastern and Western hemispheres, especially in their warmer parts. The species are so aromatic and pungent that in the countries where they exist they are popularly called peppers, specially *Z. piperitum,* called Japan pepper, which is regarded as an antidote for poison. *Z. rhetsa,* an Indian species, has small yellow flowers and small round berries, which, when unripe, taste like the skin of a fresh orange. Its fruit, and the seeds and bark of *Z. alatum,* which grows near the base of the Himalayas, and those of *Z. budrunga,* also Indian, are given as aromatic tonics in fever, diarrhœa, dysentery and cholera. They are used as a condiment in India and as a fish-poison. The small branches are employed to make walking-sticks, and the twigs as toothbrushes. The seeds of the latter are as fragrant as lemon peel. *Z. clava-herculis* and *Z. americanum* applied externally to the gums or taken internally, are powerful sudorifics and diaphoretics used in toothache, paralysis of the muscles of the mouth and rheumatism. The root of *Z. nitidum* is sudorific, emmenagogue, etc. The powdered bark of *Z. hiemale* is given in Brazil in earache; and the capsules and seeds of *Z. hastile* are employed in northern India to intoxicate fish. The West Indian species of

Zanthoxylum is called yellow-wood, *Z. cariboeum* being differentiated as the prickly yellow-wood. It is a tree, 20 to 50 feet high, whose prickly young stems are made into walking-sticks. The wood is used for inlaying and for furniture. *Z. cribrosum* is the satin-wood of the West Indies, which when first cut has the odor of the veritable satin-wood. *Z. fagara* is a small tree common in the same region, and tropical America, producing a hard, heavy, reddish-brown wood, known as savin or iron-wood or as the wild lime. Still another species is *Z. emarginatum,* a shrub with coriaceous foliage, exported under the name of rose-wood, but called licca-tree or lignumvorum at home. The commonest species of the northern United States and the hardiest is *Z. americanum,* a shrub or small tree with odd-pinnate leaves, and twigs which are generally prickly. The cymose flowers are axillary and sessile, without calyx, and they are greenish-white. The capsules are black and ellipsoidal. It is called prickly-ash or toothache-tree, because both Indians and country people used the hot, acrid bark of both this species and *Z. clava-herculis,* which when chewed produces a stinging sensation, for aching teeth.

ZANZIBAR, zăn-zĭ-bär′, East African sultanate; the islands of Zanzibar and Pemba, with adjacent islets, constitute the British protectorate of Zanzibar, and mainland territories form the Kenya Protectorate, the latter leased by the British government and administered with Kenya Colony. Zanzibar Protectorate has an area of 1,020 square miles (Zanzibar island, 640 square miles; Pemba, 380 square miles), and the population is estimated to number 250,000, of whom 100,000 live on Pemba. The island of Zanzibar is situated in 6° south latitude, off the coast of Tanganyika Territory, and separated from it by a channel 22½ miles wide at the narrowest place; the largest coralline island on the East African coast, it is 53 miles long and 24 miles wide. Pemba, 25 miles northeast of Zanzibar, is 42 miles long by 14 miles wide. The west of the island of Zanzibar is fertile and well cultivated, chiefly for cloves, coconuts, sugar, and manioc; this coast is well indented and accessible, but the east coast is steep and forbidding. The mean temperature is 80°F., and the average annual rainfall amounts to 58.59 inches. On the west coast is Zanzibar (pop. 45,276) capital and seaport of the island. Its harbor is one of the finest in Africa. The population of the capital and surrounding districts consists principally of full blooded or half-caste Arabs, Indians of several races, and Negroes of many tribal stocks, most of them professing Islam; Bantu Negroes inhabit the western part of the island. The sultan of Zanzibar is ruler in name only, for though he issues decrees they have legal effect only when countersigned by a British Resident heading the civil administration; the sultan presides over meetings of an Executive Council, and the Resident is chairman of the Legislative Council, an advisory body having official and nominated unofficial membership. The government conducts primary schools for Moslems and secondary schools open to all children, and gives financial assistance to schools administered by Indian communities and Christian missionary bodies. The clove industry is the most important, the islands of Zanzibar and Pemba yielding the bulk of the world's supply. Coconuts are exported principally in the form of copra (the sun dried kernel) and coir rope, and coconut oil is also manufactured. Prior to construction of the Uganda Railway into the interior from the mainland port of Mombasa, the seaport of Zanzibar conducted most of the transshipment trade of eastern Africa. Through Zanzibar also passed thousands of African natives seized by Arab traders in the hinterland and shipped into slavery in Arabia. Slavery in the sultanate of Zanzibar, principally for agricultural work, was not abolished until 1897.

Arab influence predominated in Zanzibar and the adjacent mainland until the Portuguese appeared in the 16th century. Subsequently the territory was part of the domains of the Arabian sultanate of Muscat down to 1856, when it became independent. In 1890 a British protectorate was declared over the islands, and the sultan's domains on the mainland were divided (from north to south) between Italy, Great Britain, and Germany; the sultan's rights were purchased by Italy and Germany, those areas being incorporated, respectively, into Italian Somaliland and German East Africa (later Tanganyika Territory), and Britain leasing its sphere (in 1920 restyled Kenya Protectorate). Consult Pearce, F. B., *Zanzibar, the Island Metropolis of Eastern Africa* (London 1921); Ingrams, W. H., *Zanzibar: Its History and Its People* (London 1931); *A Guide to Zanzibar* (Zanzibar 1939).

ZAPOLYA, zä′pô-lyŏ, or **SZAPOLYAI,** sŏ′pô-lyoi, **John,** king of Hungary: b. 1487; d. 1540. He was voivode (governor) of Transylvania, 1511–1526, and when young Louis II ascended the throne in 1516 was named regent. After the death of the king at the Battle of Mohacs in 1526 he secured the crown for himself. Thereby involved in war with Ferdinand I of Germany, Holy Roman emperor, he was forced to seek refuge in the Carpathians until 1529 when, with Turkish assistance, he regained much of his kingdom. Strife was terminated in 1538 by the Treaty of Grosswardien between Ferdinand and Zapolya.

ZARA, zä′rä, (Slav Zadar, zä′där), seaport on the Croatian coast, former capital of the Austrian province of Dalmatia, and transferred after World War I to the Italian Department of Venezia Guilia e Zara. Captured from the Axis forces by the Yugoslav National Army of Liberation before the German collapse in World War II, it was declared annexed to Yugoslavia by the Yugoslav National Assembly, and in the summer of 1946 remained in Yugoslav hands pending the peace settlement. The city's original name was Jadro (the Sail). The Romans called it Jadera, and the Byzantines Diadera. In 1202 it played an important role when it was occupied by the Crusaders, on behalf of Venice. When in 1390 the whole of Dalmatia recognized King Tvrtko (r. 1377–1391) of Bosnia as its ruler, Zadar was the only city which remained loyal to the king of Hungary. It joined the Republic of St. Mark in 1409, and remained part of it until the republic fell in 1797. In 1500 and 1570 the city was besieged and badly damaged by the Turks. The basilica of St. Anastasia (13th century) is decorated with paintings by the younger Di Palma (Jacopo, Palma II Giovane, 1544–1628). The church of St. Donato, dating from the 9th century, is used in modern times as a museum. It has steep and narrow streets; and a very

interesting cathedral, in the Lombard style, dating from the 13th century; several other churches; a town-house; a lyceum, gymnasium, archiepiscopal seminary, normal and other schools; a civil and a military hospital; and a capacious but somewhat shallow harbor admitting warships of medium size. It has manufactures of rosoglio, maraschino, and glass, and a considerable coasting trade. Zara has stood many sieges, particularly one in 1202, when it was taken by the Venetian doge Dandolo, with the assistance of the French crusaders; and another in 1346, when it was taken by Marino Faliero in the face of a large Hungarian army. It was under Venetian control from 1409 passed into Austrian possession in 1797 and to Italy in 1919. It was under French rule in 1805–13. Pop. 19,752.

ZARATE, thär-ä'tā, **Antonio Gil y,** Spanish dramatic poet: b. San Lorenzo de l'Escurial, Spain, 1795; d. 1860. He was educated in Paris; and on his return to Spain became professor of physics in Granda. He afterward wrote dramas notable for striking situations, lively dialogue and elegant versification; among them are 'Blanca de Bourbon' (1835); 'Guzmán il Bravo'; 'El Czar Demetrius.' He also published a history of Spanish literature and other prose and poetic work including good literary criticism.

ZARATE, Augustin de, Spanish historian: b. about 1492; d. Madrid, about 1560. After holding for 15 years the office of comptroller of Castile he accompanied Nuñez Vela, viceroy of Peru, to South America in 1543, and while there was not only an eyewitness of many historical events of importance, but made a close study of Peru and its annals. On the fall of Gonzalo Pizarro he returned to Spain and in 1555 published 'Historia del descubrimento y conquista de la provincia del Perú' (History of the Discovery and Conquest of the Province of Peru). There have been many later editions of this most valuable work, and it has been translated into French, English, German, Portuguese and Italian.

ZARATHUSHTRA, zä-rä-thoosh'trạ, the name by which Zoroaster is known in the 'Avesta.' See ZOROASTER.

ZARATITE, an emerald-green incrustation usually on chromite. It is a hydrous basic carbonate of nickel. Its best known locality is at Texas, Pa. It is often called "emerald nickel."

ZAREEBA, the general name of all the African striped species of the horse family. See ZEBRA.

ZARITZIN, Russia. See TSARITSYN.

ZARLINO, tzär-lē'nō, **Giuseppe,** Italian composer: b. Chioggia, near Venice, 1517; d. Venice, 14 Feb. 1590. He became a Franciscan in 1537 and in 1541 went to Venice to study music with Willaert. In 1565 he was appointed choir master of Saint Mark's, Venice, and continued in that position till his death. He was especially famous for the music he composed to be performed on the occasion of the victory of Lepanto. He determined the relations of the tones and semitones more precisely than had previously been done, and on this subject wrote 'Instituzioni armoniche' (1562–73). Other works of his are 'Dimostrazioni harmoniche (1571); 'Sopplementi musicali' (1588). Among his musical compositions may be named 'Modulationes' (1566); 'Lectiones pro Mortuis' (1563).

ZARNCKE, tsärn'kĕ, **Friedrich,** German scholar: b. Zahrenstorf, near Brüel, Mecklenburg-Schwerin, 7 July 1825; d. Leipzig, 15 Oct. 1891. After study at Rostock, Leipzig and Berlin, he founded the *Litterarisches Zentralblatt für Deutschland* at Leipzig in 1850, and in 1858 became professor at the university there. His work in connection with mediæval literature was of particular importance, and his chief publications were his edition of Brant's 'Narrenschiff' (1854), and joint-edition of Benecke's 'Middle High German Lexicon' (1863). His valuable library was acquired by Cornell University. Among his further writings were a study of Christian Reuter (1884) and 'Kurzgefasstes Verzeichniss der Originalaufnahmen von Goethes Bildniss' (1888).

ZARSKOJE-SELO, zär-skō'ĭ-sā'lō, Russia. See TSARSKOYE-SELO.

ZASULITCH, Viera Ivanovna, Russian revolutionist: b. 1851; d. 1919. She was arrested for her part in a revolutionary plot in 1869, imprisoned for two years and was later under police surveillance in Eastern Russia, but was freed in 1876. On 5 Feb. 1878 she shot, but did not kill, General Trepov, head of the secret police, because of his ordering the flogging of a student who had failed to salute him. She was acquitted by the jury at her trial and the verdict was favorably received. General Trepov, in deference to public opinion, was transferred to the cavalry. Later, her acquittal was annulled by the Supreme Court of Appeals, and Mme. Zasulitch fled to Switzerland, remaining there until the Tsar's amnesty of 1905 permitted her return to Russia. Her works were published (2 vols., 1906).

ZAUBERFLÖTE, tsow'bĕ-flē"tĕ, **Die** ("The Magic Flute"), an opera by Mozart, first produced at Vienna in September 1791, under the direction of the composer. A French version of the opera bears the title 'Les Mystères d'Isis.'

ZAVALA, thä-vä'lä, **Joaquin,** Nicaraguan politician: b. Nicaragua, about 1839. He entered the army, became prominent in political affairs and was president of Nicaragua 1879–83. He was afterward Minister to the United States and in 1893 headed the insurrection which secured the deposition of President Sacaza in May 1893. On 17 July of that year he was declared provisional president, but only to lose his position through another revolt a fortnight later.

ZBYLITOWSKI, zbĭ-lĭ-tow'skē, **Andre,** Polish writer, philosopher and poet: b. Galicia, 1732; d. 1813. He was doctor of philosophy for a time at Cracow and later made extensive travels through South America and Europe. Author of 'Rhythms in Polish Verse' (1763); 'The Marshal'; 'A Beard,' etc.

ZBYLITOWSKI, Pierre, Polish writer and poet: b. in the palatine of Lubein 1684; d. Warsaw 1757. He was educated at the Uni-

versity of Warsaw and after leaving there traveled extensively through Europe and North America. He has published 'Porydia' (1734); 'Epigrams' (1735); 'Lucie,' a poem (1739), etc.

ZEA, thā'ä, **Francisco Antonio,** Colombian naturalist and statesman: b. Medellin, New Granada (Colombia), 21 Oct. 1772; d. Bath, England, 28 Nov. 1822. After study at the College of Popayan, he was connected with the botanical expeditions of Mutis, in 1795 was sent to Spain under arrest on the charge of circulating republican literature, and though acquitted in 1799 was forbidden to return to New Granada. He carried on botanical researches in Europe, but in 1815 joined Bolivar at Jamaica. In 1819 he was chosen vice-president of Colombia by the congress of Angostura, and in 1820 went to Europe as envoy of the Colombian republic to France and England. He has sometimes been styled the «Franklin of Colombia.» Among his published works are 'Memoria sobre la Quina según los Principios de Mutis' (1800), and a 'Historia de Colombia' (1821).

ZEA, zē'ạ. See Ceos.

ZEALAND, zē'land, or **SJELLAND,** Denmark, the largest island of the kingdom, between the Cattegat and the Baltic, separated from Sweden by the Sound and from Funen by the Great Belt; it is 82 miles long by 68 miles wide and very irregular, its area being 2,636 square miles, including the two islands Möen and Samsöe, 2,793 square miles; it is three miles from Sweden and 11 miles from Fünen. It has no mountains; but the surface is finely variegated, having small hills and fields of a fertile soil, intersected by canals. It produces large crops of corn, and has excellent pasture. Besides several other towns of considerable importance, it contains the fortress of Elsinore or Helsingör, and the capital and royal residence, Copenhagen. Pop. about 960,250.

ZEALAND, or **ZEELAND,** Netherlands, a province bounded south by Belgium, west by the North Sea, east by North Brabant and northeast by South Holland; area, 690 square miles. The capital is Middleburg, in the island of Walcheren; principal seaport town, Flushing. The province consists of a low-lying tract of land on the frontiers of Belgium and on the southern shore of the estuary of the Schelde, and of the islands of Walcheren, North and South Beveland, Schouwen, Tholen, etc., separated from each other and from the mainland by arms of the Schelde, from which and from the North Sea it is protected by dikes. As a whole the province is flat and fertile, producing excellent crops of the ordinary cereals, a considerable quantity of clover, rape and madder, and a superabundance of excellent fruit. The grass lands also are rich and extensive. The climate is rather moist, but comparatively healthful. Large tracts partially covered by the sea have in recent times been successfully reclaimed. Pop. (1936) 253,857.

ZEALOTS (Greek, *zelotes,* enthusiasts, followers and strong supporters), a sect of the Jews, composed of the more fanatical elements opposed to Roman rule. They led a revolt against the Romans in 6 A.D., and after that frequently robbed and murdered those whom they knew to be supporters of or sympathizers with the Romans. Felix tried to suppress them by crucifying all of the sect whom he could capture, but this only caused an increase in the number of their acts of violence. They continually stirred up the Jews against the Romans, and were largely influential in bringing on the Jewish War of 66–70, which resulted in the overthrow of Jerusalem.

ZEBALLOS, thā-bäl'yōs, or **CEBALLOS, Pedro** (Zeballos Cortes y Calderon), Spanish general: b. Cadiz, 29 June 1715; d. Cordova, 26 Dec. 1778. Entering the army as a cavalry captain in 1738, he became a lieutenant-general in 1755 and was dispatched to Buenos Aires as governor the next year. On the outbreak of the war with Portugal and England in 1762, Zeballos besieged the Portuguese port of Colonia de Sacramento, near the entrance of the Uruguay River, forcing its surrender 2 Nov. 1762, and capturing 26 English ships in its harbor. He returned to Spain in 1767 and in 1777 was made viceroy of the newly established viceroyalty of La Plata. On his way thither he wrested Santa Catharina from the Portuguese and retaking Colonia de Sacramento, which had reverted to Portugal since its former capture, destroyed it. He was relieved of his duties in 1778 and returned to Spain where he died shortly after his arrival.

ZEBID, zĕ-bēd', Arabia, a town in Yemen, on the inland route from Hodeida to Mokha, 60 miles north of the latter. It was formerly the seat of a long line of princes, and was famous for its commerce and learning. In the neighborhood are ruins of ancient cities. The population has dwindled to 9,000 inhabitants.

ZEBRA, the name of several animals, natives of Africa, belonging to the family of the horses. The zebra belongs to the same general type as the ass, distinguished from *Equus* (the horse) proper by smaller size and by having the body more or less banded black upon yellowish. The forelegs only possess the «warts,» seen in both fore- and hind-legs in the horses; and the tail is «tufted.» The typical or mountain zebra (*Equus zebra*) inhabits South Africa, but it is now almost extinct. A few specimens, however, are strictly preserved in the mountainous districts of eastern Cape Colony, where, until about 1875, they abounded in herds on the plains. The body is cream-colored, its characteristic bands being deep black. The stripes are drawn at right angles to the axis of the body. The legs are striped right down to the hoof, but the under part of the body has no stripes. The neck bears a faint development of skin or dew-lap, and the mane is very short. The animal was long considered untamable, but experiments made since 1872 have shown that with proper treatment it can be made to work well in harness. Any general utilization and improvement of it, however, seems impracticable. The dauw, or Burchell's zebra (*Equus burchelli*), is higher and more graceful than the true zebra and is the one commonly seen in menageries. Its stripes are narrower and somewhat differently disposed from those of the true zebra, and extend under the belly, but are absent from the lower part of the legs. It has been

driven northward, and is now rare even in the Transvaal. Chapmann's zebra (*E. chapmanni*) is another variety, found from Bechuanaland north to the Sudan. Grévy's zebra (*E. grevyi*) is restricted to Abyssinia and Somaliland. The quagga (q.v.) is a near ally of the zebras. Consult Lydekker, 'Royal Natural History' (Vol. II, London 1895); Tegetmeier and Sutherland, 'Horses, Zebras, Mules and Mule-breeding' (London 1895).

ZEBRA PARRAKEET, an Australian or East Indian parrot. See BUDGERIGAR.

ZEBRA-SHARK. See TIGER-SHARKS.

ZEBRA WOLF, an early colonial name for the wolf-like, striped, predatory marsupial of Tasmania. See DASYURE.

ZEBRA WOOD, *in botany* and commerce: (1) A kind of wood imported from South America, and used by cabinet makers, produced by *Connarus guianensis* (*Omphalobium lamberti*), a large tree belonging to the natural order *Connaraceæ,* and growing in Guiana. Its colors consist of brown on a white ground, clouded with black, and each strongly contrasted, thus somewhat resembling the skin of a zebra. It is also called pigeon wood, and is used for furniture. (2) The wood of *Eugenia fragrans,* variety *cuneata.* It is a shrub about eight feet high, growing in Jamaica. (3) The wood of *Guettarda speciosa,* an evergreen tree 25 feet high, with scarlet-colored flowers, growing in the East Indies.

ZEBU, zĕ-boo′ or thā-boo,′ Philippines. See CEBU.

ZEBU. See INDIAN HUMPED CATTLE.

ZEBULUN, zĕb′ū-lŭn, or **ZEBULON,** the 10th of Jacob's 12 sons, and the sixth and last by his wife Leah (Gen. xxx, 19–20). Of his individual history nothing is related in the Scriptures, but his name was given to one of the 12 tribes of Israel, and to a region of Palestine. At the time of the exodus from Egypt the tribe of Zebulon moved in the van, following the tribes of Judah and Issacher. The territory of the tribe lay in the fertile hilly country to the north of the plain of Jezreel, and included Nazareth. The tribe of Zebulon was inferior in importance to several of the other tribes and its tribal existence closed when Tiglath-Pileser carried its principal members, with the northern tribes, into captivity (2 Kings xv, 29).

ZECH, Frederick, Jr., American pianist and composer: b. Philadelphia, Pa., 10 May 1858. Taken to San Francisco when very young, he began to study music there and afterward studied in Berlin, 1877–82. Since the year last named he resided in San Francisco, where he was conductor of the symphony orchestra and gave many piano recitals. Among his many compositions are four symphonies, four concertos for piano and orchestra, a concerto for violin, one for 'cello; two string quartettes; three sonatas for violin and piano; two for clarinet and piano, one sonata for 'cello and piano, one for flute and piano; several symphonic poems: 'The Eve of Saint Agnes,' 'The Raven'; 'Lamia' after Keats, and 'The Wreck of the Hesperus' after Longfellow; operas 'The Cruise of the Excelsior' and 'Wakinyon,' a North American Indian Opera, sonatas and songs. He died, 25 Oct. 1926.

ZECHARIAH, zĕk-ą-rī′ą, the 11th in order of the Hebrew writers known as minor prophets. Little is known of his personal history, but he first publicly discharged his office as priest in the second year of Darius 519 B.C. He is called in his prophecy the son of Berechiah and the grandson of Iddo, but in the Book of Ezra (v, 1; vi, 14) he is termed "the son of Iddo." He was priest as well as prophet and is associated with the prophet Haggai. Tradition states that Zechariah had much to do in furnishing the liturgical services of the temple, and in the Septuagint and Vulgate versions several psalms are attributed to him. He deals in his prophecy with the same objects as occupied the mind of the prophet Haggai. His style is characterized by symbolic vision and dramatic action. It is distinctly Apocalyptic. This form of prophecy never predominated until after the Exile and seems to have constituted an element in the last and most powerful appeal made by the mouthpieces of Jehovah to the heart and conscience of His people.

Contents of the Prophecy.— The great portion of the Book consists of a series of visions intended to represent grounds for national confidence and to encourage national effort. The prophecy opens with an exhortation to repentance and a warning against neglect of the prophet's word. The remainder of the book consists of two sections. The first section runs from chapters i to vi.

Ch. i, 15, contains nine symbols, mostly visions, accompanied by their interpretations.

Ch. i, 8–17, a vision of the horses of Jehovah, which, as His messengers, report to Him; along with His reply.

Ch. i, 18–21, four horns, representing the opponents of Israel, are broken.

Ch. ii, a man with a measuring-line lays out the restored Jerusalem.

Ch. iii, Joshua, the high priest, is accused by Satan, and acquitted, and is honored with commissions and revelations from Jehovah.

Ch. iv, the beautiful symbol of the golden candlestick and two olive trees, with the practical application of encouragement to Zerubbabel.

Ch. v, 1–4, a flying roll recording a curse upon immoral actions.

Ch. v, 5–11, an ephah measure containing a woman is seen carried away to Babylon.

Ch. vi, 1–8, four chariots, each having horses of a particular color, are the four heavenly spirits charged to carry out God's purposes in the earth.

Ch. vi, 9–15, the symbolical action of crowns of silver and gold being made and placed upon the head of Joshua the high-priest, who thus represents the Messiah-priest upon His throne.

The second section runs from chapters vii to xiv. In ch. vii the prophet, in answer to a question as to observance of a certain fast replies that the true fast is justice, mercy and piety, which had been so much neglected in earlier generations. This suggests, in ch. viii, the coming Messianic time, when the city shall be populous and happy under the renewed protection of Jehovah, and the fasts shall be joyful

feasts, attended by multitude of strangers seeking His favor.

There is so much that is matter of dispute in ch. ix–xiv, as regards their date and immediate application, that we shall have to content ourselves with a summary and a few general remarks. The contents are largely symbolical and figurative. Ch. ix–xi, form a division by themselves, perhaps written by the Zechariah of Isa. viii, 2. It has an entirely different historical setting from that of ch. i, 8. Here we are transported back to the 8th century B.C. Ch. ix, 1–8, refers to conquests made by Tiglath-pileser III (745–727 B.C.). Northern Israel is still in existence, and Assyria is still in its "pride" (x, 10ff). These allusions form part of the very texture of the prophecy, and are assumed by some to be old fragments embedded in a post-Exilic work.

Ch. ix, 1–8, Syria, Phœnicia and Philistia are to be brought low. Yet a remnant of the Philistines shall be united with Judah, and both shall be under the protection of Jehovah. Ch. ix, 9–17, the Messiah shall come as the Prince of Peace to restore the dispersed of Israel, and save them from their enemies. Ch. x, the people are entreated to turn to Jehovah in their troubles, and not to diviners and images. Jehovah will be the defender alike of Judah and Israel, restoring and strengthening them and bringing low their oppressors. Ch. xi announces the shock of war which appals the rulers of Judah (ver. 1–3). The rest of the chapter is allegorical. It represents Jehovah as rejected by His people, they being in turn rejected by Him, their true Shepherd. By an expressive figure, the brotherhood of Judah and Israel is declared to be broken. Ch. xii, 1 to xiii, 6, the nations come against Jerusalem; but Jehovah defends and saves it. The conflict is shown to be spiritual, for a spirit of grace and supplication is to be poured upon Judah and Jerusalem. Also a fountain is to be opened for the cleansing of guilt, and the idols and false prophets are to be banished. Ch. xiv — Again Jerusalem is besieged, and this time it is taken, half the people going into exile; but the residue are saved. After various figurative illustrations of the processes and results of the Messianic reign, it is declared that the survivors among the nations shall go up to worship in Jerusalem, which shall be wholly consecrated to Jehovah.

ZECHARIAH, Book of. One of the generally accepted results of Biblical criticism is the conclusion that Zechariah i–viii are the work of the prophet whose name they bear, but that the remainder of the book, chapters ix–xiv, was written by another author or authors. The reasons for this conclusion will be given later. The first part, chapters i–viii, will be discussed by themselves, followed by a consideration of the remaining chapters.

Zechariah the prophet is doubtless to be identified with Zechariah the priest of Nehemiah xii, 16, see also xii, 4. He was probably the son rather than the grandson of Iddo, see Ezra v, 1, vi, 14, the phrase "the son of Berechiah" in Zechariah i, 1 being a later addition, resulting from a confusion with Zechariah the son of Jeberechiah mentioned in Isaiah viii, 2. The evident interest of Zechariah in the temple is in accord with his priestly descent. But his general outlook is more prophetic than priestly, as in the case of the other priest-prophets, Jeremiah and Ezekiel. Zechariah doubtless returned from the exile in the company of Zerubbabel along with his father, Iddo, Nehemiah xii, 1–4.

These chapters are given precise dates, in the years 520–518 B.C. The historical circumstances of that time are well known. The return from the Babylonian exile under Zerubbabel had taken place some 16 years before. A beginning of the rebuilding of the temple had been made at that time, if the data are historical, but it is evident that little progress had been made. The people became discouraged, they were few in numbers, surrounded by enemies, with precarious conditions of existence. The attempt to rebuild the temple was soon given up, and the people resigned themselves to a discouraged selfish life. Haggai began his prophetic ministry in 520, endeavoring to encourage the people to rebuild the temple. His message centred about this thought, accompanied by denunciation of the people for their sins and indifference. About two months later came the first message of Zechariah. Both prophets speak as if there had been no return from the exile in any true sense. The return announced in prediction, especially by Deutero-Isaiah, was to be a glorious return, accompanied by signal manifestations of the power of Yahweh. Such a return had not taken place. Zechariah speaks of the people, therefore, as still in captivity, and the return as yet of the future. Zechariah continues and amplifies the work of Haggai. His specific object is the rebuilding of the temple, but he seeks the attainment of this end by a presentation of the glorious future in store for the nation.

There are probably no important later additions in these chapters. iv, 6b–10a is probably by Zechariah, but does not belong in its present position where it interrupts the connection. The meaning in vi, 11–13 has been obscured by textual corruption, which will be considered later.

Chap. i, 1–6 is a hortatory introduction, dated in 520. The main part of the collection consists of i, 7–vi, 15, bearing the date of 519. This is made up of eight visions and their interpretations, with an appendix. The interpreter is an angel, a feature original with Zechariah. The first three visions, i, 7–ii, 13, present various features in the coming return from the captivity; iii–iv, except iv, 6b–10a, deal with the two leaders of the people, Joshua the priest and Zerubbabel the Davidic prince, teaching the removal of the guilt of Joshua and of the nation and the divine favor which will attend both these leaders; v, 1–vi, 8 contain three visions, dealing with the purification from sin of the restored people. vi, 9–15 contains a historical appendix to the visions. This predicts, in accord with Haggai, that Zerubbabel is to be manifested as the Messiah, rebuilding the temple and bringing deliverance to the people, while Joshua is to be closely associated with him. The principal place, however, is occupied by Zerubbabel. Verse 11 doubtless originally mentioned only one crown, for Zerubbabel, this being required by the con-

text. How the verse originally read is a question; perhaps the latter part should be omitted. In verse 13 the phrase «and he shall be a priest upon his throne» should be read «and there shall be a priest upon his right hand,» with the Septuagint. The changes in the text as it now is were doubtless intentional, introduced later when it was seen that Zerubbabel was not the Messiah. For the interpretation here given compare verse 13 with iv, 8. Chaps. vii–viii give an account of the visit of men of Bethel to the prophet with inquiries concerning fasting, with special reference to the fast commemorating the destruction of Jerusalem. The prophet answers that the future will be a time of joy and rejoicing rather than of fasting and sadness.

The thought of Zechariah shows much similarity to that of the earlier prophets, with which he is evidently familiar, and his phraseology also shows the impress of their influence. He demands faithfulness to Yahweh and the observance of ethical standards, in accord with the highest teaching of the pre-exilic prophets.

The activity of angels is specially prominent in these messages of Zechariah. The superhuman adversary, Satan, also appears here for the first time, iii, 1–2.

There are practically no resemblances between chapters ix–xiv and i–viii, while there are many differences. The first chapters, those of Zechariah, are precisely dated, the second part has no dates; the first part has visions, the second not; the first part makes the temple especially prominent, it is hardly alluded to in the second part; the first part reflects the Persian period, the second part has no certain references to it; and the peaceful outlook of the first part has become warlike in the second part, and is characterized, in certain portions, by a bitterness of feeling toward other nations hardly paralleled elsewhere, see ix, 1ff, 13ff, xii, 1ff, etc. The nations mentioned are not those of the Persian period, Hadrach and Damascus, ix, 1, Hamath, ix, 2, Greece, if the text is correct, ix, 13, and Assyria and Egypt, x, 10. The Messianic picture of the second part, ix, 9–10, is the ordinary one of a Messianic king of the future, his reign in this case to be preceded by the destruction of enemy nations, in contrast with Zechariah's conception of Zerubbabel, the prince already present, as the Messianic king, himself bringing deliverance.

The question to what period chapters ix–xiv belong has been much disputed, which is also true of the further question whether they are the work of one author, or of more than one.

The following features are claimed to be references to a pre-exilic situation. The northern kingdom, it is said, is still in existence, ix, 10, 13; xi, 14; Egypt and Assyria are contemporary nations of the writer, x, 10f; idolatrous conditions, 10, 1f, are thought to indicate this period; and the nations mentioned with threats, ix, 1–7, are said to be those of this time, see Amos i, 3–10. The pre-exilic date usually assigned is about the time of Amos.

There is a growing tendency, however, to assign these chapters to the time after the exile, and usually to the Greek period. Little dependence can be placed on the mention of the Greeks as a present power, ix, 13, for there is considerable reason to think that these words may be an addition. The nations which are here denounced were prominent during the time of conflict between the Seleucidæ of Syria and the Ptolemies of Egypt. Egypt and Assyria, on this view, designate the Ptolemies and the Seleucidæ; such a usage probably has parallels elsewhere, as in Micah v, 5f, which at least uses the term Assyria after Assyria had passed away. These chapters contain evident allusions to the captivity, ix, 11f, x, 6–9. There is no reference to a Davidic king as reigning in Jerusalem, the Davidic family being like the other noble families, xii, 7, 12ff. The general character of the message is not like that of pre-exilic prophecy, it has characteristics which are usually called apocalyptic, found in Ezekiel xxxviii–xxxix, Joel iii, Isaiah xxiv–xxvii, etc. These characteristics are partly vagueness and obscurity; in part the form of presentation of the future, the nations are to attack Israel and Yahweh is to destroy them; and especially the great extravagance of representation, found particularly in chapter xiv. The priestly tone, manifesting itself in the great emphasis upon the externals of worship and upon holiness, is also a mark of the later time.

The inconclusiveness of some of the arguments given above for a pre-exiiic date has already been noted. Further, the mention of the northern kingdom is not out of harmony with the postexilic period, for a return of Ephraim along with Judah was a part of the prophetic expectation, see Ezekiel xxxvii, 16ff. Idolatry is not unknown after the exile, contrary to the view often maintained, see Malachi iii, 5.

The indications which have been mentioned point to the Greek period for chapters ix–xiv. There are many obscurities in these chapters, so that the interpretation is not always certain. But there are variations in the representation which make it probable that these chapters are not entirely the work of one author, or of entirely the same period. Especially to be noted is the optimistic tone in ix, 11–xi, 3, in which the restoration of the people from captivity under favorable national conditions is indicated. In xi, 4–17, xiii, 7–9, however, the tone is one of pessimism. Here severe oppression by their captors has aroused intense bitterness toward them. Such oppression seems to have characterized the reign of Ptolemy Philopator, 222–205 B.C., after the battle of Raphia, 217 B.C. These portions, therefore, seem to have been written after 217 B.C., while the more optimistic portions are somewhat earlier under more favorable conditions. It may be that the earlier portion includes all of ix, 1–xi, 3, and the later xi, 4–xiv, 21. But it is also quite possible that there are more than two authors.

In the whole of chapters ix–xiv the principal thought is the future expectation of the nation. In the first part it is a message of hope and national restoration, accompanied by punishment of the enemies. In the second part there is a note of discouragement, finding expression in bitterness against the oppressors. The destruction of these oppressors is portrayed with expressions of hate in chapter xiv. The ethical teaching concerning the present-day conditions, so characteristic of the earlier prophets and of Zechariah himself, is not found here. The hope for the future of

the nation is principally in Yahweh's manifestation of his power against the nations, rather than in the cooperation of the nation with God.

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ZEDEKIAH, zĕd-ē-kī'ȧ, the last king of Judah of the line of David: r. 598–587 B.C. A younger son of Josiah and Hamutal, he succeeded his brothers Jehoahaz II and Jehoiakim and his nephew Jehoiachim, who was deposed by Nebuchadnezzar II in 598 B.C. He was appointed regent of Judah by Nebuchadnezzar, who also changed his name from Mattaniah to Zedekiah. As regent, Zedekiah swore allegiance to Nebuchadnezzar, but he entered into intrigues with Egypt, contrary to the command of the prophet Jeremiah.

Nebuchadnezzar sent a punitive expedition to Jerusalem in 589 B.C., and the city underwent a terrible siege. After a year and a half, famine drove Zedekiah and his people into the countryside, and Zedekiah was captured in the plains of Jericho. He was compelled to see his sons executed; his eyes were put out; and he was taken to Babylon, where he remained a prisoner until his death.

Consult II Kings 24, 25; Jeremiah 27, 37, 38, 39, 52; II Chronicles 36; Ezekiel 12, 17.

ZEDLITZ, tsā'dlĭts, BARON **Joseph Christian, von**, Austrian poet and official: b. Johannisberg Castle, Austrian Silesia, Feb. 28, 1790; d. Vienna, Austria, March 16, 1862. After serving in the Austrian army in the Napoleonic wars, he settled at Vienna and devoted himself to literary work. Of romantic, Catholic, and liberal-monarchic outlook, he entered the Austrian chancellery under Prince Metternich in 1836 and subsequently became increasingly attached to conservatism. He was the author of romantic lyrics and dramas, notably *Totenkränze* (1828), elegies on the vanity of human greatness, and *Waldfraülein* (1843), a verse fantasia of mystical and sentimental tendency. He was also the author of a celebrated translation (1836) of Lord Byron's narrative poem *Childe Harold's Pilgrimage*.

ZEDLITZ, BARON **Karl Abraham, von**, Prussian official: b. Schwarzwaldau, Prussia, Jan. 4, 1731; d. Kapsdorf, March 18, 1793. He served in the Prussian ministry of justice after 1755 and became a minister of state in 1770. He had charge of the Prussian department of religion and education between 1771 and 1788.

ZEDLITZ-NEUKIRCH, tsā'dlĭtz noi'kĭrĸ, BARON **Octavio Athanis, von**, German politician: b. Glatz (Kłodzko), Prussia, Dec. 6, 1840; d. Berlin, March 31, 1919. He led a conservative faction in the Prussian diet between 1877 and 1918.

ZEDOARY, zĕ'dō-ĕ-rĭ,-ē-rĭ, an herb (*Curcuma zedoaria*) of the ginger family, native to Asia, and used in India as a flavoring and a medicine. Its rhizomes, or rootstocks, are aromatic, bitter, and pungent. Zedoary promotes sweating and acts as a stimulant.

ZEEBRUGGE, zā'brüg-ĕ, seaport, Belgium; in West Flanders province; on the North Sea, nine miles from Brugge (Bruges). It is connected with Brugge by a ship canal. It was developed as a port between 1895 and 1907, when extensive docking and storage facilities were constructed. A German submarine base in World War I, it was attacked, April 22, 1918, by a British naval force that destroyed the harbor mole and scuttled blockships at the entrance to the Brugge canal. Zeebrugge is the terminal of the train ferry to Harwich.

ZEELAND, zā'länt, **Paul van**, Belgian economist and statesman: b. Soignies, Belgium, Nov. 11, 1893. He was educated at Louvain and Princeton universities, and was subsequently on the faculty of Louvain University (1928–1940; 1945–) and a vice governor of the national bank of Belgium. As prime minister of Belgium between 1935 and 1937, he instituted a program of social and fiscal reform, devaluating the currency and suppressing the Rexists, a Belgian fascist party. Long an advocate of international economic cooperation, he was foreign minister of Belgium between 1949 and 1954 and was a member of the Belgian delegation to the Council of Europe. He is the author of numerous publications, notably *Réflexions sur le plan Quinquennal* (1931), *Regards sur l'Europe 1932* (1933), and *Economics or Politics?* (1939).

ZEELAND, Denmark. See ZEALAND or SJELLAND.

ZEELAND or **ZEALAND**, zē'länd, Du. zā'länt, province, Netherlands. It comprises part of the mainland bordering the North Sea south of the Schelde estuary, and several offshore islands, notably Walcheren, North and South Beveland, Schouwen-Duiveland, and Tholen. The province is mostly below sea level and is protected by dikes. It produces cereals, vegetables, flax, and fruit. In addition to agriculture and dairying, the principal occupations of the population are mussel and shrimp fishing and processing, oyster culture, and flax spinning. Coke production and associated coal-tar chemical industries are important at Terneuzen and Sluiskil.

The principal towns are Middelburg (1947 pop., 20,605), the capital; Vlissingen (Flushing, 20,217), Goes (12,762), Terneuzen (9,492), and Sas van Gent (3,512). Most of the population are scattered in small villages or isolated homesteads. About 25 per cent are Roman Catholic.

In 1303, Zeeland was annexed to Holland by Count William III. It was joined to the United Provinces of the Netherlands during the reign of Stadholder William III (1672–1702). Area 651 square miles; pop. (1953) 275,148.

ZEEMAN, zā'män, **Pieter**, Dutch physicist: b. Zonnemaire, Zeeland, May 25, 1865; d. Amsterdam, Oct. 9, 1943. From 1897 to 1900 he was lecturer at the University of Leyden; afterwards professor of physics at the University of Amsterdam and director of the Physical Institute there from 1908. In 1896 he discovered the spectroscopic phenomenon known as the Zeeman Effect (q.v.) and was awarded the Baumgartner prize at Vienna; the Wilde prize at Paris, and (with Hendrik A. Lorentz) one half of the Nobel prize in physics in 1902. He wrote *Messungen über das kerrsche Magneto-optische Phänomen* (1893); *Experimentaluntersuchungen über Teile die kleiner als Atome Sind* (1900); *Researches in Magneto-Optics* (1913).

ZEEMAN EFFECT, a phenomenon of physics in which spectrum lines are broadened, or split into two or more components, in the presence

of a strong magnetic field. The effect was discovered by Pieter Zeeman (q.v.) in 1896.

Any substance, when heated to incandescence and viewed through a spectroscope, exhibits a spectrum pattern characteristic of the chemical elements or compounds of which it is composed. (See SPECTROSCOPY.) A glowing gas or superficially vaporized solid or liquid at low pressure emits a spectrum of bright lines. Modern chemistry assigns a "discrete" origin to each spectrum line, with its emitted light being produced by a single vibrating electron.

If such a luminous source is placed between the poles of a powerful electromagnet, and the magnet current is turned on, while the source is viewed through a spectroscope, the Zeeman Effect is apparent in the line-splitting which results. A high spectroscopic resolving power is required in order for the phenomenon to be observed. Light radiation, being formed of transverse waves, is subject to the phenomenon of polarization. (See article on POLARIZED LIGHT.) The effect of an electromagnetic field is to cause the spectrum-emitting radiation to be either plane- or circularly polarized, or both simultaneously, depending upon the angle from which the phenomenon is seen.

When the light source is viewed through a hole in one of the magnetic poles, along an axis in the same plane as the magnetic field, the emitted light is circularly polarized, and a spectrum "doublet" is formed. The original single line is split into two components, circularly polarized in opposite directions, with each line possessing a slightly different wavelength from the original. The doublet lines are equally spaced on opposite sides of the previous position of the single line, and each of the constituent lines has only one half the intensity of the original. The line whose light-emitting electron is polarized in the same direction as the field existing around the core of the magnet will have the shorter wavelength of the two. The original central line is not seen, since the electron producing it is vibrating directly along the axis of sight. The separation of the lines is directly proportional to the magnetic field strength and is constant for any chosen wavelength.

When the light source is viewed at right angles to the magnetic lines of force, the original single spectrum line becomes three, the two new lines being displaced at equal distances on either side of the still visible original line. This group of lines is known as a "normal triplet." The central component is polarized with its electrical displacement parallel to the plane of the magnetic field; the two side components are plane-polarized at right angles to this field. The wavelengths of the outside lines of the triplet are the same as those of the previously mentioned doublet lines. More complex patterns of multiplet lines are also sometimes formed.

One of the most useful modern applications of the Zeeman Effect is in the study of the electromagnetic nature of sunspots. (See SUN.) Being composed of incandescent gas at relatively low pressure, a sunspot produces a bright-line spectrum. But sunspots also act as huge rotating vortices of gas, displaying strong electromagnetic activity. Accordingly, the line-splitting of the Zeeman Effect is prominently displayed in spectroheliograms of sunspots. From the direction and amount of shifting of the lines, the polarity of the spot may be determined, as well as its magnetic intensity. In the same manner as in the laboratory experiment, a spot near the center of the sun viewed face-on shows two circularly polarized spectrum lines; a spot near the limb (circumference) of the sun viewed edge-on reveals three plane-polarized components. Hence the magnetic field of the spot is shown to be perpendicular to the sun's surface.

The Zeeman Effect also provides an effective means of determining the ratio of the charge of an electron to its rest-mass, a basic proportion of physics.

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FERGUS J. WOOD,
Science Editor, "The Encyclopedia Americana."

ZEGHERS, SEGERS, or **SEGHERS,** zā'gĕrz, **Daniel,** Flemish painter: b. Antwerp, Spanish Netherlands (now Belgium), Dec. 5, 1590; d. Nov. 2, 1661. A pupil of Jan Brueghel the Elder, he entered the Jesuit order in 1614 and subsequently painted numerous works for the church of the Jesuit college at Antwerp. He specialized in pictures of flowers, but also produced many studies of religious subjects, generally represented as being framed within stone niches adorned with garlands. He had many imitators. Works by Zeghers are in the collections of museums at Amsterdam, Antwerp, Berlin, Brussels, Dresden, Stockholm, and Vienna.

ZEHDENICK, tsā'dĕ-nĭk, town Germany, on the Havel River, 30 miles north of Berlin. It is a chemical and flour-milling center, and the northern terminus of the Voss Canal. A 16th century convent and the ruins of a 13th century Cistercian monastery are in the town. After World War II, Zehdenick was included in the German Democratic Republic (East Germany). Pop. (1946) 13,246.

ZEILA, ZEILAH, or **ZEYLAH,** port town, British Somaliland, on the Gulf of Aden, 25 miles southeast of Djibouti, French Somaliland. It is located on a small peninsula between two shallow bays, and large ships are compelled to anchor some distance offshore. The surrounding region is desolate, but Zeila is astride the most direct trade route between Harar, Ethiopia, and Aden. It exports coffee, hides, sheep, and mother-of-pearl; it imports rice, cotton, dates, and silks. The population, which fluctuates with the seasons, varies between 3,000 and 7,000.

ZEISBERGER, tsīs'bĕr-gĕr, Eng. zīs'bûr-gĕr, **David,** American Moravian missionary among the Indians: b. Zanchtenthal, Moravia, April 11, 1721; d. Goshen, Ohio, Nov. 17, 1808. Educated in Saxony, he emigrated to Georgia in 1738 and in 1740 went to Pennsylvania, where he was one of the founders of the towns of Bethlehem and Nazareth. In 1743 he became a missionary to the Indians, and labored until the breaking out of the Indian war in 1755 among the Delawares at Shamokin (Sunbury, Pa.), and the Iroquois at Onondaga. In the time of the Pontiac conspiracy, he assisted in ministering to the Christian Indians for whom the governor of Pennsylvania had provided a refuge at the barracks at Philadelphia. Peace having been concluded, he led the remnant of these Indians

to Wyalusing, on the Susquehanna, in Bradford County, Pa. In 1767 he penetrated through the wilderness to Goshgoshunk, on the Allegheny, in Venango County, and established a church among the Monseys. He removed with his flock in 1770 to the Beaver Creek, and began another station, called Friedenstadt, in what is now Lawrence County; two years later he explored the Muskingum region, in the present State of Ohio, and laid out an Indian town, Schoenbrunn, on the Tuscarawas. After a time he was joined by all the Moravian Indians of Pennsylvania, whom the march of civilization drove westward. Two more towns were built, a number of other missionaries entered the field, and many new converts were added. In 1782 the Wyandots fell upon the settlement of the Christian Indians at Gnadenhutten and massacred many of them. This was a death blow to the Moravian mission among the Indians. With a small remnant Zeisberger built an Indian town, in what is now the State of Michigan, but in 1786, at the head of a small band of followers, he returned to Ohio, and in the following year commenced a new settlement, which he called New Salem, in Huron County. In 1791 the hostility of other Indians obliged them to emigrate to Canada, where they founded Fairfield, on the river Thames. In 1798 the United States Congress having granted to the Moravian Indians the tract of land in Ohio upon which they had formerly been settled, Zeisberger returned to that country with some of his converts, and near the ruins of their once flourishing towns established a new station, to which he gave the name of Goshen. There he preached the remaining 10 years of his life. His published works are a 'Delaware and English Spelling Book' (1776); 'A Collection of Hymns in Delaware' (1803); 'Sermons to Children,' in Delaware (1803). In recent years have appeared his 'Dictionary in German and Delaware' (1887); 'Diary of David Zeisberger 1781–98' (1888); and 'Essay toward an Onondaga Grammar' (1888). Consult Schweinitz, 'Life and Times of David Zeisberger' (1870).

ZEISING, tsī'sĭng, **Adolf,** German writer on æsthetics: b. Ballenstedt (Anhalt), 24 Sept. 1810; d. Munich, 27 April 1876. He wrote 'Neue Lehre von den Proportionen des menschlichen Körpers' (1854); 'Æsthetische Forschungen' (1855); 'Religion und Wissenschaft' (1873); and several works of fiction. For a time he held a professorship in the Bernburg (Anhalt) gymnasium, but after 1853 devoted himself to letters, residing generally in Munich.

ZEISLER, Fannie Bloomfield, American pianist: b. Bielitz, Austria, 1865. When she was two years of age, her family emigrated to the United States and settled at Chicago, where she showed an early aptitude for the piano. Her first teacher was Bernard Ziehn of Chicago, and she studied later under Carl Wolfsohn in this country. In 1878, she went to Vienna where she studied for five years under Leschetizky, and also made her début in 1883. In 1885 she married Sigmund Zeisler, a Chicago lawyer. Until 1893 she played in concerts in the United States; then toured Germany (1893–95), England in 1898, and returned to America for an extended tour in that year. In 1902, she was again in Europe, touring Germany, Austria and France. After 1903 she remained in the United States, with the exception of one concert tour in Europe in 1912. She was a prominent member of literary and musical clubs in Chicago. Mrs. Zeisler's playing met with the greatest praise. Her interpretation was of much intellectual depth. She founded Fannie Bloomfield Zeisler Musician's Relief Fund, Chicago, in 1925. Died 20 Aug. 1927.

ZEISS, tsīs', **Carl,** German optician: b. Weimar, 11 Sept. 1816; d. Jena, 3 Dec. 1888. He was educated for the medical profession. In 1846 he founded the Carl-Zeiss factory at Jena, which made his name famous the world over as a manufacturer of all sorts of optical instruments. Consult Auerbach, 'Das Zeisswerk und die Karl Zeiss Stiftung in Jena' (3d ed., Jena, 1907).

ZEISSBERG, tsīs'berk, **Heinrich von,** Austrian historian: b. Vienna, 8 July 1839; d. 27 March 1899. He received his education at the University of Vienna and was professor at Lemberg 1865–71. He was professor at Innsbruck 1871–72 and at Vienna 1872–97. He was head of the Institute for Research in Austrian History from 1891 to 1896 and after 1896 was director of the Imperial Literary. Among his works may be mentioned 'Die polnische Geschichtschreibung des Mittel alters' (1873); 'Der osterreichische Erbfol gestreit 1457–1458' (1879); 'Belgien unter der Generalstalthalterschaft Erzherzog Karls' (1893–94).

ZEITUN, zā-toon', or **ZEITAN,** Asiatic Turkey, a town in the vilayet of Marash, 25 miles northwest of Marash, in an iron-mining district, inhabited chiefly by Armenian Christians. The district is fertile but mountainous. The people, distinguished by their martial spirit and their immunity from crimes of violence, are descendants of the Armenian kingdom which existed in Cilicia from the 11th to the 14th century. A sanguinary conflict with Turkish troops soon after the Crimean War drew European attention to the community, and it was stopped by the intervention of the British and French consuls. In 1878, 1890 and 1895 they defended themselves successfully from Turkish oppression, securing favorable conditions of peace. The population suffered greatly from massacres during the European War. Pop. about 20,000.

ZEITZ, tsīts, Germany, a town in the province of Saxony, Prussia, on the Weisse Elster, 23 miles by rail southwest of Leipzig. A gymnasium, and a library in a former Franciscan monastery are among its educational institutions. It is a busy industrial centre with manufactures of woolens, cottons, calicoes, leather, hoisery, mineral oil, sugar, pianofortes, cycles, etc. Pop. 28,000.

ZELA, zē'lą, an ancient town of Asia Minor, in the Pontus, where Julius Cæsar defeated Pharnaces, king of Pontus and son of Mithridates, and announced his victory to the Roman Senate, in the famous brief dispatch, *Veni, vidi, vici* — «I came, I saw, I conquered.» This battle ended the war; Pharnaces escaped into Bosporus, where he was slain by his lieutenant, Asander; Pontus was made a Roman province, and Bosporus was given to Mithridates of Pergamus, 47 B.C.

ZELAYA, sâ-lä'yä, **José Santos,** Nicaraguan politician: b. Managua, Nicaragua, 1853; d. New York, N. Y., May 17, 1919, in exile. As a Liberal leader he engineered a revolution in 1893 against President Roberto Sacaza, who stood for a United States of Central America, and ruled as a dictator, though nominally president, from then until 1909. He took over the Mosquito Indian territory, which had been under British protection. His continual plots led him into conflict with the United States and Great Britain, and resulted in the Washington Conference of 1907. The expulsion of a British consul brought a demand for indemnity, and the execution of two American soldiers of fortune roused the United States to sever diplomatic relations. In 1909 an insurrection put Juan Estrada in power, and Zelaya went into exile. See also NICARAGUA—*History.*

ZELENY, John, American physicist: b. Racine, Wis., March 26, 1872; d. New Haven, Conn., June 19, 1951. Graduating from the University of Minnesota in 1892, he took his Ph.D. there in 1906, meanwhile having studied at the University of Berlin and at Cambridge University. Professor of physics at Minnesota from 1892–1915, he took that position at the Sheffield Scientific School, Yale University, in 1915 and retired as emeritus professor in 1940. He was the author of various papers on physics, particularly on the conduction of electricity through gases, and on kindred subjects.

ZELKOVA, zĕl'kō-vä, an elm-like tree. Five species are found in the Near East, in Crete, the Caucasus, and eastern Asia, and several in Korea, North China, and Japan. Of the family of Ulmaceae, the *Z. serrata* is used widely for timber, the Japanese prizing it especially for building. It makes fine furniture, the old wood being dark and having a beautiful grain. It is a graceful round-headed tree, and looks well in avenues or alone on a lawn. Other varieties are also grown for ornament in the United States, south of New England.

ZELL, tsĕl, **Karl,** German philologist and statesman: b. Mannheim, Baden, Germany, April 8, 1793; d. Freiburg-im-Breisgau, Jan. 24, 1873. A student in Heidelberg, Göttingen, and Breslau, he was made professor of philology at Freiburg in 1821, and as representative of the university in the first Baden chamber in 1831–1835, secured a reorganization of the system of higher education in the grand duchy. He was made a member of the council for higher studies, with the title of ministerial councilor. From 1848 until his retirement in 1855, he was professor of archaeology at Heidelberg. His scholarship is amply shown by his studies of Aristotle and the Aristotelian philosophy. From 1848–1855 he served in the lower chamber of the Diet of Baden, and was noted for his defense of the Roman Catholic Church against its enemies in that body. He was president of the assemblies of the Catholic Union in 1852 and 1853. He wrote books on Aristotle, Calderón, and Shakespeare, and the history of Baden.

ZELLER, tsĕl'lĕr, **Eduard,** German philosopher and theologian: b. Kleinbottwar, Württemberg, Germany, Jan. 22, 1814; d. Stuttgart, March 19, 1908. After studying at Tübingen and Berlin, he became professor of theology at Bern in 1847, and at Marburg in 1849, though opposed by the more orthodox. He forsook theology and the teachings of Hegel, returning to Kant, but after teaching philosophy at Heidelberg and Berlin, he retired to devote himself to historical studies. He founded the *Theologische Jahrbücher,* an important periodical which stressed the historical method in philosophy. Zeller's chief contribution to philosophical thought was in his work on the Greeks.

He published *Platonische Studien* (1839); his most important work, *Die Philosophie der Griechen* (1844–1852; new editions 1921–1923), which became a standard textbook; *Staat und Kirche* (1873); *Geschichte der deutschen Philosophie seit Leibniz* (1873, 1875); and works translated into English, notably *Socrates and the Socratic Schools* (1868); *Stoics, Epicureans and Sceptics* (1870); *Plato and the Older Academy* (1876); *The Pre-Socratic Philosophy* (1881); *The Eclectics* (1883); and *Aristotle* (1897).

ZELLER, zĕl-lâr, **Jules Sylvain,** French historian: b. Paris, France, April 23, 1820; d. there, July 25, 1900. A student in Paris and in Germany, he afterward held the chair of history successively in the lycées of Rennes, Bordeaux, and Strasbourg, in the faculty of Aix and in the Paris Normal School. In 1863 he was made professor of history in the École Polytechnique; in 1874 a member of the Academy of Moral and Political Sciences, and from 1867–1888 was inspector general of higher education. His works include *Les Empereurs Romains* (1863); *Entretiens sur l'histoire du moyen âge,* 4 vols. (1884–1888); *Pie IX et Victor Emmanuel II* (1879); and *Histoire de l'Allemagne* (1872–1894).

ZEMSTVO, zĕmst'vō, or **ZEMSKIYA UCHREJDERIYA** (district institutions), a Russian political body, originally designating the country people, but later used for the governments and their representative bodies, comparing with the state and provincial legislatures in the United States and Canada. The Zemstvo was first mentioned by Czar Alexander II in an imperial edict of 1859, and was officially recognized by him in January, 1864, as a governing institution. Its original intent was the greatest possible development of local home rule, the members of the district assemblies or zemstvos being elected by three different electoral classes—the landowners, the city people, and the country inhabitants—thereby introducing for trial a sort of constitutional representation.

Before long, however, dissensions arose, the central government accusing the zemstvos of assuming too much authority, of becoming too liberal, and by several edicts the orderly development of these districts was checked. Finally by the edict of June 1890, the zemstvo representation was limited to two classes of citizens—the hereditary and personal nobility and the burghers of the cities—thus depriving the peasants entirely of their briefly held elective franchise, their representatives afterward being selected by the governors and by members of the volost assemblies.

ZENANA MISSION, a mission founded in 1852 under the auspices of the Protestant missionary societies in India, with the object

of Christianizing women of the higher classes in the zenanas (harems) to which women missionaries had access. Most of the Anglican members seceded in 1880 to form the Church of England Zenana Missionary Society, later renamed Zenana, Bible, and Medical Mission. Cooperating with Anglican and Presbyterian missions it developed important medical work.

ZEND, more correctly **AVESTAN,** an ancient Iranian language, in which the Zend-Avesta is composed. This language was first introduced to notice by Anquetil Duperron, and the accurate knowledge of it has been developed among others by Rask, Burnouf, Bopp and Haug. It is now recognized to be a coeval and cognate dialect with the Vedic Sanskrit. It embraces two dialects called Bactrian, in contradistinction to the ancient languages of Media and Persia, which are called the Western Iranian, while the Zend or Bactrian dialects are called the Eastern Iranian dialects. The two Zend dialects consist of an earlier and a later, analogous to the Vedic and classic Sanskrit or to the Homeric and classic Greek. The period of transition between them is perhaps from 100 to 200 years. The earlier dialect is called the Gâtha, from the Gâthas or sacred songs which form the only remains of it; the later is that in which the greater part of the Zend-Avesta or Zoroastrian sacred writings are found. They differ both in grammar and pronunciation, they are both highly cultivated languages and rich in inflections, but the earlier is richer in inflections and the later in compounds. The earlier is distinguished by long vowel terminations, probably produced by transcribing the singing pronunciation of the gâthas. The present alphabet is comparatively modern and is probably derived from the Syriac. There are 12 simple vowels, 14 diphthongs and 29 consonants, represented by separate characters. The roots are mostly monosyllabic, some consisting only of a single vowel, others of a vowel and consonant or a vowel between two consonants. These primitive roots are modified by articulate additions, which extend or limit their meaning after the manner of prefixes and suffixes, thus *dâ,* to make, with the addition of *th,* becomes *dath,* to place. Verbal roots undergo modifications producing three distinct forms, the causal, the desiderative and the intensive. Verbs have three voices, active, middle (reflective) and passive; and four moods, indicative, subjunctive, potential and imperative. Some of these moods are double. The tenses include one for the present, four for the past and two for the future. Nouns are formed from roots by means of suffixes. There are three genders, masculine, feminine and neuter. There are also three numbers, singular, dual and plural, with eight inflections in the first and last and five in the middle number. The forms of the declensions closely resemble those of Sanskrit; and there are many other analogies between the Gâtha dialect and the Vedic Sanskrit. See also AVESTA.

ZENGER, John Peter, American printer and journalist: b. Germany 1697; d. New York July 28, 1746. His family was one of many Palatines sent to New York in 1710 by Queen Anne. A year later the 14-year-old boy was apprenticed to the printer William Bradford (q.v.) for an eight-year term. After expiration of his indenture he moved to Chestertown, Md., but soon returned to New York and in 1723 was made a freeman of the city. In 1725 he formed a partnership with Bradford which lasted but a year. In 1730 he printed Peter Venema's *Arithmetica,* the first arithmetic text printed in New York. He began the publication of the *New-York Weekly Journal* on Nov. 5, 1733, an organ opposed to the governor but supported by Chief Justice Lewis Morris and other leading men who undoubtedly contributed its major articles. The paper greatly influenced public opinion against the government, and Zenger was arrested Nov. 17, 1734 on a charge of publishing seditious libels. He was imprisoned for nearly ten months before his trial, at which he was defended by Andrew Hamilton (q.v.) of Philadelphia. His acquittal by the jury in August 1735 was regarded as the first important victory for the freedom of the press in the English colonies. His newspaper reported the trial verbatim, and a year later (1736) he published separately *A Brief Narrative of the Case and Tryal of John Peter Zenger* which went through numerous editions. After his death the *Journal* was published by his widow until December 1748, then by John Zenger, a son by his first marriage, until 1751 when it ceased publication.

ZENITH, the vertical point of the celestial sphere at any place, where the plumbline, extended upwards, would pierce it. A plane passed perpendicular to the plumbline, through the observer's eye, cuts the celestial sphere in the true horizon, hence the zenith is everywhere 90° from that plane.

ZENITH SECTOR, an astronomical instrument consisting of a telescope swinging upon pivots and having attached to it an arc graduated into degrees and minutes. It is used for the same purpose as the mural circle, namely, to ascertain the zenith distance of the several stars.

ZENITH TELESCOPE, an instrument used in both field astronomy and at fixed observatories for the accurate determination of latitude. The instrument consists essentially of a telescope which is mounted to the side of a vertical, fixed pillar, being supported at one end of a horizontal axis, perpendicular to the vertical pillar. The axis has a counter weight at the other end and in its middle a pivot attached to the pillar, which permits it to revolve in azimuth. The telescope itself can rotate in a vertical plane, and a circle attached to the axis permits it to be pointed to any altitude or zenith distance. A very sensitive level is also attached.

The instrument is used in the following manner. The latitude of the place must be approximately known already, either from sextant or other type of observation. Two stars, whose declinations are accurately known, are chosen so that one crosses the meridian about as far north of the zenith as the other does south. They should *not* differ by more than fifteen minutes in right ascension. Their actual zenith distances will then be $Z_1 = \delta_1 - \phi$ and $Z_2 = \phi - \delta_2$ respectively, where δ_1 is the declination of the northern star, δ_2 that of the southern star, and ϕ the desired latitude. The telescope is then set and clamped at such a zenith distance that both stars will cross its field not more than about half

a radius from the central horizontal wire. The telescope is provided with a good filar micrometer. With this, the distance of the first star as it crosses the meridian is measured from the central wire. Without disturbing the angle the telescope makes with the vertical, it is then rotated 180° and the second star is similarly observed. Combining the two equations above we then get

$$\phi = \tfrac{1}{2}\ (\delta_1 + \delta_2) + \tfrac{1}{2}\ (Z_2 - Z_1)$$

In this the declinations are known from the star catalogues, the zenith distances have just been determined, hence we solve at once for ϕ, the latitude. As at large zenith distances refraction errors become greater, the method is most accurate for stars within 15° ± of the zenith, while 30° would be about the limit. The method just described is known as Talcott's Method because first practically employed in 1832–1836 by Capt. Andrew Talcott of the United States Engineers in the Ohio-Michigan boundary survey.

A zenith telescope, in which the whole instrument floats in a basin of mercury, has been devised by B. Cookson and used at the Greenwich Observatory. The observations are made photographically by allowing the stars to trail across the field. The reductions are of the same type as with the visual type of instrument. Older methods of latitude determination, which employed the prime vertical instrument, are no longer in general use.

CHARLES P. OLIVIER.

ZENITH TUBE, an instrument designed for very accurate determinations of latitude by observing stars which transit the meridian close to the observer's zenith, or (when the latitude is known) for determining the declinations of such stars. It consists of a rigid, immovable telescope tube so mounted as to point always to the zenith; the plane of the telescope lens is thus horizontal. Within the tube, at a distance below the lens of slightly less than one-half of the focal length, there is a basin of mercury; the rays from a zenith star after passing through the objective are reflected from the mercury surface and finally come to a focus and form the image a short distance above the lens, a hole being drilled through the center of this to allow of their passage. The micrometer wires are adjusted above the lens in this focal plane, both they and the image being reflected horizontally from a prism placed at this point into the eyepieces, of which there are two on the sides of the main tube, one to the east and one to the west of it.

The great advantage possessed by the instrument consists in the fact that the observer's horizon (and, therefore, his zenith) is determined wholly by the surface of the mercury; the more usual level tubes, which always present irregular and annoying anomalies when employed for work of the highest accuracy, are wholly dispensed with. Only stars which enter the fixed field of the telescope, and hence pass within a few minutes of the zenith, can, however, be observed with it.

In 1904 a large zenith tube with an eight-inch aperture was installed in Flower Observatory at the University of Pennsylvania in Philadelphia in order to find out if certain sudden changes of local latitude, sometimes amounting to several feet, had real existence or arose from undetected changes in the zenith telescope previously used for determining latitudes. Both instruments agreed in their indications, and the cause of the changes in latitude is not yet known.

ZENJAN, zĕn-jän′, or **ZINJAN,** zĭn-, town, Iran, in First Province (former Khamseh Province), on the Zenjan River, 180 miles northwest of Teheran. An agricultural center, it has manufactures of cutlery, rugs, and cotton goods. The population is mainly Turkic. Pop. (1941) 39,450.

ZENKER, Friedrich Albert von, German pathologist: b. Dresden, March 13, 1825; d. Reppentin, Mecklenburg, June 13, 1898. From 1851 he was connected with the city hospital of Dresden. Professor of pathological anatomy and pharmacology at Erlangen in 1862, in 1865 he became joint editor of the *Deutsche Archiv für klinische Medizin.* In 1860 he discovered that the parasite *Trichina spiralis,* detected by Dr. Sir James Paget in 1835, was the cause of the sometimes fatal disease, trichinosis.

ZENO, zē′nō, emperor of the East (Byzantine empire) from 474 to 491 A.D. An Isaurian by birth and named Trascalisseus he changed his name to Zeno upon his marriage to the daughter of Leo I. He commanded the imperial guards and armies, and was elevated to the consulship in 469; procured the assassination of Aspar, the minister of Leo, in 471, and usurped the crown on the death of Leo in 474. He was driven out of his capital by Basilicus, who was proclaimed emperor in 475, but regained Constantinople in 477 by buying over Harmatius, the nephew and general of Basilicus, who was deposed and died shortly afterward. In 478 a Gothic invasion was bought off; in 479 a revolt in Constantinople was put down by corrupting the troops engaged; a second Gothic invasion was bought off, and a third was repelled by purchasing the aid of an opposing party among the Goths, one of whose chieftains, afterward Theodoric the Great, was made consul in 484. Having quarreled with Theodoric, Zeno in 488, anxious to save himself and his capital, persuaded him to invade Italy, and expel Odoacer and the Heruli. Among the more important events of his reign was the publication of the so-called *Henoticon* (482), or *Decree of Union,* intended to adjust the controversy between the Monophysites (q.v.) and the Orthodox Church.

ZENO, Apostolo, Italian dramatist and literary historian: b. Venice, Dec. 11, 1668; d. there, Nov. 11, 1750. He was a cofounder (1710) of the critical periodical *Giornale dei Letterati d'Italia,* in 1718–1729 was court-poet and historiographer to the Holy Roman Emperor Charles VI at Vienna, and made his reputation in Italian literature by libretti for the musical drama, which in his work attained real literary rank. For many years he was Italy's leading dramatic poet. He was also a scholar, antiquary and well-known numismatist. His collected dramas appeared in 1744. Among his further writings is the *Dissertazioni Istorico-Critiche e Letterarie* (1752–1753).

Consult the *Life* by Negri (1816); Fehr, M., *Apostolo Zeno und seine Reform des Operntextes* (1912).

ZENO, Nicolò and **Antonio,** Venetian navigators of the late 14th and early 15th centuries. Antonio about 1390 fitted a ship with which he sailed northward on the Atlantic. He was

wrecked on one of the Faroe islands. Here he would have been killed by the Scandinavian natives had he not been opportunely rescued by Earl Sinclair, whom Haakon VI of Norway had invested with the Orkneys and Caithness. He was made commander of the earl's small fleet, and in 1393 or 1394 sailed with three ships to Greenland, where he spent some time. He died in the Faroes about 1395. Antonio went out to the Faroes in 1391, and was in Sinclair's service for 14 years, dying at Venice in 1406. After Nicolò's death he was commander of the fleet; and on one occasion, to verify fishermen's reports of land some 1,000 miles westward, he undertook a voyage of discovery in the Atlantic. He described his adventures in a letter, and on this letter and some others and a sailing-chart, probably made by Antonio, is based a work containing matter of some interest in connection with pre-Columbian discovery in the New World. The letters were worked into a narrative, and, with a copy of the map, appeared in book-form in 1558. The narrative says that a fisherman, returning to the Faroes after a 26 years' absence, told of a land called Estotiland, where there was much gold and forest. The people built small boats and traded with Greenland. The description of Estotiland is vague, and contains little to suggest North America. But a voyage was undertaken from Estotiland to a region southward, called Drogio. There, said the fishermen, the people were cannibals. «They have no kind of metal. They live by hunting, and carry lances of wood, sharpened at the point.» Farther south, «they have cities and temples,» as well as «some knowledge and use of gold and silver.» The honesty of the Zeno narrative has been sufficiently well established; but whether or not the fisherman had the experiences he narrated in Drogio, and whether that may be identified with North America, are questions that have been much debated. The map, drawn from hearsay, and necessarily of the vaguest character, was accepted as authentic and caused trouble for mariners and geographers for more than a century. Consult Major, 'The Voyages of Nicolò and Antonio Zeno' (Hakluyt Society, 1873), with a translation of the narrative and a copy of the map; and Fiske, 'The Discovery of America' (Vol. I, 1892).

ZENO (zē'nō) (Gk. Ζήνων) **OF CITIUM**, ancient Greek philosopher: b. Citium, island of Cyprus. He flourished in the late 4th and early 3d century B.C., and was the founder of the Stoic school of philosophy (see STOICISM). The circumstances of his life are not well known. Tradition says that after suffering shipwreck near the Peiræus, and according to one account losing his all, while by another his wealth amounted to 1,000 talents, he settled at Athens. There he early made himself remarked for the virtues of moderation and contentment, and during his long life he so acquired the esteem of the citizens that they voted him a crown of gold and a public burial in the Ceramicus. He is said to have declined the citizenship of Athens from fidelity to his native country. He first resorted to the teaching of the Cynic Crater, and by this school his own views, especially in the earlier period of his career, were much influenced. It may seem surprising that Zeno, who rejected both the contempt for established usages and for general knowledge which distinguished the Cynics, should have attached himself to that school, but the central point of every true system of philosophy is its ethics, and he was attracted to the Cynics by their doctrines of moral obligation, which he made the foundation of his own system. Contrary to the advice of Crater he afterward studied under Stilpo the Megarian. Among his subsequent advisers or teachers are enumerated the Megarians, Cronus and Philon, and the Academics, Xenocrates and Polemon. Of the last two he is said to have been a pupil. He maintained a friendship with Antogonus Gonatas, king of Macedon, of whom his disciples Persæus and Philonides were companions. About 310 B.C. he opened his school in the Ποικλη Στοά (*Stoa*), or «Painted Porch.» This place, which was adorned with paintings by Polygnotus, had formerly been the resort of a school of poets, who were from this circumstance called Stoics, and the name was now transferred from them to the disciples of Zeno, who at first had been called Zenonians. All the works of Zeno are lost. They were numerous, and include treatises 'On the State' (early and of cynical tendencies); 'On the Ethics of Crater'; 'On Life According to Nature'; 'On Impulse'; 'On the Nature of Man'; 'On the Affections'; 'On the Becoming' (or Fitting); 'On Law,' and 'On Grecian Education'; various treaties on physics, logic and poetry, and a work on the Pythagorean doctrine. Concerning the doctrines of Zeno, which employed very largely the ethics of the Cynic school, as well as the physics of Heraclitus and Pythagoras, see STOICISM; and consult also Zeller, 'Stoics, Epicureans, and Skeptics' (1870); Ueberweg, 'History of Philosophy' (Eng. trans., 1887); and Ritter and Preller, 'Historia Philosophiæ Græcæ' (8th ed., 1898).

ZENO OF ELEA, ancient Greek philosopher: b. Ele (Velia), Lucania, southern Italy, about 488 B.C. He was the favorite disciple of Parmenides, whose opinions he defended, and whose ethico-political schemes he shared. He appears to have lived for a considerable time in Athens, where he taught for remunerations, and had distinguished pupils, as Pericles and Callias. He is said, on unsatisfactory evidence, to have engaged in an enterprise on behalf of his native land against the tyrant Nearchus. Whether he perished in this attempt or survived is not known. None of his writings are extant, but his opinions are referred to by Aristotle, who attempted to confute some of them, and who had distinguished him as the inventor of dialectic. As a defender of the Eleatic doctrine of the unity of the existent, he was the first to lay down the problems of skepticism in regard to the real existence of the phenomenal world, and has thus exercised an important influence on philosophy. He is said to have directed four arguments against the reality of motion. These all are very similar to one another; the two most famous are those of the flying arrow and of Achilles and the tortoise. The first finds a contradiction in the properties of the arrow, which cannot be where it is not, but is at rest if it remain where it is. That is, al-

though a body in motion is in motion throughout its course, if any instant of the existence of the body be considered in itself, there is no distinguishable property of the body which can be called motion. Bergson considers that the paradox, which was stated by Zeno in order to prove the specious character of motion and change, is insoluble on any view which analyzes motion into a series of states. An answer to the paradox which is more in favor among scientists follows outlines that had already been indicated by Aristotle, and depends upon the fact that the velocity or measure of motion of a body is a limit — the limit of the ratio of the distance traversed by a body, divided by the time which it takes the body to traverse the distance, as this time grows smaller and smaller. The distinction between a property of a body at an instant, and the limit of a property of a body in the neighborhood of that instant, is all-essential for the explanation of the paradox. This distinction was only rendered clear in the last century by the development of the theories of assemblages and of the functions of a real variable, which made clear the nature of continua and of continuous functions. It will be seen, then, how incorrect is the often-repeated statement that the paradoxes of Zeno were dialectical puerilities which were completely refuted by Aristotle.

The other famous paradox of Zeno is that of Achilles and the tortoise. Achilles, the swiftest of mortals, can never catch up with the tortoise, because when he reaches the tortoise's former position, the animal is no longer there, so that he has to traverse an infinite number of distances to overtake it. This argument is completely dependent on a clear distinction between the measure of an interval and the number of points it contains — a distinction whose true import has only been understood within the past 50 years. Zeno, in his arguments against motion, exhibits a truer appreciation of the nature of this process than is evinced by many moderns in their support of it.

In another argument, designed to establish the fallacious nature of sense-perception, Zeno shows his knowledge of the existence of sensory limina (see WEBER'S LAW). He points out the difficulty of understanding how, if the fall of one grain of wheat makes no audible noise, the fall of a bushel can be heard. See TIME; SPACE; ASSEMBLAGES, GENERAL THEORY OF; REAL VARIABLE, THEORY OF FUNCTIONS OF THE.

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ZENO OF SIDON, Epicurean philosopher: b. about 150 B.C.; d. about 80 B.C. He was a contemporary and instructor of Cicero, who refers to him in 'De Natura Deorum' (i, 34), as an accurate and highly cultivated thinker, but one who was scornful of other philosophers. His works are not in existence, but a treatise by Posidonius gives a summary of his beliefs and teachings.

ZENOBIA, zĕ-nō'bĭ-ạ, queen of Palmyra (q.v.). Her native name was Septimia Bathzabbai, and she was instructed in the sciences by the celebrated Longinus, and made such progress that besides her native tongue she spoke the Latin, Greek, Coptic and Syrian languages. She also patronized learned men, and herself formed an epitome of Egyptian history. She was married to Odenathus, king of Palmyra, accompanied him both in the war and the chase, and the success of his military expedition against the Persians is, in a great degree, attributed to her prudence and courage. Gallienus, in return for services which tended to preserve the East to the Romans after the capture of Valerian by Sapor, king of Persia, acknowledged Odenathus as emperor, and on his death, 267 A.D., Zenobia assumed the sovereignty, under the title of Queen of the East. She preserved the provinces which had been ruled by Odenathus, and was preparing to make other conquests, when the succession of Aurelian to the purple led to a remarkable change of fortune. That martial prince, disgusted at the usurpation of the richest provinces of the East by a female, determined to make war upon her: and having gained two battles, Antioch and Emesa, beseiged her in Palmyra, where she defended herself with great bravery. At length, finding that the city would be obliged to surrender, she quitted it privately; but the emperor, having notice of her escape, caused her to be pursued with such diligence that she was overtaken just as she got into a boat to cross the Euphrates, in 272. Aurelian spared her life, but made her serve to grace his triumph. The Roman soldiers demanded her life, and according to Zosimus she purchased her safety by sacrificing her ministers, among whom was the distinguished scholar, Longinus. She was allowed to pass the remainder of her life as a Roman matron, and her daughters were married by Aurelian into families of distinction. Her only surviving son retired into Armenia, where the emperor bestowed on him a small principality. Consult Gibbon, 'Decline and Fall' (ed. Bury, 1896–1900); 'Life of Aurelian' by Vopiscus in 'Augustæ Historiæ Scriptores' (Eng. trans., Bernard 1740); Ware, 'Zenobia, or The Fall of Palmyra' (1837).

ZENOBIA, or THE FALL OF PALMYRA, a noted historical novel, by William Ware, first issued in 1837 in the *Knickerbocker Magazine,* and then entitled 'Letters from Palmyra.' It was shortly afterward published in book form, and later editions were issued from time to time for more than 50 years.

ZENOS, zē'nŏs, **Andrew C.,** American theologian: b. Constantinople (Istanbul), Turkey, 13 Aug. 1855; d. Chicago, Ill., 25 Jan. 1942. After being graduated from Robert College, Constantinople, in 1872, he came to the United States and was graduated from Princeton Theological Seminary in 1880. Ordained to the Presbyterian ministry in 1881, he was pastor at Brandt, Pa., 1881–83; professor of Greek, Lake Forest University, 1883–88; professor of New Testament exegesis, Hartford Theological Seminary, 1888–91; professor of church history, 1891–94; professor of historical theology, after 1894, and dean after 1920 of Presbyterian (formerly McCormick) Theological Seminary. His writings include 'Compendium of Church History'; 'Elements of Higher Criticism'; 'Teachings of Jesus Concerning Christian Conduct';

'The Son of Man'; and 'Presbyterianism in America.' He also edited (with Francis W. Kelsey) Xenophon's Anabasis (1889–98).

ZENTA, or SENTA, Jugoslavia, a town in Bács-Bodrog, on the Theiss, 120 miles southeast of Budapest. Here, 11 Sept. 1697, the Germans under Prince Eugene of Savoy, defeated the Turks, a victory which led to the Peace of Carlowitz, ratified January 1699. Pop. about 30,000.

ZEOLITE, a name given to a group of hydrated silicate minerals commonly found in cavities n igneous rocks, from which they are derived through secondary alteration. They include thompsonite, natrolite, scolecite, analcite, chabazite, gmelinite, phillipsite, harmotome, stillite and heulandite. The name is derived from the boiling reaction before the blowpipe.

ZEPHANIAH, zĕf-ą-nī'ą, the ninth in order of the Scriptural writers known as the minor prophets. His pedigree is traced back for four generations. He is the son of Cushi, the son of Gedaliah, the son of Amariah, the son of Hezekiah and he is supposed to have been of noble, if not of royal, ancestry. His brief but pregnant prophecy was delivered just after the time of the first appearance of Jeremiah (626 B.C.)—that is, in the first half of the reign of Josiah. The next preceding prophet was Micah, who died in the early part of the reign of Manasseh. But the condition of the whole of western Asia, including Palestine, portended a speedy upheaval. Above all, Nineveh was beginning its memorable decline after the death of its king. Assur-banipal (668–626 B.C.). Morally and religiously the Jewish nation had improved but little since the degeneracy that had followed the death of Hezekiah, and Josiah's reform (621 B.C.) had not yet begun, if we may judge the invectives of the prophet against idolatrous practices. Zephaniah was apparently a descendant of King Hezekiah.

The Prophet's Message.—Zephaniah spoke and wrote primarily for the correction and warning of Judah and Jerusalem, though he draws illustrations from the sins and fates of other peoples. The culmination of these is found in the iniquities, the pride and the speedy fall of Nineveh. His prophecy extends to three chapters in the Bible. A division into four parts is as follows:

The threatening: ch. i (1), the whole world—that is, the Semitic world—is to undergo exemplary punishment, particularly Jerusalem and its apostates from Jehovah (ver. 1–6). (2) The classes of people who are to be thus visited—the royal house, the nobles, the wealthy traders, the careless and defiant generally—are characterized, and their chastisement set forth in language largely figurative (ver. 7–18).

The lessons from the nations: ch. ii. God's own people are warned to repent in time (ver. 1–3), and so avoid the doom that is about to fall upon the Philistines (ver. 4–7), Moab (ver. 8–11), Egypt, under the name of Ethiopia (ver. 12), and finally Assyria and Nineveh (ver. 13–15).

The remonstrance: ch. iii, 1–7. Rebellious and obstinate Jerusalem is urged to repent by the righteous and reasonable God, in view of coming woes; for the lesson of the fate of other nations has so far been unheeded.

The promised redemption: ch. iii, 8–20. (1) The faithful remnant is bidden to wait and trust. It shall survive the ruin of the nations, be joined by exiled brethren from far and near, and rest in quiet content (ver. 8–13). (2) Joyous thanksgiving is now in place, for Jehovah is in the midst of Jerusalem, to comfort and bless his people. Their reproach is taken away; dispersion and captivity are at an end.

ZEPHANIAH, Book of. The title of the book of Zephaniah says that the prophetic message was given in the days of Josiah, king of Judah, 639–608 B.C. Since that time is appropriate for the book, the title is usually considered to rest upon an historical basis, although other suitable times for these utterances might be found. In the title Zephaniah is said to have been the great-great-grandson of Hezekiah, by whom the king of that name is doubtless meant. This also is generally accepted, since the book contains nothing out of harmony with the royal descent.

It is evident that the message of Zephaniah must have preceded the introduction of the Deuteronomic law in 621. This is because the conditions here reflected are such as doubtless belonged to the early part of the reign of Josiah, but were somewhat changed, perhaps only temporarily, by the Deuteronomic reform. The characteristic features are religious syncretism, astral worship, imitation of foreign customs, and scepticism, i, 4–6, 8, 9, 12. Since the book shows no clear influence of Jeremiah it is probably to be dated not later than the beginning of his work. That indicates a date of about 627 B.C.

The background of the book is some great invasion affecting many lands. At the time mentioned that must have been the Scythian invasion, alluded to in Jeremiah i, as a danger from the north. The invasion cannot have come from Egypt or Assyria, since both are mentioned as affected by it, ii, 12. This Scythian invasion, it is known, affected Assyria and extended to the borders of Egypt, overrunning also several of the intermediate countries. It lasted for a considerable number of years, and, while its limits cannot be determined with entire certainty, the year mentioned, 627, was quite evidently near the beginning of its course.

The theme of the book is the coming of the day of Yahweh. This is probably not to be regarded as identified with the Scythian invasion, but the latter is an introductory movement indicating that it is at hand. The day of Yahweh is first mentioned by Amos, and then as a familiar idea. As here presented the destruction of that day is to engulf Judah, Philistia, Moab, Ammon, Ethiopia (Egypt) and Assyria; but the mention of Moab and Ammon is often considered a later addition. That day, while regularly a day of world-judgment in some real sense, is here presented in unusually vivid terms as a day of universal judgment and destruction. The judgment upon Judah has an ethical basis, a point which does not appear in the condemnation of the other nations.

Zephaniah, like Amos whom he resembles, is distinctly a prophet of judgment. Most of the book gives little suggestion of mercy. At the end, however, are several verses of a different tenor which, as in the parallel case in Amos, are to be regarded as a later addition.

This applies most clearly to iii, 14-20. Here is a message of restoration of the people now scattered among the nations. This belongs to the exile or, more probably, after the exile. iii, 9–10 is probably also a later addition because its attitude toward the nations is out of harmony with most of the book. Other passages sometimes considered to be later are less certainly so; most prominent among these is ii, 8–11, which has suggestions of the exile.

While Zephaniah adds nothing of fundamental importance to the messages of the line of prophets who have preceded him, yet his utterance is characterized by a zeal for righteousness and a vigor of presentation not unworthy of that goodly fellowship. Historically, his testimony to the conditions in the time shortly before the reform of Josiah is of much value.

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ZEPHYR, a soft, cool, agreeable wind; in Greece the west, or rather west-southwest wind, typified in Greek mythology by the god of the west wind Zephyrus (q.v.). The Greek name, according to the etymology, signifies life-bringing, because at the time when this wind begins to blow, the plants are restored to life by the balmy spring air.

ZEPHYRANTHES, a genus of *Liliaceæ,* indigenous to the warmer regions of America, and most commonly represented by the atamasco lily. The species are bulbous, and are not hardy in the Northern States, but make charming summer-blooming window and greenhouse plants, resting in the winter. The foliage is linear, springing from the bulb, and a scape, appearing at the same time, is crowned by a regular, three-parted corolla which is nearly, or quite, erect, from one to three inches across, and red, yellow or white. *Z. candida* is one of the white-flowered species, and is also one of the hardiest and thriftiest. It is a lovely, crocus-like plant, with pure-white blossoms, opening out flat in the sunshine, and evergreen foliage.

ZEPHYRUS, zĕf'ĭ-rŭs, in Greek mythology, the god of the west-wind, a son of Æolus, or of Astræus and of Aurora. He was married to Chloris, goddess of fruits and flowers, their son being Carpus, god of fruit. By the harpy Podarge he was the sire of the swift horses of Achilles, Xanthos and Balios. His love being rejected by Hyacinthus, he was the cause of his death by blowing Apollo's quoit against his head. Some make him the husband of one of the Hours. Flowers and fruits are under his protection. He is represented as a gentle beautiful youth, naked, with a wreath on his head or flowers in the fold of his mantle. According to Homer he was brother to Boreas, with whom he lived in a palace in Thrace. The Romans identified him as Favonius, and his wife, Chlris, as Flora.

ZEPPELIN, tsĕp'pĕ-lĭn, **Ferdinand,** COUNT VON, German airship builder: b. Constance, Baden, 8 July 1838; d. Charlottenburg, Prussia, 8 March 1917. His father was Count Friedrich von Zeppelin, a Württemberg court official. After studies at the Stuttgart Polytechnicum, the Ludwigsburg Military Academy and the University of Tübingen, he entered on a military career and as a lieutenant was one of the German military observers in 1863 attached to the Army of the Potomac during the Civil War in the United States. His first ascent in a balloon made at Saint Paul, Minn., during this visit, is said to have been the incentive of his later experiments in aeronautics. He took part in the Seven Weeks' War of 1866, fighting for Württemberg against Prussia, and was an officer of cavalry in the Franco-German War 1871–72. He rose to the rank of lieutenant-general in the German army and in 1891 at the age of 53 retired and devoted his time and wealth to experiments in connection with dirigible balloons. While increasing proofs of success encouraged him to continue his efforts, a record of failures which reduced him to poverty marked his experiments for several years. Imperial patronage and public subscriptions, however, enabled him at last to conquer all difficulties, and in 1908–09 dirigibles of the type constructed with his name were making successful journeys ranging from 350 to 1,000 miles. Thirteen Zeppelins, however, had been destroyed and numerous lives sacrificed during the experiments up to 1914. During the European War, Zeppelins were used mostly for raids over Belgium and England, and over 40 were reported as destroyed. Their failure as warships is said to have been a great disappointment to Count Zeppelin. (See AERONAUTICS; DIRIGIBLE). Consult Hearne, R. P., 'Zeppelins and Super-Zeppelins' (New York 1916).

ZERAFSHAN, zĕr-äf-shän', Uzbekistan, a river rising in a valley at the junction of the Hissar and Turkestan Mountain chains, and after a westerly by north course of about 400 miles, passing the towns of Penjakent, Samarkand, Katakurgan, Kerminch and Bokhara, dispersing itself in the desert sands, between Karakul and the Oxus River. A railway line traverses the valley from Karakul to near Penjakent.

ZERAH, (Heb. *Zarach*), king of Ethiopia, known to the Egyptians as Azech Amen, who flourished in southern Egypt about 900 B.C. He conquered Egypt and invaded Palestine, where he was defeated by Asa, king of Judah. Zerah then abandoned not only Palestine, but also Egypt (2 Chron. xiv).

ZERBI, or DE ZARBIS, Gabriel, Italian physician and anatomist: b. Verona in the 15th century; d. there, 1505. He lectured for some time at Rome, and became professor of medicine at Padua in 1495. His chief work is 'Anatomy of the Human Body' ('Liber Anatomiæ Corporis humani'), published about 1490, a work remarkable for its keen insight and deductions confirmed by later discoveries in anatomy.

ZERBONI DI SPOSETTI, Joseph, German philosopher: b. Breslau, 1760; d. 1831. In 1796 he wrote to the governor of Silesia a letter in which he set forth the absurdity of granting to the nobility exalted privileges through

right of birth. Knowledge of the letter reaching Frederick William III, he was imprisoned for three years on a charge of high treason. When his case was brought to trial he was freed, with no political disability, and later received various official appointments.

ZERBST, tsĕrpst, Germany, a town in the State of Anhalt, on the Nuthe, a small tributary of the Elbe, 70 miles southwest of Berlin, and 27 miles southeast of Magdeburg, on the Dessau-Leipzig Railway. The chief buildings are the great Schloss in a fine park; the 15th century Nikolaikirche, and the stately 15th century Rathhaus on the market place where are the Roland column (1445) and the Butterjungter, a slender column bearing a female figure. The chief educational institution is the Francisceum, a gymnasium of high repute. The town has manufactures of noted bitter beer, of silks, plush, cloth, leather, machinery, musical instruments, etc. Zerbst was founded in 1007. From 1603 to 1793 it was the capital of a principality of the same name, which in 1797 was absorbed in Anhalt-Dessau. Pop. of commune about 19,210.

ZERFFI, George Gustavus, English author: b. Hungary, 1821; d. Chiswick, England, 28 Jan. 1892. He edited a newspaper at Budapest, and in 1848 served as a captain in the revolutionary army. He also acted for a time as Kossuth's private secretary. On the failure of the revolution in 1849 he went to England and was naturalized, and some years later was engaged as a lecturer in the department of art at South Kensington. Throughout his career Zerffi gave much attention to the subjects of decoration and history, and wrote many works treating these themes in a comprehensive manner. He asserted that history should be studied as a whole on philosophical principles. He planned a general work on these lines entitled 'Studies in the Science of General History,' of which two volumes were issued, dealing with ancient and mediæval history respectively. Among his other publications are 'A Manual of the Historical Development of Art, with Special Reference to Architecture, Sculpture, Painting and Ornament' (1876); an English version of Goethe's 'Faust' with critical and explanatory notes (1859); he also published a number of his lectures.

ZERIBA, or **ZAREEBA,** a temporary military enclosure, the sides of which are formed of prickly brush wood, sheltered by which a force may camp comparatively safe from sudden surprise. The term came into prominent use during the Anglo-Egyptian campaign of 1884. The protection is also used against wild animals.

ZERMATT, tsĕr-mät', or zĕr-mät' (formerly called **PRABORGNE**), Switzerland, a mountain village and tourist-resort in the canton of Valais, at the foot of the Matterhorn and near the head of the Visp Valley, 22½ miles by rail southwest of Visp. It stands 5,315 feet above sea-level, having to the south the great Théodule glacier, above which tower the Breithorn on the east, and beyond the Monte Rosa group, and on the west the rocky cone of the Matterhorn. An electric mountain railway connects with the Riffelberg and the summit of the Gornergrat (10,290 feet). The Théodule Pass or Matterjoch (10,899 feet) leads to Aosta in Italy. Its scenery compares in grandeur with that of Grundewald and Chamonix. In the village churchyard are the graves of many victims of mountaineering. Pop. about 750.

ZERO, *in mathematics,* the absence of magnitude; the remainder that is obtained when any quantity is subtracted from itself; nothing, considered as a quantity; that which separates real positive quantities from real negative quantities. Zero is denoted by the symbol 0 ("cipher"), and this symbol itself is often called "zero." In the theory of functions, any value of a variable which reduces a given function of that variable to zero is called a "zero" of the given function. In infinitesimal analysis, infinitesimal quantities are sometimes called zeros. This usage is incorrect, and it leads to confusion of thought. An "infinitesimal" has an actual magnitude, and although that magnitude is smaller than any quantity that can be definitely stated or assigned, the fact that it exists distinguishes the infinitesimal from zero, properly so-called.

In physical measurement, the "zero" of any scale is the starting point from which measurements on that scale are reckoned. In thermometry (q.v.) it is customary to distinguish three different kinds of zeros. These are, respectively, (1) the arbitrary zero, (2) the "natural" zero and (3) the "absolute" zero. The arbitrary zero on such a scale is a zero that is selected arbitrarily, as a convenient point of reference; the selection being governed by practical considerations of convenience, or by the facility with which the point can be experimentally determined. (See THERMOMETER). The "natural" zero is employed chiefly in connection with the gas thermometer. In a gas thermometer in which the temperature is indicated by the expansion of a given volume of gas at constant pressure, the "natural" zero is the temperature at which the volume of the gas would just vanish, if the contraction of the gas were to follow, at very low temperatures, the law of variation with temperature that prevails between the freezing and boiling points of water. Similarly, in a gas thermometer in which temperature is measured by the change in pressure of a mass of gas that is confined at constant volume, the "natural" zero is the temperature at which the pressure of the gas would just vanish, if the law of variation of pressure were the same, at very low temperatures, as it is between the freezing and boiling points of water. The "natural" zeros of the various gas thermometers that are in actual use are not identical, but their positions differ only by a few degrees, at the most.

The "absolute" zero of temperature is the temperature that a body would have, if it were absolutely deprived of heat; and this "absolute" zero is identically the same for all substances. It happens that the "absolute" zero has nearly the same position on the thermometer scale as the "natural" zeros of the various gas thermometers that are in use, and this fact has led to a great deal of confusion in popular and semi-scientific writings upon the subject of temperature, the "natural" and "absolute" zeros being

very commonly confounded with one another. The "absolute" zero is slightly lower than the "natural" zero of any gas thermometer that we know of, with the possible exception of the "natural" zero of the hydrogen thermometer. There is some reason for believing that the "natural" zero of the normal hydrogen thermometer (whether at constant volume or at constant pressure) is a few hundredths of a centigrade degree lower than the true "absolute" zero. If further research bears out this opinion, then it is plain that the "natural" zero of the hydrogen thermometer can never be attained; for the "absolute" zero, being the temperature corresponding to absolute cold, is the lowest temperature that can possibly have a real existence. On the absolute centigrade scale, the temperature of the "absolute" zero is approximately 273.10° below the freezing point of water. This estimate is probably in error by a few hundredths of a degree. There is no theoretical reason why the position of the "absolute" zero cannot be determined to the thousandth of a degree; but the experimental data required for such a determination are not yet available. See THERMODYNAMICS.

ZERRAHN, Carl, American musical conductor: b. Malchow, Mecklenburg, 28 July 1826; d. Milton, Mass., 29 Dec. 1909. In 1848 he came to America as flute-player with the Germanica Orchestra, and six years later became director of the Handel and Haydn Society of Boston, a position he held for 42 years. He was conductor of the Harvard Symphony concerts 1861–82, and for several years was a successful director of famous musical festivals throughout New England, among them being those at Worcester, Mass., which he conducted in 1866–97. He retired in 1898.

ZERUBBABEL, zĕ-rŭb'ą-bĕl, leader of the first band of Israelitish exiles returning from Babylon. His name in the Captivity was Sheshbazzar. He was the recognized prince of Judah, son of Shealtiel, governor of Judah (Hag. i, 12, 14), and on arrival at Jerusalem, with Jeshua, the high-priest, directed the renewal of public daily worship and of festival days, and in the second month of the second year of the return, the reconstruction of the Temple. This last work was stopped by their foes and revived only after 16 years, when it was again undertaken and finally completed by Zerubbabel and Jeshua.

ZETA, zē'tą, (1) the Greek equivalent of the English letter Z, and sixth in the Greek alphabet. (2) a small closet or chamber; applied by some authorities to the room over the porch of a Christian church, where were kept the documents of the church and also containing quarters of the sexton.

ZETLAND ISLANDS. See SHETLAND.

ZEUGLODON, zū'glō-dŏn, a gigantic fossil cetacean mammal, found in the Eocene and Miocene strata of the southern United States and Europe, so named by Owen from the yoke-like character displayed by a section of the molar teeth. Its remains were first discovered in 1834 in the Tertiary of Louisiana, and were supposed to belong to some reptile, to which Dr. Harlan gave the name of *Basilosaurus;* but Owen showed that it was a mammal, and belonged among cetaceans. A few years later a German collector named Koch collected great quantities of the bones and stringing them together in some semblance of a natural skeleton, constructed a "sea-serpent," mostly neck and tail, no less than 114 feet long, which was exhibited widely in America and Europe, and required the exertions of eminent men (for example, Wyman, 'Proc. Boston Soc. Nat. Hist.,' November 1845) to expose as a humbug. The form was probably cetacean, though slender, elongated and more snake-like, with small anterior limbs in the shape of paddles, and no hind limbs; the length about 70 feet; the skin was supplied with an armor consisting of small irregular bony plates more or less fused together. The skull in some specimens was nearly a yard in length. It is well constructed, the blow-hole in the middle of the face, and the brain-cavity. The teeth are limited in number and disposed in three series as incisors, canines and molars; the molars are double-rooted, and have serrated crowns. Much discussion has occurred as to the affinities of this great sea-beast, whose characters are so generalized, and period of existence so early that it is now agreed to be a representative of the most primitive *Cetacea,* and is set apart as a family, *Zeuglodontidæ* constituting a primitive order *Archæocæti.* Consult Woodward, 'Vertebrate Palæontology' (New York 1898); Zittel-Eastman, 'Text-Book of Palæonotology' (Part III); Lucas, F. A., 'Animals in the Past' (1901), and 'The Pelvic Girdle of the Zeuglodon' (1901).

ZEUGMA, zūg'mą, the connection of one word with two words or with two clauses, to both of which it does not equally apply; so that, for one of them, another word (to be gathered from the sense of the passage) must be mentally supplied. Zeugma is, therefore, a species of ellipsis; both abbreviate discourse. Where the word to be supplied is a form of another in the sentence, as "I love you, and you [love] me,' the construction is elliptical; where the sense requires a different word, as "The sun shall not smite thee by day, nor the moon [injure thee] by night" (Ps. cxxi, 6) (Prayer Book), it is zeugma.

ZEUNERITE, a hydrous copper-uranium arsenate, $Cu(UO_2)_2As_2O_8.H_2O$. Minute yellowish-green crystals with barite in ores of the Tintic district, Utah. A possible source of uranium.

ZEUS, zūs (Greek Ζεύς), in Greek mythology, the chief of the gods. He was the son of Cronus and Rhæa. According to the myth Cronus was in the habit of swallowing his children immediately after their birth. When Zeus was about to be born Rhæa consulted Uranus and Gæa as to how he might be saved, and they sent her to Crete (the Trojan Ida and other places are mentioned in other accounts) to be delivered. She concealed Zeus in a cave in Mount Ida, and gave Cronus a stone wrapped up in a cloth to swallow. The infant Zeus was tended by the nymphs Ida and Adrastea. He was supplied with milk by the goat Amalthea, and the bees gathered honey for him. When he had reached manhood, by the aid of Gæa or Metis he persuaded his father to restore to the light the children he had swallowed. Zeus now united with his brothers to dethrone his father. This led to a war with the Titans, a struggle

not terminated until Zeus delivered the Cyclopes, sons of Uranus and Gæa, who had been bound by Cronus, and who in return provided him with thunder and lightning, and also liberated the hundred-handed beings Briareus, Cottus and Gyes, who likewise lent him their aid. Having vanquished the Titans, the other children of Uranus and Gæa, he shut them up in Tartarus. Tartarus and Gæa now begot another monster, Typhœus, who engaged in a fearful struggle with Zeus, but was finally vanquished by a thunderbolt. Zeus now obtained the dominion of the world, which he divided by lot with his brothers Poseidon (Neptune), who obtained the sea, and Hades (Pluto), who received the lower world. Zeus retained for himself the heavens and the upper regions, while the earth was held as common property. Another dreadful war was now waged against the Olympian gods by the giants sprung from the blood of Uranus. In this struggle the gods were assisted by Athene, Apollo, Heracles and other children of Zeus, and the giants were completely vanquished. Zeus had three sisters and three brothers, Hestia (Vesta), Demeter (Ceres) and Hera (Juno). He first married Metis, a daughter of Oceanus and Tethys; but as Fate had prophesied that she should bear a son who should rule the world, Zeus swallowed her when she was with child, and Athene subsequently sprang from his head. As his second wife he took, for a time, Themis, daughter of Uranus and Gæa, but his final and best-beloved consort was his sister Hera, by whom he had Hebe, Ares and Hephæstus. Zeus was regarded at the height of the organization of the Roman pantheon, as the founder of law, order and authority, the avenger of wrongs, the punisher of crime, the rewarder of good actions, the source of prophetic power, the author of all good things and the omnipotent, all-wise and benevolent ruler of the universe. He was especially looked upon as the controller of all the phenomena of the heavens, and was constantly spoken of as the «Cloud-gatherer» or the «Thunderer.» Notwithstanding his general character of wisdom and benevolence, his conduct was anything but immaculate. The incongruity struck some of the ancients themselves, and led to protest against such stories being believed. There appear to have been various local gods of the same name, with various attributes and legendary histories, who were finally merged in the national Hellenic Zeus. Traces of the original traditions, however, remained in the local rites of particular places. An Arcadian and a Cretan Zeus are particularly distinguished. The former had a temple at Mount Lycæus, so sacred that if any one entered it he died within 12 months, while intentional trespassers were stoned to death. In Crete there were many places sacred to Zeus, who had passed his early life there, particularly Mount Ida and the district around it. Zeus, according to tradition, also landed on the island at Gortyn in the shape of a bull, when he carried off Europa, and was worshipped there by the surname of Hecatombæus. The national god was worshipped by sacrifices of bulls, cows and goats. Two of the principal localities where his worship was carried on in Greece were Athens and Olympia. At the latter place the Olympic games, the most splendid festival in Greece, were held in his honor. (See Olympic Games). Here there was a magnificent temple and a gold and ivory statue of the god, the work of Phidias, and reckoned one of the seven wonders of the world. In representations of Zeus his attributes are the eagle, the sceptre and the thunderbolt. See Roman Religion. Consult Preller-Robert 'Griechische Mythologie' (1887).

ZEUSS, tsois, **Johann Kaspar,** German philologist and historical scholar: b. Vogtendorf, near Kronach, in Upper Franconia, 22 July 1806; d. there, 10 Nov. 1856. He was educated in Munich, and became professor of history in the lycée at Bamberg, Upper Franconia. He wrote several valuable books—'Die Deutschen und die Nachbarstämme' (1837); 'Die Herkunft der Bayern von den Markomannen' (1839); 'Traditiones Possessionesque Witzenburgenses' (1842); 'Die Freie Reichstadt Speier vor ihrer Zerstörung' (1843). But his greatest work was 'Grammatica Celtica' (1853; 2d ed., by Ebel, 1868–71), a pattern of scholarship and thorough method, in which he really founded the science of Celtic philology. Consult Kuhn, E., 'Johann Kaspar Zeuss' (1906).

ZEUXIPPUS, zūk-sĭp'ŭs, one of the eight successors of Ænesidemus (q.v.) in the last school of Greek skeptics. Of him, as of all the others with the exception of Sextus Empiricus (q.v.), nothing further is known. Consult Zeller, E., 'Outlines of the History of Greek Philosophy' (trans. Alleyne and Abbott, 1886).

ZEUXIS, zūk'sĭs (Greek Ζεῦξις), ancient Greek painter. He was a native of Heracleia, but which town of that name was his birthplace is not certain. He was born about the middle of the 5th century before Christ, and flourished about the end of the 4th century B.C. He is said by some authorities to have studied under Demophilus of Himera, by others under Neseas of Thasos. He also studied at Ephesus, where he eventually settled, although he worked at times at Athens and other cities. Aristotle says that an elevated conception of character was wanting in his work, while Cicero praises him along with Polygnotus and Timanthes for *formæ et lineamenta.* He learned from Apollodorus the treatment of light and shade, which he greatly developed, and from Phidias to take Homer's descriptions of his heroes as ideal models and to paint them with limbs larger than the ordinary human proportion. One of his most famous works was a picture of Helen for the temple of Hera at Croton. The rivalry of Zeuxis and Parrhasius is represented in a well-known story about a contest in which Zeuxis painted grapes at which the birds pecked, and Parrhasius a curtain which Zeuxis wished to have raised in order to see the picture. Some of his later works he gave away as being valuable beyond any fixed price. As far as may be judged from extant accounts, he painted small works on panels in contrast to the large mural paintings of Polygnotus. It is, of course, now impossible to form a correct idea of his art, though more ancedotes are told of him than of any other painter of antiquity. These are to he found in Lucian, Cicero, and especially the 'Historia Naturalis' of Pliny. Among his other works were 'Zeus on His Throne Sur-

rounded by Deities; Eros Crowned with Roses; Centaur Family; The Infant Hercules Strangling the Serpent; Penelope; Menelaus Weeping; Boy with Grapes.

ZEYER, tsī'ĕr, **Jules,** Czech author: b. Prague, April 26, 1841; d. Jan. 29, 1901. After travel in France, Germany, Italy, Greece, and Russia, he became an instructor in the last, and published a number of volumes highly rated in literature. In prose, these included *Count Xavier* and *Andrew Cernysev,* the period of which was that of Catherine II; in verse, *vysehrad,* a series of epic poems, the subject of which was derived from the early history of Bohemia.

ZHITOMIR, zhê-tô'mêr, USSR, city of the Ukrainian Soviet Socialist Republic, capital of the Zhitomir Region. It is situated on the Teterev, and affluent of the Dnieper River, 80 miles southwest of Kiev. The principal industries are iron-smelting, brewing, sawmilling, and foodstuffs manufacture; tobacco, soap, candles, and dyes are also made; and there is a considerable trade in grain. Public institutions include a teachers' college, museum, and valuable libraries. Zhitomir rose to importance in the 9th century, when it became a center of caravan trade. The city changed hands several times, at various periods being in the possession of the Tatars, and being annexed by both Lithuania and Poland. In 1793, when Poland was partitioned for the second time, it passed under Russian sovereignty. Pop. (1939) 95,090.

ZHOB, zhōb, a river of India, in British Baluchistan. It rises in the western foothills of the Sulaiman mountain range and flows parallel to the frontier of Afghanistan until its junction with the Gomal River at Khajuri Kach; with the latter, it empties into the Indus near Dehra Ismail Khan. The valley of the Zhob first became known to white men in 1884, when it was visited by a British military expedition. The valley and the adjacent Gomal Pass, which gives access to Afghanistan, were annexed by Great Britain in 1889. The most direct route from the North West Frontier Province to Quetta, capital of British Baluchistan, lies through the valley of the Zhob.

ZHUKOV, zhōō'kôf, **Georgi Konstantinovich,** Russian army officer: b. 1895. He entered the Russian Imperial Army as a private in 1915, during World War I, and on outbreak of the October Revolution of 1917 he joined the Bolsheviks. Gaining a commission during the fighting with the White Russian counterrevolutionists, he continued army service after the Soviet Union was firmly established and, in 1932, entered the famed Frunze Military Academy. There he specialized in armored warfare, studying under Marshal Boris Mikhailovich Shaposhnikov (b. 1882), chief of the Red Army's general staff; he put these precepts into practice during the Spanish Civil War of 1937–1938, where he advised the Loyalist government on tank tactics. He saw more fighting in Outer Mongolia during 1938–1939, commanding tank detachments against the Japanese in the region of the Amur River. His reputation as a skillful commander was firmly established in the brief Russo-Finnish War of 1939–1940, and in February 1941, he was appointed chief of the general staff of the Red Army, vice-commissar for defense, and an alternate member of the Political Bureau of the Central Committee of the Communist Party. He co-operated with Marshal Semyon Konstantinovich Timoshenko (q.v.) in the reorganization and training of the Soviet armies, and this bore fruit the following summer when, in the midst of World War II, the Germans suddenly invaded Russia. In October 1941 he took over command of the forces defending Moscow, succeeding Timoshenko (who was transferred to the southern front), and in a series of hammering blows brought the Germans to a halt when they were only 20 miles from the capital. Late in 1942, in cooperation with Marshal Alexander M. Vasilevski (q.v.), he directed the counteroffensive at Stalingrad, and for saving the city he received the personal congratulations of Generalissimo Joseph Stalin; and he was awarded the Order of Suvorov, first class, for brilliant leadership in raising the 17-month siege of Leningrad in January 1943. He was also promoted to the rank of marshal of the Soviet Union, and in March 1944, appointed to command of the First Ukrainian Army in succession to Gen. Nikolai Vatutin, he launched a drive across the southwestern Ukraine which continued without a pause until April 8, when he had reached the borders of Czechoslovakia. In July 1944 he was relieved from this command in order to become Stalin's deputy commander in chief, in Moscow, but before the year ended he was once more in the field, being given command of the First White Russian Army. After careful preparation he launched a great attack upon the Germans on Jan. 12, 1945, along an 800-mile front from East Prussia to the Carpathians. By the end of the month his forces were 12 miles within Germany proper, northwest of encircled Poznan (Posen) and by mid-April his armored divisions were poised before Berlin. His troops, together with those of the First Ukrainian Army, then under Marshal Ivan Stepanovich Konev (q.v.), effected the occupation of the German capital on May 2, 1945, thus concluding one of the most brilliant campaigns in military history. Russia's greatest soldier of World War II, Zhukov received the Order of Victory, the Soviet's highest award, and received the title of Hero of the Soviet Union. In Berlin, on May 8, 1945, he signed the terms of surrender imposed upon the Germans, whose chief signatory was Field Marshal Wilhelm Keitel (q.v.), and in that city, on June 5, he was one of the Allied cosignatories of the proclamation of the assumption of the government of Germany by the victorious powers. With division of Germany into separate zones of administration for each nation, Zhukov was appointed administrator of the Russian Zone.

ZHUKOVSKI, zhōō-kôf'skû-ĭ, **Vasili Andreevich,** Russian poet: b. near Belev, government of Tula, Jan. 29, 1783; d. Baden-Baden, Germany, April 12, 1852. He served in the campaign of 1812 against Napoleon, later settled in Dorpat, and in 1816 obtained an imperial pension. In 1826 he became tutor to the czarevitch, later Alexander II. His most important service to Russian literature was to be found in his translations of the poems of Byron, Gray, Moore, Scott, Goethe, Schiller, Rückert and others; *Don Quixote;* the *Odyssey* and various further foreign classics. Among his original verses, *Liudmilla,* an imitation of Bürger's *Lenore,* and *The*

Minstrel in the Russian Camp were the most successful.

ZIEGFELD, zĭg'fĕld, **Florenz,** American theatrical producer: b. Chicago, Ill., March 21, 1869; d. Hollywood, Calif., July 22, 1932. At the age of 23 he went to Europe, whence he brought back to the United States a number of military bands for the Chicago World's Fair of 1893. His first stage production was made in 1896, starring a French girl who, as Anna Held, became a popular actress; his marriage to her, in 1897, ended in divorce in 1913. In June 1907 he made theatrical history by producing the *Follies of 1907,* first of a series of yearly revues, popularly known as *Ziegfeld's Follies,* which featured a chorus of girls with striking costumes and settings. He also staged numerous highly successful musical comedies, notably *Sally, Rio Rita, Kid Boots, Show Boat, Bitter Sweet,* and *Pink Lady.* The star in most of them was Billie Burke, whom he married in 1914.

ZIEGLER, zē'glĕr, **Theobald,** German philosopher, and writer on pedagogy and ethics: b. Göppingen, Württemberg, Feb. 9, 1846; d. 1918. He studied at Tübingen, and from 1871 he was instructor in various gymnasia. In 1884 he was appointed lecturer on philosophy and pedagogy in the University of Strassburg, and in 1886 he became professor there. He retired in 1911. His *Sittliches Sein und Sittliches Werden* (2d. ed., 1890; English 1892) was a substantial enrichment of the literature of moral philosophy, and the *Geschichte der Ethik* (2d. ed., 1892) was also a work of importance. His further volumes included *Religion und Religionen* (1893); and *Fr. Th. Vischer* (1893); *David Friedrich Strauss* (2 vols., 1908); *Menschen und Probleme* (1914); *Der Krieg als Erzieher* (1914); *Das offentliche Leben* (1914).

ZIEGLER, William, American manufacturer: b. Beaver County, Pa., Sept. 1, 1843; d. Stamford, Conn., May 24, 1905. He at first entered the printers' trade, and in 1868 the bakers' and confectioners' supplies business. In 1870 he organized the Royal Chemical Company, which he developed into the Royal Baking Powder Company, retiring from active business in 1886. He also operated largely in real estate. The Baldwin-Ziegler Polar expedition of 1901–1902, led by Evelyn Briggs Baldwin (q.v.), was financed by him. He also outfitted a Polar expedition named for him and conducted by Anthony Fiala (q.v.) during 1903–1905; leaving Vardö, Norway, on July 10, 1903, the ship was lost after a survey of Francis Joseph Archipelago, but the members of the expedition were rescued in July 1905.

ZIEM, zyĕm, **Félix François Georges Philibert,** French landscape and marine painter: b. Beaune, Feb. 25, 1821; d. Paris, Nov. 10, 1911. He studied in the art school of Dijon, traveled in southern France, Italy, and the Orient, and obtained a third-class medal at the Salon of 1851, and a first-class in 1852. He was well known for his landscapes, particularly for scenes of Venice. Among his many canvases were *View of Venice* (1852; Luxembourg); *The Bank of the Amstel* (Bordeaux Museum); *Quai Saint-Jean at Marseilles* (Marseille Museum); *The Doge's Palace* (Ravené Gallery, Berlin); *Venetian Fishing Boat* (Metropolitan Museum of Art, New York City).

ZIERIKZEE, zē'rĭk-zā, Netherlands, a town in the province of Zeeland, on the south side, and the chief town of, the island of Schouwen. It lies three miles from the Ooster Schelde, with which it is connected by two canal harbors, and 38 miles northwest of Antwerp. It has six churches, a fine townhouse dating from the 15th century, and a gymnasium; it manufactures madder, carries on brewing and oyster fishing, and has considerable trade and shipping. It is the oldest town of Zeeland.

ZIETEN, or **ZIETHEN,** tsē'tĕn, **Hans Joachim von,** German army officer: b. Wustrau, near Neuruppin, Brandenburg, May 14, 1699; d. Berlin, Jan. 26, 1786. He entered the Prussian Army in 1714, and distinguished himself as a colonel in the Silesian campaign of 1742, and as a major-general in that of 1745. In May 1745 he made a celebrated march through the enemy's country in Upper Silesia, in order to communicate with the Margrave Karl at Jägerndorf. In 1756 he was made lieutenant-general. He obtained his chief renown in the Seven Years' War (q.v.), winning the victories of Reichenberg, Prague and Leuthen, and deciding the day at Torgau by storming the heights of Süptitz.

ZIF, ZIV, ZIPH, IYAR, or **IYYAR,** in the Hebrew calendar, the second month of the year, always of 29 days. It falls between April 10 and June 8.

ZILBOORG, zĭl'bôrg, **Gregory,** American psychiatrist: b. Kiev, Russia, Dec. 25, 1890. His medical studies were interrupted for hospital service in the Russian Army during the early years of World War I. Obtaining his medical degree in 1917 at the St. Petersburg (later Leningrad) Psychoneurological Institute, he participated in the February Revolution of 1917 and became secretary to the minister of labor in the administrations of Prince Georgi Evgenievich Lvov (1861–1925) and Alexander Feodorovich Kerensky (q.v.). He then edited a daily paper in Kiev until southern Russia was occupied by the Germans, when he was forced to leave the country. In 1919 he reached the United States, where he was naturalized in 1925. During those first years in the country he lectured, engaged in journalism, and wrote *The Passing of the Old Order in Europe* (1920); he also made translations from the Russian, including *He Who Gets Slapped* (1921), by Leonid Nikolaevich Andreyev (q.v.), and *We* (1924), by Zamiatin. In 1926 he secured an M.D. degree at the College of Physicians and Surgeons, Columbia University, and in 1931, after serving on the staff of the Bloomingdale (N. Y.) Hospital, he entered private practice in New York City as a psychiatrist and psychoanalyst. He translated from the German *The Criminal, the Judge, and the Public* (1931) and *Outline of Clinical Psychoanalysis* (1934), and his own works include: *The Medical Man and the Witch During the Renaissance* (1935); *A History of Medical Psychology* (co-author, 1941); *Mind, Medicine, and Man* (1943).

ZILE (anc. Zela), Turkey, a town in the vilayet of Sivas, 25 miles south of Amasya. A modern castle occupies the site of an old

Byzantine fortress. Ancient Zela was a theocracy ruled by the priests of the temple of Anaitis. Here Mithridates won a victory over the Romans 67 B.C., and it was also the scene of Cæsar's victory over Pharnaces, 47 B.C., concerning which Cæsar wrote "*Veni, vidi, vici.*" Pop. 20,000.

ZILLER, tsĭl'lĕr, **Tuisken,** German educator: b. Wasungen, Saxe-Meiningen, 22 Dec. 1817; d. Leipzig, 20 April 1882. He was educated at Leipzig, where he was at first a lecturer in jurisprudence, but in 1854 became professor of philosophy and pedagogy. At his initiative the Verein für Wissenschaftliche Pädagogik was founded. Among his books are 'Einleitung in die Allgemeine Pädagogik' (1856; 2d ed., 1901) and 'Allgemeine Philosophische Ethik' (1880; 2d ed., 1886).

ZILLERTHAL, tsĭl'lĕr-täl, Austria, a valley of the Tyrol in the eastern Alps, about 25 miles below Innsbruck, famous for its scenic beauties. It is traversed by the Ziller, which joins the Inn River at the mouth of the valley. It is much frequented by tourists, a railway line connecting with Mairhofen in the valley.

ZIMBABWE, zēm-bäb'wā, or **ZIMBABYE** (Bantu for "here is a great kraal"), a name applied to numerous interesting South African ruins in Rhodesia and the Transvaal. They were discovered by Adam Benders in 1868. The best known and most important is the Great Zimbabwe, near the Sabi River, about 17 miles from Victoria in southern Rhodesia. There are two principal structures at Great Zimbabwe, one on the crest of a granite hill breaking down precipitously to the south, and the other on the level ground about a third of a mile to the south. The lower one is roughly circular or elliptical, enclosed by a wall of 30 or 40 feet high, 14 feet thick at the base, and from six to nine feet thick at the summit. The wall is composed of well-trimmed blocks of granite fitted together without mortar in regular courses and occasionally set angularly for ornamental purposes. An inner wall runs close to the outer for a considerable distance, forming a passage which leads to a sacred enclosure containing two conical solid towers, the larger of which is some 40 feet high. The rest of the enclosure is divided into irregular unroofed chambers. The building on the hill is very strongly built for defense and also contains a sacred enclosure. Emblems, believed by some to be phallic, many curious objects in soapstone, and undoubted remains of gold-working utensils have been found in the Zimbabwes. The nearest gold deposits and ancient gold workings are, however, some miles distant. Some theorists would locate here the Ophir of Solomon. It is also suggested that the lower building was a kind of town occupied by pre-Mohammedan Arabs who came here in search of gold, and that the ruin on the hill was a stronghold for defense. The signs of orientation reported by earlier visitors were disproved by scientific investigators who explored the ruins in 1905. The theories of Bent are now definitely discarded. Consult Randall-MacIver, D., 'Mediæval Rhodesia' (1906); for illustrations Bent, J. T., 'The Ruined Cities of Mashonaland' (1892); and Hall and Neal, 'The Ancient Ruins of Rhodesia' (1902).

ZIMMERMAN, Eugene ("Zim"), American caricaturist and illustrator: b. Basel, Switzerland, 25 May 1862. After a public school education in Paterson, N. J., and some time in various employments, he turned his attention to comic art, was on the staff of *Puck* in 1882–85 and then with *Judge* as a cartoonist (known as "Zim"). He also illustrated some of the works of J. W. Riley ("Bill Nye") and others. He later conducted Zim's Correspondence School of Cartooning, Comic Art and Caricature. Author of 'This and That About Cartooning' (1892–93). Died 26 March 1935.

ZIMMERMAN, Jeremiah, American clergyman and numismatist: b. Snydersburg, Md., 26 April 1848; d. 19 Feb. 1937. Graduated from Pennsylvania College, Gettysburg, in 1873, and the theological seminary there in 1876, he was pastor of the Lutheran Church at Valatie, N. Y., in 1877–78, and in 1879 organized at Syracuse, N. Y., the First English Lutheran Church, of which he was pastor until 1904. He then resigned to engage in foreign travel and literature, specializing on the Far East, archæology and history. He is also regarded as an authority on the historical branch of numismatics, and was professor of numismatics at Syracuse University 1911–17. Author of 'Spain and Her People' (1902); 'The Religious Character of Ancient Coins'; 'The Problem of Evil and Suffering—A Solution and the Antidote' (1927).

ZIMMERMANN, tsĭm'mĕr-män, **Albert,** German painter: b. Zittau, Saxony, 20 Sept. 1809; d. Munich, 18 Oct. 1888. He studied in Dresden and Munich and was made professor in the Milan Academy in 1857 and at the Vienna Academy in 1859 His works display admirable characterizations of mountainous scenery and excellent light-effects, and are represented in the museums at Leipzig, Munich, Stuttgart, Hanover, Dresden, Frankfort and in the R. L. Stuart Collection (New York Public Library). Among them are 'Rocky Landscape with Centaurs and Leopards'; 'Chiem Lake in Storm'; 'The High Göll'; 'Sunset on Hintersee'; and 'Lake Como.'

ZIMMERMANN, Johann Georg, Ritter von, Swiss philosopher and writer: b. at Brugg, canton of Aagau (then in Bern), 8 Dec. 1728; d. Hanover, 7 Oct. 1795. He studied medicine under Haller at Göttingen, and in 1754 was appointed public physician to his native town. He employed his leisure in the publication of pieces in prose and verse, including the first sketch of his popular work 'Ueber die Einsamkeit' (On Solitude, 1756; completely rewritten 1784–85). This was followed by his essay 'Vom Nationalstolz' (On National Pride 1758). In 1763 he composed his work 'Von der Erfahrung in der Arzneikunst' (1764), which he followed up by several other professional treatises; in consequence of which he received an offer of the post of physician to the king of England for Hanover, which he accepted, and removed in 1768 to that capital. In 1786 he attended Frederick the Great in his last illness, which afforded little room for medical skill, but enabled him to publish an account of his conversations with that celebrated sovereign, 'Ueber Friedrich den Grossen und meine Unterredung mit ihm' (1788), and 'Fragmente über Friedrich den Grossen' (1789), works of little value. His 'Solitude' was at one time very popular, and

was translated into almost every language of Europe. Consult the studies by Bodemann (1878) and Ischer (1893).

ZIMMERMANN, Wilhelm, German poet and historian: b. Stuttgart, 2 Jan. 1807; d. Mergentheim, Würtemberg, 22 Sept. 1878. After study at Tübingen, he was connected with carious journals at Stuttgart, from 1847 to 1850 was professor of history and of German language and literature in the Polytechnic Institute there, but lost the post through his liberal attitude as a member of the German National Assembly (1848) and the Würtemberg Parliament. Subsequently he was pastor of Evangelical churches at Leonbronn, Schnaitheim and Owen. He is best known for his 'Gedichte' (1832; 2d ed., 1839; 3d ed., 1854), which reveal the influence of Schiller and Uhland, but are never merely imitative. Others of his publications are 'Befreiungskämfke der Deutschen gegen Napoleon' (1836; 3d ed., 1859); 'Geschichte des Grossen Bauernkriegs' (3 vols., 1841–43; 3d ed., 1891), etc.

ZIMMERN, Helen, English author: b. Hamburg, Germany, 25 March 1846. She was taken to England when an infant and was naturalized as a British subject upon coming of age. After a secondary education at Bayswater, she became a contributor to *Once a Week, Old Merry's Monthly,* the *Press,* the *Examiner* and other periodicals, and in 1876 achieved a success with 'Schopenhauer, his Life and Philosophy.' From 1887 she resided at Florence, Italy, where she corresponded for Italian, English and American periodicals. She also lectured in Italy, England and Germany on Italian art. Among her further publications are 'Gotthold Ephriam Lessing, his Life and his Works' (1878); 'The Epic of Kings' (1882); a paraphrase from Firdusi; a 'Life of Maria Edgeworth' (1883); 'The Hansa Towns' (1889); 'Italy of the Italians' (1906); 'Tripoli and Young Italy' (1912); 'Italian Leaders of Today' (1915); 'New Italy' (1918), etc. She also translated from Nietzsche, and Lessing's prose; edited the comedies of Goldoni (1892); was joint translator of Ferrero's essays as 'Europe's Fateful Hour' (1918), and translated Enrico Castellani's 'Italy and Austria at War' (1918). Died 11 Jan. 1934.

ZIMRI, zĭm'rī, in the satire 'Absalom and Achitophel' (pt. i, 1681; pt. ii, 1682) by John Dryden (q.v.), a character representing Villiers, Duke of Buckingham:

> Some of the chiefs were princes in the land:
> In the front rank of these did Imri stand, etc.
> (Pt. i, 545 et seq.)

Buckingham was depicted as a factional leader, like Zimri who conspired against Asa, king of Judah (1 Kings xvi, 9).

ZINC. Zinc cast into slabs as it comes from the furnace is commercially known as spelter, but zinc recast into forms such as are used in galvanic batteries is known as battery zinc, and zinc rolled into sheets is known as sheet zinc. There is a growing movement, fostered by the American Zinc Institute, to avoid confusion by abandoning the use of the word spelter.

Properties.— Zinc is a bluish-white metal with a bright metallic lustre, an atomic weight of 65.37, a density of about seven, and a hardness, when cast, of 38 in the Brinell scale, as compared to a hardness of 40 for copper and 28 for silver. Both density and hardness are slightly increased by rolling. It is so hard that it can be filed with difficulty, and in a large mass it can be broken only with considerable force. Its texture as shown on a broken surface is prismatic crystalline, the crystals being six-sided and belonging to the hexagonal system. At different temperatures zinc has different properties. At ordinary temperatures it is fairly brittle, but at 100°–150°C. it can be rolled out into sheets or drawn into wire, though above 200° C. it becomes brittle again. It melts at 419.4° C. and boils at 920° C., the vapor burning in air with a characteristic brilliant bluish-green flame to zinc oxide, formerly known as "philosopher's wool" or "flowers of zinc." Zinc is not affected by dry air or by oxygen at ordinary temperatures, but under moist atmospheric conditions the surface becomes covered with a coating of grayish-white basic carbonate of zinc, which protects the metal from further corrosion. The industrial value of zinc for use as a protective coating for iron and steel and for use in exposed positions is due largely to this property.

Uses.— Zinc is used in metallic form in galvanizing iron and steel, in making sheet zinc, and in making brass and some other alloys. Iron and steel may be galvanized in several ways — by dipping the articles in a bath of molten zinc; by heating them to 425°–450° C. in a drum filled with zinc dust, a process known as "sherardizing," in which they are coated with zinc by the zinc vapor given off from the zinc dust; and by electroplating them with zinc. As only the last method employs the galvanic current, the others are miscalled "galvanizing," and an article protected by a coat of zinc would better be called "zinc-coated." In normal times about 60 per cent of the zinc output of the country is used in zinc-coating iron and steel. Metallic zinc may be rolled in plates an inch or so thick — "boiler plates," which, suspended in boilers, preserve them from the corrosion of sea water — or in thinner sheets for roofing, shingles, gutters, spouts, household utensils, zincographer's plates, dry batteries, buttons, shoe-lace tips, etc. Much sheet zinc was used during the European War to line packing cases filled with munitions and machined parts which needed protection from the sea air. Metallic zinc is alloyed with copper to form brass, some "bronzes" and other alloys. In normal times only about 20 per cent of the total consumption is used in making brass, but during the European War the greater part of the metallic zinc produced in the country was used for that purpose. A considerable quantity of metallic zinc is used annually in desilverizing lead by the Parkes process.

Zinc oxide is made under the French process by burning metallic zinc in an oxidizing atmosphere, and under the American process by burning oxidized or desulphurized zinc ores mixed with ground coal in an oxidizing atmosphere. The purity of the product depends on the purity of the metal and the ore. Chemically pure zinc oxide is used in pharmaceutical preparations. Zinc oxide of good grades free from lead is also used largely in making rubber, to increase its tensile strength, toughen it

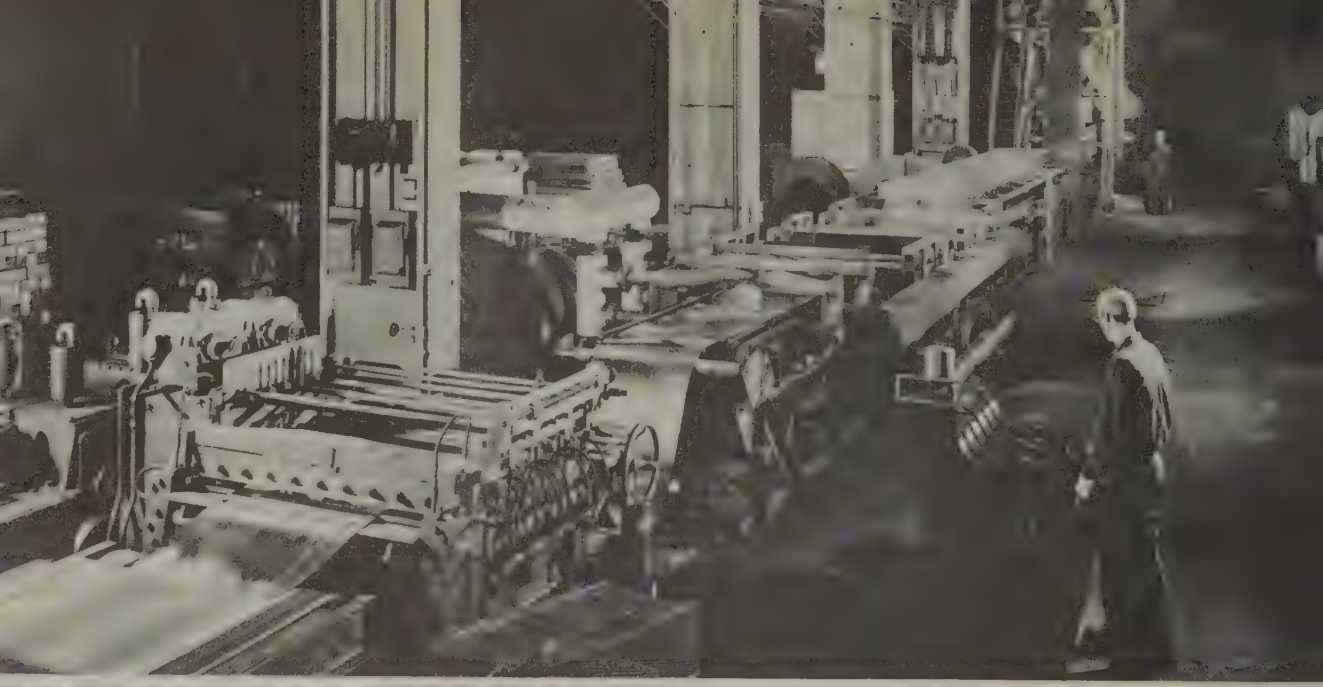
Above: Two "hard rock" zinc miners adjust their drill, mounted on a mobile carriage or jumbo.

ZINC

Right: Molten zinc pours from a furnace. Slab zinc of high purity is produced for making zinc alloys, used extensively for die casting machine parts.

Below: Water heating tanks are lifted from a galvanizing bath of molten zinc. Coatings of zinc protect iron and steel from rust and corrosion.

(Above) Eagle-Picher Company; (right) New Jersey Zinc Co.; (below) Rheem Manufacturing Co.



Above: Zinc-coated metal sheet moves along a continuous coil galvanizing line. Zinc-coated sheet is extensively used as a low-cost roofing material.

Left: Brass bars are cast for rolling into sheet. Zinc and copper are essential constituents of brass. Some brasses also contain other metals.

ZINC

Below: Brass sheet is sheared to length by a powerful machine. The strength of some brasses increases with their zinc content, but their ductility decreases.

(Above) Wean Engineering Co.; (left) Copper and Brass Research Association; (below) Bristol Brass Corporation

and increase its wear-resisting properties. Zinc oxide of both good and common grades is used as a pigment in making paints. American process oxide, in which there is a considerable percentage of lead, i.e., leaded zinc oxide, is also used for pigment, as a combination of lead and zinc is held to be desirable in a paint.

Zinc dust, which consists of minute droplets of metallic zinc coated with a film of zinc oxide, is formed in the distillation of zinc, or is specially prepared. It is a very active chemical agent and is used to discharge the color of the pattern in calico printing. It is also used to precipitate gold in the cyanide process of gold recovery and to precipitate other metals and purify the solution in making lithopone and in the electrolytic deposition of zinc. Another use is in sherardizing as mentioned above. Lithopone, a chemical combination of zinc sulphide and barium sulphate, is a white pigment used for interior paints and forms the base of most white enamels. Several salts of zinc are employed in medicine and the arts. Zinc acetate and zinc sulphate are used in medicine as an emetic, astringent and antiseptic. They are used as a mordant in dyeing, and are also useful in wood preservation, but the chloride is generally employed for that purpose, as in the Burnett process. Zinc chloride is used as a caustic agent in the treatment of certain diseases, as a general disinfectant and preservative, and as a flux in soldering. Zinc sulphate is used in bleaching paper and as a dryer in varnishes and in fireproofing paints.

Sources.— The chief zinc minerals are zinc sulphide, sphalerite (zinc blende or "black jack"); zinc carbonates, smithsonite (calamine in Europe) and hydrozincite; zinc silicates, calamine (smithsonite in Europe) and willemite; zinc oxide, zincite ("red zinc ore"); and zinc-iron-manganese oxide, franklinite. The three minerals last named form the ore at Franklin Furnace mines, in New Jersey, where they occur more plentifully than anywhere else in the world. Zinc blende is the most common ore of zinc. It usually occurs as a complex ore in association with galena and with pyrite and other metallic sulphides, but in the Mascot mines of eastern Tennessee it is unassociated with either lead or iron. The upper parts of sulphide deposits containing zinc have usually been altered by oxidation, and the zinc minerals changed to the silicate and carbonate. The principal zinc-producing region in the United States is the Joplin-Miami district of southwestern Missouri, southeastern Kansas and northeastern Oklahoma, which in 1938 produced ores containing 196,174 short tons of recoverable zinc, about 40 per cent of the total production of the country. The Franklin Furnace mines produced 85,839 tons of recoverable zinc or 16 per cent of the total, the East Tennessee-Virginia district produced 56,766 tons, or 10 per cent, the Cœur d'Alene district of Idaho, 31,937 tons, and St. Lawrence County, N. Y. produced 29,896 tons. Other important zinc districts are the Bingham district in Utah, the Central and Willow Creek districts in New Mexico, the Warm Springs in Idaho and the Metaline district in Washington. The total recoverable zinc content of zinc ores mined in the country in 1917 was 710,972 short tons, a large increase in response to the demands of the war. The five-year average of 1925–29 was 724,720 tons. Output in 1938 was 516,699 short tons.

Imports of zinc ore in 1938 came from Peru and Mexico, and the latter country and Canada shipped zinc slabs to the United States. During the early years of the European War large imports of zinc concentrates were brought to the United States from Australia, where the extensive deposits of lead-zinc ores of the Broken Hill lode of New South Wales have been for years the main foreign dependence of the zinc smelters of Belgium, Germany and France. The zinc deposits of Rhodesia Broken Hill in Africa are extensive, and there are many deposits in Algeria and Tunis. The Bawdwin deposits of India are reckoned among the largest in the world, as are also those of the Ridder and adjoining concessions in the Irtysh region of southwestern Siberia. The chief zinc-producing regions of Europe are the Upper Silesia district, formerly a part of Prussia; the Rhine district of Germany; the island of Sardinia in Italy, and the Santander and Cartagena districts of Spain.

Before the complex ores, sulphides of zinc, lead, copper and other metals — the refractory ores of the metallurgist — are treated in the usual practice by smelting in the blast furnace, the zinc minerals must be separated from the others because zinc interferes so greatly with the reduction of the other minerals that a "fine" or "penalty" is placed by the smelter on ores containing zinc above a fixed limit, depending on circumstances. Moreover, the zinc is lost. Hence practically all zinc-bearing ores are subjected to milling, in which the zinc minerals are separated from the others and all are concentrated to workable richness. In the Joplin region ore of lower metallic content than anywhere else in the world is profitably mined. In one type of deposits, the "sheet ground," the ore mined in 1916–17 averaged 1.3 per cent of zinc and 0.3 per cent of lead, as shown by the metal content of the concentrates. The zinc concentrates average from 58 to 59 per cent of zinc. In the Broken Hill district of New South Wales in early years the zinc was separated as middlings and accumulated in huge stacks. By the flotation process, perfected in that region since 1903, the sulphide minerals are floated off in a froth while the gangue minerals sink to the bottom. The stocks of zincky middlings thus became available and have furnished the bulk of Broken Hill's large annual output of zinc concentrates in recent years. The flotation process has likewise made available large reserves of lead-zinc ores previously unworkable in various parts of the world.

Zinc Smelting.— The origin of the art of smelting is lost in the mists of antiquity. Brass was an article of commerce with the Orient from the earliest days of which there is record, but brass can be made by the "cementation" process in which granulated copper is melted with granulated "calamine" (oxidized zinc ore), and hence the existence of brass is not proof of the production of metallic zinc. However, metallic zinc was certainly known in India in the 14th century. Zinc ore may be reduced by burning off the zinc as oxide, and the oxide may be utilized as such or may be dissolved and the zinc content deposited

electrolytically; or the desulphurized ore may be leached with sulphuric or other acid and the zinc obtained by electrolysis. Both these methods are in commercial use, and other electrochemical processes are in a fair way to be established. Electrothermic reduction of zinc ores is practised in Sweden, but has not yet proved commercially feasible in the United States. The low volatilization point of zinc led to distillation as the first method for the reduction of zinc ores, and it is yet the chief method. The native Chinese method of making zinc, though primitive, nevertheless, involves all the essential principles of modern zinc distillation. Clay pots or crucibles are set in the flat top of the furnace so that the lower half is exposed to the heat of the furnace. The zinc ore and carbon are put into the pot, a sloping partition with a perforation at the upper edge is luted (sealed with clay) into position at the middle of the pot, and the cover is luted on. The zinc vapor comes up through the perforation, condenses in the cooler upper chamber and collects as liquid zinc on the lower portion of the sloping partition, whence it may be dipped and cast into cakes. In the modern retort furnace there may be 300 to 450 clay retorts set in three to five horizontal rows, each retort about 10 inches in diameter and about five feet long. Two such furnaces are joined back to back in a block. Only the mouth of the retort projects from the furnace, and to this is luted the condenser, a conical clay cylinder closed at the slightly lower front end, except for a small aperture, by a clay plug. The zinc vapor distills over and is liquefied in the condenser, from which it is «drawn» and cast into slabs four times during the «campaign,» which lasts 24 hours, the retorts being cleaned out and the charges renewed each morning.

Production.—On a smelter basis zinc production in the United States in 1938 was 20 per cent less than the year before, though most foreign countries registered gains. Total world production for 1938 was estimated at 1,558,000 metric tons as credited to the countries where smelted. The United States output was 404,912 metric tons or 26 per cent of the total. Belgium was second with 209,983 tons, closely followed by Germany which had greatly increased its output of zinc, reaching 192,000 tons in 1938. Canada produced 155,973 tons; Poland 108,071; Australia 70,941, and the Soviet about 70,000 metric tons.

In 1930 the output of primary metallic zinc from both domestic and foreign ores, in the United States, was 499,300 short tons, and in the year 1929 was 612,136 tons from domestic ores and 13,311 from foreign ores, or a total of 625,447 tons. Next to the United States, the other large consumers of zinc are Great Britain. Germany and Belgium. See table below for production and consumption of metallic zinc in the United States compared with pre-World War averages.

	1910–1913 (average)	1917	1923	1925–29 (5 year average)	1933	1938
Production of primary zinc*						
From domestic ore	296,315	584,597	508,334	589,645	306,010	436,007
From foreign ore	13,983	84,976	2,099	12,734	1,172	10,334
	310,298	669,573	510,434			
Production of secondary zinc*						
Redistilled	19,721	16,834	39,434	43,755	30,087	31,613
Remelted	26,302	14,565	25,776	21,624	18,013	10,657
	356,321	700,973	575,644	667,762	355,282	488,611
Apparent consumption of primary zinc	290,413	413,643	446,514	514,311	321,789	375,004

* "Primary zinc," which is produced from ore, is distinguished from "secondary zinc," which is obtained by refining zinc ashes, skimmings, drosses, and old metals and which has already been statistically counted as metal.

The first zinc was made in the United States in 1835 by Dr. F. R. Hassler, superintendent of the United States Coast Survey. Finding it impossible to obtain abroad brass or zinc of the requisite purity for the standard sets of weights and measures he set up a small zinc-distillation plant in the arsenal at Washington. The ore used was a mixture of blende from Perkiomen, Pa., and red zinc ore from Franklin Furnace, New Jersey. The first zinc smelting on a commercial scale was at the Lehigh works at South Bethlehem, Pa., in 1860. In the same year the Matthiessen and Hegeler works were opened at La Salle, Ill. These were the main eastern and western centres of zinc smelting until 1892, when smelters in the coal fields of Kansas assumed equal importance with Illinois plants. This importance was increased about 1896, when natural gas began to be used for smelting, and by 1899 Kansas had become the largest producer among the States. The waning of the gas fields caused Kansas to fall behind Illinois in 1913, but by 1919 and 1920 the natural-gas smelters of Oklahoma, which first smelted zinc in 1907, put that State in the front rank. (See ELECTROCHEMICAL INDUSTRIES; METALLURGY; METALS). Consult Holley, C. D., 'Lead and Zinc Pigments' (New York 1909); Ingalls, W. R., 'Production and Properties of Zinc' (ib. 1902); id., 'Lead and Zinc in the United States' (ib. 1908); Holman, H. O., 'Metallurgy of Zinc and Cadmium' (1922); American Institute of Mining and Metallurgical Engineers, 'Lead and Zinc' (1937); United States Geological Survey, 'Minerals Year Book' (annually).

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Geologist, United States Geological Survey.

ZINC, Refining of. See ELECTROCHEMICAL INDUSTRIES.

ZINC WHITE. See WHITE COLORS.

ZINCITE, or KINKITE, a deep blood-red to orange-red mineral found quite abundantly in Sussex County, N. J. It is

usually in granular or foliated masses, associated with franklinite, willemite, tephroite and calcite. It rarely occurs in hexagonal, hemimorphic crystals, with perfect basal cleavage. Its hardness is 4 to 4.5 and specific gravity about 5.7. It is an oxide of zinc, ZnO, and is valuable as an ore of that metal. It is often called «red oxide of zinc» and «red zinc ore.»

ZINCOGRAPHY. See LITHOGRAPHY.

ZINGARELLI, dzēn-gä-rĕl'lē, **Nicolo Antonio,** Italian composer: b. Naples, 4 April 1752; d. Forre del Greco, 5 May 1837. He studied at the Conservatorio di Loreto and also under the Abbate Speranza, and on leaving the conservatory received the place of master of the chapel at Torre dell' Annunziata. In 1781 he composed for the Theatre San Carlos, in Naples, his opera 'Montezuma,' and in 1785 brought forward his 'Alzinda' in La Scala, Milan, with great success. In this work he adopted a more simple and easy style. His best operas are 'Pirro,' 'Artaserse' and 'Romeo e Giulietta.' In 1789 he brought out his 'Antigone,' from Marmontel in Paris; but the public events then occurring absorbed the attention of the public, and he soon returned to Italy, where he became director of the Vatican chapel in 1804. He refused to conduct the musical services rejoicing over the birth of Napoleon's son as the «King of Rome,» and by the order of Napoleon was arrested and taken to Paris. Napoleon, however, pardoned him because of his fondness for the composer's music. In 1813 he was appointed director of the musical academy of San Sebastiano, and in 1816 chapel-master in Saint Peter's, Naples, holding both positions while he lived. Zingarelli composed much church music, including more than 30 masses, and numerous cantatas and oratorios. His works are highly esteemed for their expression. From 1781 he wrote about 40 operas, many melodies from which have continued to be interpolated in modern Italian productions.

ZINGERLE (VON SOMMERSBERG) tsĭng'ĕr-lĕ, **Ignaz Vincenz,** Austrian Teutonic scholar: b. Meran, 6 June 1825; d. Innsbruck, 17 Sept. 1892. He was a nephew of Pius Zingerle (q.v.). He studied at Innsbruck, Trent and Brixen, and was for a time an inmate of a Benedictine monastery at Marienberg, but later abandoned theology. From 1859 until his retirement in 1890 was the professor of German language and literature at Innsbruck. Among his works are 'Sagen aus Tirol' (1850; 2d ed., 1891); 'Sitten Bräuche, und Meinungen des Trioler Volkes' (2d. ed., 1871).

ZINGERLE, Pius, Austrian Orientalist and Catholic theologian: b. Meran, 17 March 1801; d. Marienberg cloister, 10 Jan. 1881. He studied at Innsbruck, became in 1862 professor of Oriental languages in the Sapienza at Rome, and in 1867–71 was director of the gymnasium at Meran. Among his works are 'Ausgewählte Schriften des Heiligen Kirchenvaters Ephräm' (1830–37; 2d ed., 1845–46).

ZINJAN, zĭn-jän', Persia. See ZENJUN.

ZINNIA, a genus of annual and perennial herbs and sub-shrubby plants of the family *Astéraceæ.* The species, of which about 20 are known, are indigenous from southern Colorado to Chile, but are chiefly distributed in Mexico and Central America. They have opposite, generally entire leaves and terminal heads of very variously tinted flowers, for which some of the species have become popular in gardens. The best-known species is the garden zinnia or youth-and-old-age (*Z. elegans*), an erect annual usually about 18 inches tall and originally bearing yellow or orange flowers, but now exhibiting nearly every tint except blue and green in both single and double forms, which often exceed three inches in diameter. *Z. haageana* was introduced into cultivation in 1861, but being less showy and smaller than the former is of secondary importance. A hybrid race developed from these two species, and known as *Z. darwini,* has been evolved, but has not become widely popular in America. The plants are rather stiff, formal and coarse in habit, and their colors, although brilliant and metallic, lack the delicacy of the dahlia and the china aster, to which they are not distantly related. They are, however, among the most useful garden annuals, because they will thrive upon almost any kind of soil.

ZINNWALDITE, tsĭn'vält-īt, a silicate of the mica group, similar in form to biotite, but different in composition, in that it carries 3 to 4 per cent of lithia. It occurs at Zinnwald and Altenberg in the Erzgebirge of Germany, in Cornwall, England, and elsewhere, usually associated with tin deposits.

ZINZENDORF, tsĭn'tsĕn-dôrf, **Nicholas Ludwig,** COUNT VON, German religious leader, founder of the Society of United Brethren: b. Dresden, Saxony, 26 May 1700; d. Herrnhut, Upper Lusatia, 9 May 1760. From 1716 to 1719 he studied at the orthodox University of Wittenberg, and subsequently traveled in Holland and France, describing his journey in 'The Pilgrimage of Atticus Through the World.' In 1721 he received an appointment to the council of state from the Saxon government, which he held till 1727. He then completely withdrew from public affairs. He received at his estate in Upper Lusatia in 1722 the persecuted Moravian Brethren. This settlement received in 1724 the name of Herrnhut. With a view to founding the body called the United Brethren (q.v.), he published various projects, not in harmony with each other, which excited opposition, but he persevered in his plan and finally succeeded in establishing a religious order based on family instead of monastic conditions. In 1734 he passed a theological examination under an assumed name, and was ordained a clergyman of the Lutheran Church. After two years spent in traveling on behalf of his society, he was banished in 1736 from Saxony. The order of his banishment was repealed in 1747. In the meantime he had been consecrated bishop of the Moravian Church in Berlin, founded Moravian colonies in Holland, Esthonia and Livonia, and visited England. In 1739 he wrote a catechism which he styled the 'Good Word of the Lord,' and the same year visited the missions of the Brethren in the West Indies. In 1741 he visited the United States and founded the well-known Moravian colony at Bethlehem, Pa., and before returning to Germany in 1743 assisted in establishing missions among the Indian tribes. After returning to Europe he made a journey to Livonia, whence the Russian

government sent him back under a military escort to the frontier. He afterward visited Holland, spent several years in England, and obtained an act of Parliament for the protection of his followers in the British dominions. He wrote more than 100 works in prose and verse. His *Diary* was published in 1907.

Consult Spangenberg, A. G., *Leben des herrn Nicolaus Ludwig, grafen und herrn von Zinzindorf und Pottendorf* (Barby 1772–75; Eng. tr., abridged, London 1838); Römer, H., *Zinzindorfs Leben und Werken* (Gnaudau 1900); Langfelder, E. M., *Les séjours en Suisse, en France et en Belgique du comte Zinzindorf d'aprés son journal (1764–1770)* (Szeged, Hungary 1933).

ZION, zī'ŭn, city, Illinois, in Lake County, on the shore of Lake Michigan, five miles north of Waukegan, and served by the Chicago, North Western and the Chicago North Shore and Milwaukee railroads. It has manufactures of lace, candy, and bakery goods. Zion was founded in 1901 by John Alexander Dowie of the Christian Catholic Apostolic Church, and was governed theocratically by his successor, Wilbur Glenn Voliva, from 1907 until 1936, when a commission form of government was instituted. A passion play is produced here annually. Pop. (1950) 8,950.

ZION or **SION,** sī'ŭn, an elevated scarp of rock on one of the hills of Jerusalem, situated between the valleys of Kidron and Tyropoeon, called in modern times Temple Hill. The term Zion is often used in Biblical and other literature to designate the entire city of Jerusalem and, metaphorically, to designate the kingdom of God on earth and in heaven.

Zion was a stronghold of the Jebusites until conquered by David (II Samuel 5-7), who built there his palace and erected a tent for the Ark. The hill was known to the Jews as the "City of David" and became the center of Jewish religious and cultural life, and when Solomon built the Temple here, it became indeed the "habitation of the Lord" (Psalms 9:11, 76).

Zion, with the hills of Moriah and Ophel, was enclosed by the first wall of Jerusalem and here were built the palaces of Solomon and later of Herod. Newer walls around Jerusalem excluded Zion from the city, placing it entirely in what is now the Kingdom of Jordan. The Christian church erroneously assigned the name to another ridge southwest of the true Zion, although archaeological findings have asserted that Zion was indeed where the Old Testament placed it. The Christian Mount Zion is in the city of Jerusalem, and is a part of both Israel and Jordan.

ZION NATIONAL PARK, a government reservation in southwestern Utah, established in 1919. It has an area of 94,881 acres. It comprises the upper part of the valley of the Virgin River which here flows for eight miles in a narrow canyon, falling from 50 to 70 feet per mile, with walls in places 2,500 feet high, of brilliant colors and with great variety of gorgeous cliffs, towers, and pinnacles. Notable among these are two great monoliths known as the Great White Throne and the West Temple; they rise nearly 4,000 feet above the valley and consist of red sandstone. While the reservation is 50 miles from the nearest railroad at Cedar City, it is accessible by good auto roads.

ZIONISM. See Jewish History and Society—*Zionism.*

ZIPAQUIRA, sē-pä-kē-rä', town, Colombia, Department of Cundinamarca, 30 miles north of Bogotá. It is built on the site of an old Chibcha Indian town, and is especially noted for its valuable salt bed which is owned and operated by the government and supplies the greater part of the salt used in the republic. It is in a cattle raising district, and coal, lead, copper, and iron are mined in the vicinity. Pop. (1938) 6,955.

ZIPH. See Zif.

ZIRCON, zûr'kŏn, *in mineralogy,* the native zirconium silicate, $ZrSiO_4$. Its crystals are tetragonal and isomorphous with thorite, zenotime, cassiterite, and rutile. Though its crystal forms are extremely varied, they are usually prisms terminated by pyramids. Small crystals frequently show a wealth of faces, among which the "zirconoids" or ditetragonal pyramids are prominent. It is a heavy mineral, its specific gravity varying from 4.2 to 4.7, and it has a characteristic adamantine luster. Though often nearly or quite opaque, transparent crystals are not uncommon, and owing to its hardness, 7.5, strong double refraction, and the variety of rich colors in which it is found, zircon has long been prized as a gem. Its dispersive power is excelled only by the diamond. "Hyacinth" or "jacinth" includes reddish, orange, or brownish gem stones, which can be turned colorless by extreme heat and are marketed as "Matura diamonds." "Jargoon" or "jargon" is the name of the colorless, yellowish, grayish, or smoky varieties.

The finest zircon gems come from Ceylon and New South Wales, while excellent translucent to opaque crystals occur in Arendal, Norway; the Ural Mountains, USSR; Ontario and Quebec, Canada; Essex and Orange counties, New York; the Pikes Peak district, Colorado; and Henderson County, North Carolina. By far the most important locality is in the last named, where many tons of crystals occur loose in the soil. Zirconia, derived from this source, was used in the "Wellsbach" or "Auer" gas mantles, but has been superseded by thoria. The mineral is used as an abrasive and in refractories and enamels, as well as for gems. The bulk of zircon production comes from Australia, India, and Brazil.

ZIRCONIUM, zĕr-kō'nĭ-ŭm, a chemical element named after the mineral zircon in which Martin H. Klaproth discovered the oxide zirconia (1789), and obtained by Jöns Jakob Berzelius in 1824 as an iron-gray powder. Afterward it was found in many other minerals, some of the most important being eudialyte, hyacinth, and polymignite.

Its symbol is Zr; atomic number 40; atomic weight 91.22; specific gravity 6.44; with a valence of 4. It is in Group IV of the periodic table and has eight isotopes, of which five are stable. It has many physical and chemical properties resembling the element silicon. Like silicon and carbon it exists free in three allotropic forms: (1) amorphous, obtained by heating sodium zirconium chloride with metallic sodium potassium; (2) crystalline, as foliated leaves from heating sodium zirconium fluoride with metallic aluminum; (3) graphitoidal, obtained in scales of steel gray by action of iron on sodium zirconium. Insoluble in water, it is readily soluble in aqua regia or in hydrofluoric acid. When heated highly in the air it burns to the

oxide ZrO_2. This oxide, commonly known as zirconia, is prepared by fusing the mineral zircon ($ZrSiO_4$) with a mixture of sodium hydrate and sodium carbonate, treating with hydrochloric acid and heating to separate the silica, precipitating the solution so obtained with ammonia, and heating this white precipitate. Another method is now used by which the chloride is made by treating crushed zircon with chlorine, separating the silicon chloride by heat, precipitating the solution of zirconium chloride with ammonia, and heating the precipitate. Zirconia forms a white powder or amorphous lumps. It has both basic and acid properties. It dissolves slowly in hydrofluoric or sulphuric acids, the fluoride (ZrF_4) uniting with fluorides of other metals forming complex salts called zircofluorides, example K_2ZrF_6, potassium zircofluoride. With strong alkalies zirconia forms zirconates, example, K_4ZrO_4, potassium zirconate. Zirconium forms a long series of salts, in most of which it acts as a basic element.

Uses.—Zirconium in metal compounds and alloys has come into importance recently. A good copper alloy is made, also one for steel refining. The metal is used too as wire in radio tubes, and in sheet form for rayon spinneret cups, and the powdered metal goes into flashlight mixtures and ammunition primers. The sand finds use in the making of cast-steel molds, and as an insulating material in electrical appliances. But the main bulk consumption is in ceramics for enamel and glaze frits, and in coating welding rods.

ZIRKNITZ, tsĭrk'nĭts, or **ZIRKNITZER ZEE,** or **CZIRKNITZER SEE,** Yugoslavia, a phenomenal periodical lake in Carniola, 30 miles east-northeast of Trieste, in a deep valley surrounded by mountains, the principal of which are Javornik, Succhi, Slivinza and Sternitz. The lake takes its name from Zirknitz, situated at an elevation of 3,500 feet, and one of many villages in the neighborhood. Receiving the waters of six streams, and surrounded by mountains with no outlet, the characteristic feature of the lake is its internal drainage. The bottom of the lake partakes of the limestone formation of the district, which fissures readily, and has numerous subterranean caves and channels. Some of these caverns are of great depth, and in the dry season absorb the waters of the lake, leaving it sometimes completely dry, with only a few pools, in which the fish take refuge. A luxuriant natural vegetation covers the surface of the deserted lake, and when the drought is protracted grass, millet, or buckwheat is sown on it and the harvest reaped before the return of the water. In June the lake is frequented by wild ducks, which afford abundant sport, and when the water is decreasing fish are caught in great numbers. The lake is from six to seven miles long, nearly three broad and of an average depth of 11 feet, but there is no stated limit to its basin. It receives the drainage of a considerable country, and even when no rain falls in the immediate neighborhood its reservoirs are filled from the rainfall of more distant hills. In dry seasons the lake takes about 30 days to empty. When rain has been abundant and all its subterranean sources are in simultaneous activity, it reaches the average height in 72 hours, and when the rain has extended to all the tributary region it reaches its extreme level, which is about two feet above the average, in 196 hours. The natural outlets then no longer suffice to carry away the water, and it overflows the country, damaging or destroying the surrounding villages. The emptying and flooding of the lake depends upon the drought or moisture of the season, and is not strictly periodic. It has been known to empty and fill three times in one year. From 1707–14 it was only once dry, and from January 1834 to February 1835, it remained entirely without water, the longest drought on record. This lake was known to the ancients for the same phenomena, the Romans calling it *Lacus Lugens* or *Lugea Palus;* and it has been picturesquely described by Tasso in his 'Sette Giornate del Mondo.'

ZISKA, zĭs'kạ (properly **ZIŽKA,** zhīzh'kạ), **John,** Bohemian Hussite leader: b. Trocznov, near Budweis, about 1360 (by some authorities as late as 1380); d. Prbyslav 11 Oct. 1424. He was educated at the court of King Wenceslas at Prague, entered the profession of arms, joined the contingent that went from Bohemia and Hungary in 1410 to the assistance of the Teutonic Kinghts against the Poles and Lithuanians, and fought with great prowess in the fiercely contested battle of Tannenberg, 15 July 1410. Then he served in Hungary against the Turks, and with the English at Agincourt, 25 Oct. 1415. Soon after the execution of Huss (q.v.), he returned to Bohemia and became a leader of the Hussites. In 1419, when the Hussites broke into rebellion against the Emperor Sigismund, Ziska organized their military forces into a well-disciplined army of infantry, supplying the want of cavalry by means of the Waggenburgen, or "car-forts," constructed of the baggage-wagons. He took up his headquarters at a stronghold on the heights of Austie, in southern Bohemia, the fortress being known as Tabor (with reference, perhaps, both to *tabor,* Bohemian for "encampment," and to Mount Tabor in Palestine), and the extreme Hussites as "Taborites." Sigismund sent an army of 30,000 into the country, but Ziska, with a hasty levy of about 4,000, took up his position on Mount Vitkov, near Prague, and on 14 July 1420 defeated the enemy with great slaughter. The eminence has since been known as the Hill of Ziska. On 1 Nov. 1420, at Pankratz, he was again victorious over Sigismund, and on 2 November captured the fortress of Vysehrad, near Prague. He won a second great battle against Sigismund 8 Jan. 1422 at Deutschbrod, and penetrated into Moravia and Austria. He had long had but one eye, and lost the other by an arrow-wound at the siege of Raby castle in 1421. Notwithstanding his blindness he continued to direct his troops with great efficiency and almost unvarying success. Prague refused to recognize his authority, and he thoroughly subdued it in 1424. In that year, it is said, Sigismund, realizing the impossibility of conquering Bohemia, began negotiations toward a treaty, by the terms of which the Hussites were to have full religious liberty and Ziska was to be governor of Bohemia. Such negotiations, if undertaken, were interrupted by Ziska's death at the siege of Přbyslav.

Ziska became the hero of the Bohemian revolutionary party, and for this character he was well fitted by his zeal and military ability. He was frequently cruel in his method of warfare and conquest. Much fiction has been mingled with the facts of his career. Alfred Meissner's epic 'Ziska,' based on the leader's history, reached a 12th edition in 1884. Consult the German translation (1882) of Tomek's 'Life.'

ZITHER, or **CITHERN,** a modern development of the musical instrument known to the Greeks as cithara. In the early part of the 19th century it became a favorite with the peasantry of the Styrian and Bavarian Alps, and was introduced into England about 1850. The zither consists of a resonance box, with a large circular sound hole near the middle; the strings, 32 in number, in some cases increased to 40 and even 46, being made of steel, brass, catgut and silk covered with fine silver or copper wire, and tuned by pegs at one end. Five of the strings are stretched over a fretted keyboard, and are used to play the melody, the fingers of the left hand stopping the strings on the frets, the right-hand thumb, armed with a metal ring, striking the strings, which are tuned in fifths, and have a chromatic range from C in the second space of the bass staff to D in the sixth ledger line above the treble. The remainder, called the accompaniment strings, are struck by the first three fingers of the right hand. The viola zither, in which the resonance box is heart-shaped, is tuned like the violin, and is played with a bow.

ZITTAU, tsĭt'tow, Germany, a town of Saxony, on the Mandau, near the Austrian frontier, 49 miles by rail east-southeast of Dresden. The town was practically destroyed in the Seven Years' War, since which time most of its buildings have been erected. The chief public buildings are a splendid town-house, the churches of Saint Peter, Saint Paul, Saint John and Mary, hospitals, custom-house, gymnasium, a municipal museum, and a valuable library. Its principal manufactures are cotton-spinning, dress goods, iron-founding machinery, stained glass, cycles, ropes, paper, brewing and brick-making; and there is a trade in cotton and linen goods, chemicals, etc. There are a number of lignite mines in the neighborhood. Pop. (1925) 38,353.

ZITTEL, tsĭt'tĕl, **Karl Alfred von,** German palæontologist and geologist: b. Bahlingen, Baden, 25 Sept. 1839; d. Munich, Bavaria, 6 Jan. 1904. After study at Heidelberg and Paris, he entered the geological survey at Vienna, in 1863 became a lecturer in the university there, and later in the same year was appointed professor of mineralogy at Karlsruhe. In 1866 he was made professor of palæontology and geology at Munich; and from 1899 he was president of the Bavarian Academy of Sciences and curator-general of the scientific collections of Bavaria. The Rohlfs expedition, which he accompanied to Egypt and the Libyan desert in 1873–74, derived much of its value from his important labors. Among his publications are the 'Paläontologische Studien über die Grenzschichten der Jura- und Kreideformation' (1868–83); 'Aus der Urzeit' (1872; 2d ed., 1875); 'Handbuch der Paläontologie' (5 vols; 5th vol. with Schimper and Schenk, 1876–93), the most complete and authoritative work in that field; and 'Geschichte der Geologie und Paläontologie bis Ende des Neunzehnten Jahrhunderts' (1899). He edited the periodical *Palæontographica* from 1869.

ZIWET, Alexander, American mathematician: b. Breslau, Germany, 8 Feb. 1853. Graduated from the Polytechnical School of Karlsruhe in 1880, he came in that year to the United States, and for some time was connected with the United States lake survey (Detroit) and the coast and geodetic survey (Washington). Subsequently he became successively instructor in, and junior professor of, mathematics in the University of Michigan, professor in 1905. In 1892 he was made co-editor of the *Bulletin* of the American Mathematical Society. He died, 18 Nov. 1928. He published an 'Elementary Treatise on Theoretical Mechanics' in three parts, as follows: Pt. I, 'Kinematics' (1893); Pt. II, 'Introduction to Dynamics, Statics' (1893); Pt. III, 'Kinetics' (1894; revised ed., 1904). D. 1928.

ZIZANIA, a genus of grasses (q.v.) including the wild rice.

ZIZYPHUS, a genus of the family *Rhamnaceæ,* shrubs or small trees, with spiny stipules, alternate three-nerved leaves, a spreading five-cleft calyx, five hood-like petals, five stamens, a five-angled disc, adhering to the tube of the calyx, and having enclosed within it the two- or three-celled ovary. Fruit a drupe, which is sometimes edible and has a large stone or kernel containing from one to several flattened seeds. *Zizyphus* is widely distributed, but is chiefly indigenous to tropical Asia and America. The fruits of the cultivated *Z. jujuba,* and of *Z. sativa,* are of the size and shape of a small, oval plum. They ripen in September when they are gathered and stored in a dry place, the pulp becoming sweeter by the process. They have a dark-red skin, but are yellow within. If carefully dried, these fruits, called jujubes, will keep for a long time, and retain their acid flavor, which has made them a refreshing dessert fruit, in the Mediterranean countries and in China. They are nutritive and demulcent, a cough medicine having been prepared from them, and formerly the sweet-meat known as jujube paste was made from the evaporated juice of jujube, and of gum-arabic; but now the jujube is displaced by the gum and by gelatine. *Z. sativa* is a handsome arborescent shrub, with small, varnished, oval leaves and greenish inconspicuous flowers, succeeded by the bright drupes. It is sometimes cultivated in the United States, being hardy as far north as Washington. The bark, in its native countries, was used medicinally, for fever and for sores; and it is also employed for tanning and for a dye-stuff like that of *Z. xylopyra* which yields a black dye. Various parts of other species yield medicines, and the edible fruits of *Z. baclei* of Africa are used for a pleasant drink and are also made into bread. *Z. lotus* is by some believed to be the lotus-trees the fruit of which produced such indolence in those who ate them. It grows in Barbary,

where it is called sadr. *Z. spinachristi* is a small, prickly tree, which is reputed to have composed Christ's crown of thorns. Like other spiny species of *Zizyphus,* this is a good hedge plant. *Z. nummularia* of Persia and India is one of the camel's thorns, whose foliage forms a fodder, and which has edible fruits. The cog-wood of Jamaica, an important timber tree, is *Z. chloroxylon.*

ZLATOUST, zlä-tō-oost', Russia, a town in the province of Ufa, on the Ai, an affluent of the Ufa, near the Ural Mountains, 150 miles direct and 199 miles by railway northeast of Ufa. It has a cathedral and a meteorological and magnetical observatory. In the vicinity are rich iron and gold mines, and in the town are government works, manufacturing sword-blades, steel instruments and ammunition. Pop. about 34,245.

ZNAIM, tsnīm (formerly **ZNOIMO** or **ZNOJMO),** Czecho-Slovakia, a town of Moravia, on the Thaya, 50 miles northwest of Vienna. The chief buildings are a Rathhaus (1446), a circular church, said to have been a heathen temple, and the Gothic church of Saint Nicholas, dating from 1348. The old ducal castle crowns a neighboring height. The trade is largely agricultural. Mustard, wine and cucumbers are exported. Fine majolica, leather and chocolate are manufactured. New waterworks were opened in 1877. As Znoimo, it was the capital of Moravia, destroyed in 1145 by the Bohemian Prince Vladislav, and rebuilt in 1226. On 11 July 1809, the French under Massena and Marmont defeated the Austrians here, resulting in the armistice between Napoleon and Archduke Charles; it was captured by the Prussians 13 July 1866 and was occupied by them until 3 Sept. 1866. Pop. (1921) 21,197.

ZOANTHARIA, an order of *Actinozoa* (q.v.) characterized by the fact that the tentacles are simple and unbranched, that there are usually incomplete as well as complete mesenteries, and that the tentacles usually alternate in several circles. The mesenteries and tentacles are often arranged in multiples of the number six, but this is variable, and in some forms the number of mesenteries increases during the growth of the animal. The animal develops as a gastrula, the blastapore of which remains as the mouth. The larva is usually ciliated and free-swimming. The Zoantharia include the sea-anemones and corals (qq.v.); these do not represent natural divisions of the class, but merely modes of life of its members. A colonial Zoantharian with a calcareous exoskeleton is a coral; an isolated Zoantharian without an exoskeleton is a sea-anemone.

ZOAR, Palestine, an ancient city mentioned in the Bible, but whose exact location is unknown, although it probably stood at the southern end of the Dead Sea. It is spoken of as visible from Pisgah (Deut. xxxiv, 3). The Arabic historian Abulfeda speaks of a Zoara near the Dead Sea, and the Roman garrison, Zoara, mentioned by Jerome and Eusebius, is probably the same place. Mention of it occurs in Genesis xiv and xix; in Isaiah, xv, and in Jeremiah xlviii. Consult Smith, G. A., 'Historical Geography of the Holy Land' (16th ed., London 1910).

ZOAR, zō'ar, **Separatists Society of.** The Separatists Society of Zoar was a communistic religious organization located at Zoar, on the Tuscarawas River, Tuscarawas County, Ohio. They were German Protestant peasants, 225 in number, who emigrated from Württemberg in April 1817. Their chosen leader was Joseph Baumler, whose name was later changed, for the sake of euphony, to Bimeler. Bimeler was of humble origin, but a man of unusual ability and independence, well educated, a natural leader, and a fluent speaker; he purchased in his own name, in the locality named above, 5,000 acres of farm land, at an average value of $3 per acre, giving a mortgage at long time for the entire amount. This Separatist emigration had been primarily for the purpose of securing religious liberty; and for better opportunities in obtaining a livelihood. It was expected that each family would, by its industrious labor, secure separate ownership in a portion of the land held by Bimeler, but the colonists being diverse in age, strength, experience, education and enterprize, they soon realized that their personal inequality stood in the way of the collective success of the colony, and early in 1819 they decided to organize into a community of property and effort. Articles of agreement were signed by 159 adults — 53 males and 104 females. The articles created a community of interest, present and prospective, whereby all the property, movable and immovable, of the individual members, and their future earnings should become the common stock of the association, to be held and managed by chosen directors. Death of a member passed no property interest to his heirs, and withdrawal from the society, voluntary or compulsory, carried with it no claim upon a divided or undivided right in the association. Bimeler was to retain the realty in trust until the societey by its earnings could pay the mortgage and assume title.

In 1832 the society reached its highest membership of 500, and was incorporated under the then existing laws of Ohio by the name of "The Society of Separatists of Zoar." This conferred upon the society the ordinary powers of a corporation, with perpetual succession, power to hold property, purchase and sell, pass by-laws, etc. Under this reorganization the members were divided into two classes, known as the novitiates and the full associates; the novitiates were obliged to serve at least one year before admission to the second class, and this applied to the children of the members if, on becoming of age, they wished to join the society; the full associates must be of legal age — the males 21 and the females 18; all officers were elected by the whole society, the women voting as well as the men, all elections being by ballot and a majority vote; the government of the community vested solely in a board of three trustees (or directors) to serve three years each, one to be elected annually; these trustees had unlimited power over the custody and management of the property and all the temporalities of the society, but were bound to provide clothing, board and dwelling for each member "without respect to person," and use all means

confided to their charge for the best interests of the society; they directed the industries and detail of affairs of the society; assigned each member his especial work, and the portion of necessaries each should receive. Beside the board of trustees there was a standing committee, or council, of five, one member being elected each year. This council was the supreme judiciary, or board of arbitration, of the society, in cases of disagreement, dissension or complaint; it had power to excommunicate members or deprive them of participation in the affairs of the society. They also elected once in four years a cashier or treasurer who had custody of all moneys, kept the books, and had immediate oversight over the finances of the society. In addition there was an official known as the "agent general," who acted as the trader to buy and sell for the society in its dealings with the outside world, make and enforce contracts, etc. The office of agent general was regarded as the position of honor and influence, and to it Joseph Bimeler was elected for life; after his death the office remained vacant, its duties being performed by the cashier or the trustees.

The society, from its organization as a commune, steadily prospered, and in time built up a large number of enterprising and successful industries, having in the period of its height two large flour mills, saw mill, planing mill, machine shop, tannery, dyehouse, stove foundry, cooper shop, woolen mill, brewery, slaughter-house, blacksmith shop, tile works, pottery, etc. In all these concerns a high grade of goods was produced which found a ready market with foreign customers. The value of the Zoar property increased until about 1875, when their land, industrial plants and money accumulation were estimated at $1,500,000. From that time the enterprise began to decline. Bimeler died in 1853, and there was no leader or director his equal in sagacity or personality. The environment of the society slowly changed from that of a western pioneer frontier to a prosperous, cultivated section of country, and rival neighboring industries made inroads into the export business of Zoar; the Zoarites were not progressive and did not keep pace in their manufactures with modern methods and improvements, and in time found that they could purchase products for use and wear cheaper than they could make them; there were few accessions to the society; the original members became too old and feeble to conduct its affairs; outside laborers had to be employed; the younger members were inclined to leave and seek their fortunes where they could acquire independent property and freedom of action. This decline continued until in 1897, when, by a common consent, the organization decided to disband and place the property in the hands of a commission for equal division. The appraisement and distribution was completed in the fall of 1898. There were at this time 222 people, adults and children, in the society, of whom 136 were entitled to one equal share. They each received a few hundred dollars in cash and a portion of the farm land or village property.

The religious tenets of the Zoarites were few and simple. They confessed the doctrine of the Trinity; the fall of man, the return through Christ, the Holy Scriptures as the guide of their lives, all ceremonies were declared useless and injurious, marriages were contracted by mutual consent and before witnesses, they recognized no ordained minister, and engaged in no public prayer. Bimeler was their only preacher and teacher, he spoke each Sunday to the society, and after his death his published discourses were read in the public meetings by various members. The society did not seek additions and made no attempt to propagate its principles, either economic or religious. The life of the Zoarites was one of utmost simplicity, serenity and morality. There never was a divorce in the community and no member was ever charged with a crime or felony. Consult Nordhoff 'Communistic Societies in United States' (1875); and Randall, 'History Zoar Society' (1904).

ZOBEIR, or **ZUBAIR,** IBN **al Awam,** a relative of Mohammed, and one of the earliest converts to Islam: d. 656. He was one of the 10 predicted by Mohammed as certain to enter the Garden of Allah. Before his death, Omar, successor of Mohammed, appointed Zobeir one of a council of six who were to choose from their own number a new caliph. Zobeir opposed the election of Othman and was thereafter his enemy; he also opposed his successor, Ali, with whom he had been friendly before Ali's accession. Later Zobeir succeeded in raising a rebellion against Ali, and he was slain at the battle of the Camel, at Basra. For his son see ABD ALLAH IBN ZUBAIR. Consult Huart, C. I., 'Histoire des Arabes' (Paris 1912).

ZOBEIR, Rahama, Egyptian pasha and Sudanese governor: b. 1830. He came of a family claiming descent from an uncle of Mohammed. By 1860 he had established his leadership among the Arab ivory and slave traders on the White Nile and in the Bahr-el-Ghazal, and although nominally an Egyptian subject he maintained a great army of blacks and was the real ruler of the surrounding country. He defeated an expedition sent from Khartum to Bahr-el-Ghazal in 1869, but pleaded innocence in the matter, was pardoned and appointed governor of the district. In 1874 he conquered Darfur, and was made governor-general of the new province, but when he went to Cairo in 1876 the authorities prevented his return. His son assumed his place in Bahr-el-Ghazal, and under the instruction of Zobeir defied the forces of General Gordon, and in 1878 was subdued. In 1884, however, General Gordon, apprehensive of the Mahdist movement, vainly asked that Zobeir be permitted to return in order to check it. Zobeir was interned at Gibraltar in 1885–87, returned to Cairo in 1887, and after 1899 lived on his estates in his native country.

ZOCKLER, tsĕk'lĕr, **Otto,** German Lutheran theologian: b. Grünberg, Hesse, 27 May 1833; d. Greifswald, 9 Feb. 1906. He was educated in the universities of Giessen, Erlangen, Halle, Göttingen and Berlin, became a lecturer at the first-named in 1857, and in 1863 professor of theology. In 1866 he was appointed professor at Greifswald, and in 1885 consistorial councillor. He was one of the leaders of the movement toward the establishment of a state church in Prussia. In 1882 he became editor of the

Evangelische Kirchenzeitung. For the 'Kurzgefasstes Kommentar zum Alten und Neuen Testament und zu den Apokryphen' (1886 et seq.), which he edited with Strack, he prepared the commentaries on the Old Testament apocryphal books, the Acts, and the epistles to the Thessalonians and Galatians. Among his works are 'Hieronymus, sein Leben und Wirken' (1865); commentaries to Chronicles, Job, Proverbs, Ecclesiastes, Canticles and Daniel, in Lange's 'Bibelwerk' (1866–72; Eng. trans. 1870 et seq.); 'Das Kreuz Christi' (1875; Eng. trans. 1877); 'Gottes Zeugen im Reich der Natur' (1881; 4th ed., 1906; Eng. trans. 1886); 'Biblische und Kirchen-historische Studien' (1893); 'Die Tugendlehre des Christentums' (1904); 'Geschichte der Apologie des Christentums' (edited by H. J. and E. Schlapp, 1907), etc.

ZODIAC. The zodiac is a belt of the celestial sphere, extending 8° on each side of the ecliptic, or the path of the sun among the stars. "The name is derived from ζώον a living creature, because the constellations in it (except Libra) are all figures of animals. It was taken of that particular width by the ancients simply because the moon and the then known planets never go farther than 8° from the ecliptic" (Young's 'Astronomy'). The belt is divided into 12 parts, of 30° each, to which are given the following names: Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricornus, Aquarius, Pisces. This division into 12 parts was suggested by the 12 reappearances of the moon in a year. The idea seems to have originated with the Chaldæan astronomers, about 2100 B.C.

Owing to the fact that the earth is not a perfect sphere, the pole of the earth's equator describes a circle around the pole of the ecliptic, which causes a constant retrograde motion in equator with the point of intersection of the plane of the zodiac. The rate of this motion is 1° in 70 years, and has amounted to 30°, or one entire sign, up to the present time. "The sign of Aries, therefore, is now in the position of the constellation Pisces; each sign having backed so to speak into the constellation west of it." The constellations themselves bear no resemblance to the signs designated by them.

During the Middle Ages the signs of the zodiac were supposed to influence human life, and hence were distributed to different parts of the human body. Disease was supposed to be cured by the aid of the zodiacal power presiding over that part of the body. The remnant of this superstition is still seen in some almanacs.

The Egyptians are supposed to have adopted the 12-fold division of the Zodiac from the Greeks, but they changed the symbols of living creatures to others of their own. The Chinese divided the course of the sun into 12 parts, which they designated as the rat, the ox, the tiger, hare, dragon, serpent, horse, sheep, monkey, hen, dog and pig. This division is still found in some parts of Central Asia and Japan. It has also been found among the remains of the Aztec race in America. The original zodiacal constellations occupied unequal spaces in the heavens. Hipparchus was the first to divide the zodiac into equal spaces of 30° each, and give to them the names of the older constellations. His method of reckoning positions in the ecliptic was used until this century. Astronomers have now abandoned it for the more accurate measurement of degrees, beginning at the vernal equinox.

The origin of the names of the animals assigned to the zodiac by the ancients is unknown. Some have supposed that the spring signs: Aries, the Ram, Taurus, the Bull, and Gemini, the Twins, mark the time of the bringing forth of young by flocks and herds. Cancer, the Crab, marks the time when the sun appears to move backward. Leo, the Lion, symbolizes the fierce heat of summer, and Virgo, the Virgin, gleaning corn, symbolizes the harvest. In Libra, the Balance, the day and night balance each other. Scorpio is supposed to have marked the presence of venomous reptiles in October: while Sagittarius symbolizes the season of hunting. Capricornus marks the beginning of the return of the sun to the north, Aquarius symbolizes the winter rains, and Pisces the season of fishes. These are but fanciful representations, and have no foundation in fact.

ZODIACAL LIGHT. "The zodiacal light is a faint column of light rising from the western horizon after twilight in winter or spring evenings; and before daybreak in summer or autumn. It extends out on each side of the sun, and lies nearly in the plane of the ecliptic. Near the equator it can be seen all the year, and has been traced all the way across the heavens from east to west, forming a complete ring." In our latitudes it can seldom be traced more than 90° from the sun. Parts of the column near the sun are somewhat bright, but distant portions are extremely faint, and can only be seen on the very clearest nights; though the cause of the zodiacal light cannot be said to have been definitely proved, it is very probable that it is sunlight reflected by myriads of small meteoric bodies revolving around the sun, nearly in the plane of the ecliptic. This theory requires a thin flat ring of these meteors to extending beyond the orbit of the earth. The name zodiacal light was given to this phenomenon by Cassini in 1653, who described it as a flat luminous ring encircling the sun nearly in the plane of the ecliptic. Kepler supposed it to be the atmosphere of the sun; but Laplace showed that the atmosphere of the sun could not extend to anything like the distance from the sun which is reached by the zodiacal light. In 1853 an extended series of observations was made by Jones from different parts of the Pacific Ocean. From these observations he deduced the theory that the zodiacal light was caused by a ring of matter surrounding the earth, and not the sun.

Professor Wright, of Yale University, has determined that the spectrum of the light is continuous, and therefore is essentially reflected sunlight. He has also determined that the light is partially polarized in a plane passing through the sun, and that the amount of the polarization is between 15 and 20 per cent. The origin of the minute particles which reflect the light has been accounted for in many ways. By some they are believed to have been thrown out from the corona of the sun; by others to be composed of dust thrown out from the equatorial

regions of the sun; but by most they are believed to be an immense cloud of meteoroids filling the space between the earth and the sun. The meteoric theory of the sun's heat presupposes a multitude of these meteoric bodies constantly falling into the sun to supply the loss by radiation, as well as multitudes of others which never reach the surface. It is not probable, however, that these meteors if they exist play any part in the phenomena of the zodiacal light.

A most valuable and important contribution to our knowledge of the zodiacal light is due to a recent research of Seeliger. It has long been known that the slow, secular changes of some of the elements of the orbits of the planets of the solar system, when these are derived from observation, are not in exact agreement when these same changes are determined from a computation based upon the law of universal gravitation. In particular, it is found that the computed motions of the perihelia of the orbits of Mercury and Mars and of the node of Venus differ from the motions derived from observation by amounts far in excess of the uncertainties inherent in the observations themselves. Many attempts to account for the first discrepancy have been made. Thus, Leverrier assumed that it arose from the disturbing pull of a small planet near the sun, which for many years found its place in our astronomical books under the name of Vulcan. Other astronomers have supposed that the disturbance might be due to the pull of a ring of particles about the sun, to an unequal distribution of the material within the body of the sun itself, or even to an inexactness in the accepted statement of the law of gravity. Analysis shows, however, that none of these explanations are admissible, for all of them lead to disturbances in other directions, either of the planets or of the moon, which are in discordance with observation. But Seeliger has shown that if there be ascribed to the zodiacal light an even almost inconceivable tenuity, its gravitational pull will exactly account for the discrepancies observed, without at the same time introducing any new discrepancies. The densities to be assumed for the inner and outer portions of the zodiacal light in order that its attraction may be sufficient to balance the former discrepancies are as follows:

Average density of the inner portion, extending from the sun to 0.24×, the distance of the earth = $2.52 \times 10^{-11} \times$, the sun's density;

Average density of the outer portion, extending from the sun to 1.20×, the distance of the earth = $2.52 \times 10^{-11} \times$, the sun's density. Average density of the outer portion, extending from the sun to 1.20 ×, the distance of the earth = $0.0026 \times 10^{-11} \times$, the sun's density.

ZOE, zō'ē (Gr. Ζωή), empress of the East: b. about 978; d. 1050. She was the daughter of Constantine VIII, and became the wife of Romanus III in 1028. In 1034 Romanus was put to death by Zoe and Michael the Paphlagonian, whom she married and raised to the throne as Michael IV. The latter dying, was succeeded by his nephew, Michael V, who was deposed by the people in 1042. Zoë and her sister Theodora were then proclaimed joint sovereigns. She displayed great ability and firmness in the government, and in 1042 married Constantine IX, Monomachus, who supplanted Theodora. She reigned till her death.

ZOETROPE, an optical instrument used as a mechanical top, depending, for its interest, on the constancy of visual impressions. It consists of a rotating drum, open at the top, in which around its inner periphery are placed strips of paper, having figures of men, animals, etc., in varying positions. By turning the cylinder the images are seen through slots in its upper side, giving the effect of action to the figures.

ZOFFANY, tsŏf'fä-nĭ (properly **ZAUFELBY**), **Johann,** British painter: b. Ratisbon, 1733; d. London, 11 Nov. 1810. He was a pupil of Speer at Ratisbon, but at 13 ran away to Italy, where he studied for 12 years. In 1758 he went to England, where he first attracted attention by a portrait of Garrick, and soon won considerable reputation, becoming one of the original members of the Royal Academy on its foundation in 1769. He was sent by George III to Italy, where he remained in 1772–79, and among other paintings executed 'The Tribune of Florence,' one of his most celebrated works. In 1783–90 he engaged in painting in India; and the last 20 years of his life he spent in England. Among his further paintings are 'Earl of Barrymore'; 'Foote'; 'Weston'; 'Members of the Royal Academy'; 'Tiger Hunt'; and 'Embassy of Hyder Beg.'

ZOGBAUM, Rufus Fairchild, American artist: b. Charleston, S. C., 28 Aug. 1849; d. New York, 22 Oct. 1925. He studied at the Art Student's League 1878–79, and in Paris with Leon Bonnat in 1880–82, and made extensive study of European armies in field and garrison, and later became known as a leading delineator of military and naval subjects, which he renders with scrupulous fidelity to the various points of detail. His publications, written and illustrated by himself, are 'Horse, Foot and Dragoons' (1887); 'All Hands' (1897); and 'The Junior Officer of the Watch' (1908).

ZOHAR, zō'här, the Bible of the Kabbalists, long reverenced by Jewish mystics and regarded by some as higher than the Bible and the Talmud, but proved a clever forgery The secret science of the Kabbala received a marked development at the beginning of the 13th century, when a mystic, Ezra or Azriel (b. 1160; d. 1238), compiled a work called 'Brilliancy' ('*Bahir*'). In an atmosphere of reputed miracles and a new Messiah, there appeared some years later the most famous Kabbalistic book of the time — the 'Zohar,' or 'Splendor.' It was offered as the work of Simon ben Jochai, a sage of the 2d century, of whom many legends are told. He is said to have spent years in solitude, a hermit receiving special revelations. It was claimed that for over a thousand years the 'Zohar' had been concealed in a cave in Galilee and had been at last brought to light. The literary forger who "discovered" the 'Zohar' was Moses of Leon (b. Leon, about 1250; d. Arevalo, 1305), who employed an Aramaic idiom to give the book an air of antiquity, and with such skill that Jew and Christian alike were deceived and some even to-day attribute to it hoary age. Yet his widow declared that it was a forgery.

The character of the 'Zohar' can hardly

be dismissed as unique in literature, with its fantastic, imaginative and emotional elements. It is a medley of spirituality and coarseness, a strange combination of intellectuality and grossness, whose influence has been far-reaching and whose adherents have numbered hundreds of thousands. It is a work without method, a kind of impressionist commentary on the Pentateuch, half homily, half meditation, dwelling largely on the "higher" sense of Scripture and allowing every opportunity for vague and mystic interpretation. Hence the moral perversions that abound, the blasphemy and absurdity. The pre-existence of the soul is assumed — paradise and hell are alike depicted, the varieties of sin described with painful minuteness, Messianic speculations indulged in, and views favorable to the dogma of the Trinity uttered, while communion with departed spirits, celestial hosts and angels completes the farrago of nonsensical speculation. Such an aberration is rare in the history of Judaism and has been productive of much harm. Its soil has nourished gross superstitions and strengthened the belief in ghosts and evil spirits; its mode of interpretation has degraded the study of the Bible and spread the wildest fancies. At one time it was high in favor with the papacy when the Talmud was condemned to the flames, but it was later included in the Index Expurgatorius. Its occasional Christian tone was not overlooked by Christian scholars — Pico di Mirandola (1463–94) and Reuchlin (1455–1522) both made the 'Zohar' the basis of their vindication of Jewish literature. Its literary influence, however, was not long retained. It developed a few "saints" and "miracle workers," spurious Messiahs and the like, but it has had no successor. In absorbing the miasma of the earlier Kabbalistic literature, it left no germs for further development. (See JEWS AND JUDAISM). Consult Graetz's 'History of the Jews' (Vols. III and IV); Abrahams' 'Jewish Literature' (pp. 172–175).

ZOILUS, zō'ĭ-lŭs (Gr. Ζωΐλος): b. about 400 B.C.; d. about 320 B.C. Thracian rhetorician, chiefly remembered for the asperity of his criticisms on the poems of Homer. An account of his career is given by Vitruvius, which is not self-consistent, and states that he lived 385–247 B.C. He is said to have been a pupil of Polycrates, to have been eminent before the rise of Socrates, and to have continued to write until the reign of Alexander. Vitruvius represents him as seeking the patronage of Ptolemy Philadelphus. Heracleides says he was originally a Thracian slave. He is reported by Vitruvius to have died a violent death. The virulence of his attacks on Homer procured him the title of *Homeromastix* ("The Scourge of Homer"). He also attacked Plato and Isocrates. It is said he censored Homer principally for introducing fabulous and incredible stories into his poems. He has the reputation of a captious and unjust critic, so that his name became a synonym for such, but Dionysius of Halicarnassus places him in the highest rank. Consult Spindler, 'De Zoïlo' (1888–89).

ZOISITE, a mineral closely related to epidote named by Werner in 1805 in honor of Baron von Zois who discovered it. It is a basic ortho-silicate of calcium and aluminum, $HCa_2Al_3Si_3O_{13}$. The aluminum is sometimes partly replaced by iron, the mineral thus approaching epidote in composition. Though its crystals are orthorhombic, their form is very similar to the monoclinic epidote. Its hardness is 6 to 6.5 and specific gravity about 3.3. Its color is usually dull gray or brown, but in the variety "thulite," found in Norway, it is a beautiful rose pink. It is found in many European localities, also abundantly in the New England States, Pennsylvania, and North Carolina, and in exceptionally good crystals at Ducktown, Tenn.

ZOLA, zō'lą (Fr. *zō-lä*), **Emile Edouard Charles Antoine,** French novelist: b. Paris, 2 April 1840; d. there, 29 Sept. 1902. He was educated at the College of Aix, from which he went to the Lycée Saint Louis at Paris with a scholarship in 1858. His career there was undistinguished, and he left in 1860 after failing to take his degree owing to insufficiency in literature. After a brief experience as a clerk in a business house he was for more than a year compelled to sound the lowest depths of poverty in Paris, but in 1861 he obtained employment as a shopman with MM. Hachette, the publishers, at a salary of about five dollars a week. He devoted his spare time to literary work, contributing short stories to the *Petit Journal* and *La Vie Parisienne* and critical articles to the *Salut Public* of Lyons and afterward to Villemessant's journals, *L.Evènement* and the *Figaro*. Several of his stories were published separately in the volumes 'Contes à Ninon' (1864), which contain some of his best and purest work, and which were followed in 1874 by 'Nouveaux Contes à Ninon.' Some of his critical articles were collected under the title 'Mes Haines' (1866). In 'La Confession de Claude' (1865), a novel in which he utilized his early struggles, we find him already in full progress toward the characteristic work of his maturity, and this tendency became still more marked in the immediately succeeding novels: 'Le Vœu d'une Morte' (1866); 'Les Mystères de Marseille' (1867); 'Thérèse Raquin' (1867), a powerful study of the effects of remorse following on adultery and murder; and 'Madeleine Férat' (1868). Having by this time gained a secure footing in the world of letters, he conceived the plan of the series of novels known as 'Les Rougon-Macquart' (1871–93), which includes his best-known work and occupied him for nearly a quarter of a century. It is described as an 'histoire naturelle et sociale d'une famille sous le second empire,' and consists of 20 works dealing with different phases of modern life, not always strictly that of the Second Empire, but rather that of the Third Republic. The particular departments of life treated in the volumes were studied by Zola in the spirit of a scientific observer, but of one with a decided bias toward the portrayal of moral filth and disease; and the bond of connection which constitutes them a series is the persistence under various forms in all the members of the Rougon family of a moral taint which is transmitted in accordance with Zola's views of heredity. The series consists of the following works: 'La Fortune des Rougon' (1871); 'La Curée' (1874); 'La Conquête de Plassans' (1874); 'Le Ventre de Paris' (1874), treating of the Paris markets;

'La Faute de l'Abbé Mouret' (1875), whose subject is clerical celibacy; 'Son Excellence Eugène Rougon' (1876); 'L'Assommoir' (1877), a powerful but revolting study of the effects of drunkenness and idleness, the first great success of the series; 'Une page d'amour' (1878); 'Nana' (1880), a coarse picture of courtesan life; 'Pot-Bouille' (1882); 'Au Bonheur des Dames' (1883), dealing with the great shops of Paris; 'La Joie de Vivre' (1883); 'Germinal' (1885), treating of the life of French miners; 'L'Œuvre' (1886), in which he dissects literary and artistic decadents; 'La Terre' (1888), a study of the French peasantry in which prurient naturalism reaches the zenith of repulsiveness; 'Le Rêve' (1888); 'La Bête Humaine' (1890), treating of railways; 'L'Argent' (1891), dealing with stockbrokers and company promoters; 'La Débâcle' (1892), a powerfully realistic picture of military life in connection with the Franco-German war and the break-up of the Second Empire; and 'Le Docteur Pascal' (1893), in which the whole is brought to a conclusion. Immediately after completing this huge undertaking he started the 'Trois Villes' series, consisting of 'Lourdes' (1894), 'Rome' (1896), and 'Paris' (1898), in which he portrays the spiritual development of a priest, Pierre Froment, out of miraculous Christianity through a sort of social Catholicism into a creed of justice and labor. In the incomplete tetralogy entitled 'Les Quatres Evangiles' ('The Four Gospels') he proposed to formulate his social gospel. The first volume is 'Fécondité (1900), whose hero, Mathieu, is the son of the hero of the preceding series. The second volume, 'Travail' ('Labor,' 1901), has a hero named Luc; and of the remaining two, 'Vérité (Truth) and 'Justice,' whose heroes were to be named after the other two evangelists, the former was appearing at the time of his death. In the eyes of English readers Zola appears best in his short stories, of which, in addition to those already mentioned, collections entitled 'Le Capitaine Burle' (1882), and 'Naïs Micoulin' (1883) have been published. His famous story of 'L'Attaque du Moulin' forms part of the volume of 'Soirées de Médan' (1880), to which Maupassant and other friends also contributed. He defended his view of the nature and function of literary art and collected many critical articles in several works. Several of his novels were dramatized by himself and others, and he also wrote for the stage 'Les Héritiers Rabourdin' (1874), and 'Le Bouton de Rose' (1878), but none of them, except 'L'Assommoir' (1881), known in Charles Reade's English version as 'Drink' (1879), were at all successful. On 13 Jan. 1898, Zola, convinced of the innocence of Captain Dreyfus, (q.v.) went chivalrously to the defense of that officer in a letter 'J'Accuse' published in *L'Aurore*. In it he arraigned the government for the irregularities of Dreyfus's trial, making charges that practically forced the government to prosecute him, an expedient that achieved its purpose in reopening the Dreyfus case and led to the complete vindication of that officer. Zola was tried in February 1898 and a verdict imposing imprisonment and fine was brought against him. He appealed the case and the verdict was quashed by the Cour de Cassation, 2 April 1898. A second trial was called and Zola, his purpose accomplished, decided not to appear, but went to England where he remained until the amnesty for offenders connected with the Dreyfus case, 24 Dec. 1900, permitted his return to France. His account of his connection with the case is given in 'L'affaire Dreyfus: La vérité en marche' (1901). He was created a knight of the Legion of Honor in 1888 and an officer in 1893, but after his condemnation in 1898 his name was removed from the roll. He was president of the Société des Gens de Lettres in 1891–94, but he was repeatedly refused admission to the Academy. Zola was the recognized head of the naturalistic school in fiction, but his followers were latterly few in number. His novels belong rather to the domain of science than to that of art. They are studies, in the main faithful enough though not free from distortion and exaggeration, in moral and social pathology; but they are not true to life and nature in the fullest sense, in the only sense which would entitle them to rank as artistic creations. Translations of the most important have appeared, chiefly by Vizetelly. Consult Brunetière, 'Le Roman Naturaliste' (1883); R. H. Sherard's highly eulogistic biographical and critical study (1893); 'Le Procès Zola' (2 vols., 1898); Vizetelly, E. A., 'Emile Zola, Novelist and Reformer' (1904); and his 'Letters' (1908); Barbusse, 'Zola' (1933).

ZOLLARS, Ely Vaughan, American educator: b. near Lower Salem, Washington County, Ohio, 19 Sept. 1847; d. Warren, Ohio, 10 Feb. 1916 Graduated from Bethany College, West Virginia, in 1875, he was pastor of the church of the Disciples of Christ at Springfield, Ill., in 1885–88, and in 1888–1902 was president of Hiram College (Ohio). He was president of the Texas Christian Union in 1902–06; and from 1906 was president of Phillips University. His writings include 'Holy Book and Sacred Day' (1893); 'Bible Geography' (1894); 'Great Salvation' (1895); 'Hebrew Prophecy'; 'The King of Kings'; 'Word of Truth'; 'The Commission Executed'; 'Sermons,' etc.

ZOLLICOFFER, zŏl'ĭ-kŏf-ẽr, **Felix Kirk,** American soldier: b. Maury County, Tenn., 19 May 1812; d. near Mill Springs, Ky., 19 Jan. 1862. He entered the printer's trade, published a weekly newspaper at Paris, Tenn., for about a year, and afterward was editor of the *Observer* at Columbia, Tenn., his duties being temporarily interrupted by his service in the Seminole war, in which he rose to be a commissioned officer. At Columbia he also published and edited an agricultural weekly. He became editor of the Nashville *Banner,* the leading Whig organ of Tennessee, in 1841; in 1844–49 was State comptroller; and in 1853–59 was a representative in Congress. In 1861 he entered the Confederate army with brigadier's rank. He was in immediate command at the battle of Mill Springs, on the Cumberland, when Thomas drove the Confederates from the field, and achieved the first real victory for the National cause. Zollicoffer was killed within the Union lines, whither he had passed by mistake while on a tour of reconnaissance.

ZOLLNER, tsŏl'nẽr, **Johann Karl Friedrich,** German physicist and astronomer: b. Berlin, 8 Nov. 1834; d. Leipzig, 25 April 1882. Educated at Berlin and Basel, he became a

lecturer in the University of Leipzig in 1865, in 1866 professor extraordinary of physical astronomy, and in 1872 professor ordinary. He made numerous contributions to astronomical science. These included the determination of the reflective capacity (albedo) of many planets and a study of their thermal conditions; photometric investigations of the Mercurian phases; and a study, through observation, of the intensity of solar radiations at their source, of the solar temperature. His 'Grundzüge einer allegemeinen Photometrie des Himmels' (1861) contained the description of a new instrument, the astrophotometer, for the measurement of the light and color of stars. To the publications of the Royal Saxon Scientific Society he furnished many papers on the physical constitution of the sun and stars; and he constructed spectroscopic instruments. 'Ueber die Natur der Kometen' (1872; 3d ed. 1883) expounded the theory that the brightness of comets is due not to the fact that they are incandescent through heat but that they are glowing with electricity. Zöllner was latterly interested in spiritualism. Among his further volumes are 'Photometrische Untersuchungen' (1865), and 'Ueber die universelle Bedeutung der mechanischen Principien' (1867). 'Wissenschaftliche Abhandlungen' (4 vols., 1878–82). Consult the study by F. Körber (Berlin 1899), and Clerke, A. M., History of Astronomy in the 19th Century' (London 1908).

ZOLLVEREIN, tsōl'fĕr-īn («customs-union»). The feeble German Confederation formed in 1815 failed in many respects to meet the desire for union among the German people, or even to satisfy their practical requirements. The trade of Germany in particular suffered much from the obstructions caused by the different customs systems of so many petty states. In 1818 Prussia took the initiative of abolishing internal customs, but this policy excited much opposition among the other German states, and even on the part of the Bund itself, which was indeed to some extent justified by the coercive measures used by Prussia to enforce the adoption of its policy on the smaller German states within its bounds. Prussia offered to admit the other German states within its union, but many of them preferred to set up rival and antagonistic associations. Thus Bavaria and Würtemberg formed a customs league in 1827, and Hohenzollern joined these states in 1828. In the same year was formed the Middle German Union, including Saxony, Hanover, Hesse, Brunswick, Nassau, Oldenburg, Bremen, Frankfort-on-the-Main, etc., and in 1834 another union (Steuerverein) between Hanover, Brunswick, Schaumburg-Lippe, and which was joined by Oldenburg in 1836. But these hostile unions were not sufficiently extensive to have any great vitality, and they were gradually distintegrated by the desertion of their individual members to join the Prussian union. Electoral Hesse joined in 1831; Bavaria, Württemberg, Saxony, and other states in 1833; Hesse-Homburg, Baden, and Nassau in 1835; Frankfort in 1836; Luxemburg in 1842; Hanover, Oldenburg, etc., in 1851. During the treaty period of 1854–65 nearly all Germany, with the exception of Austria, the two Mecklenburgs and the Hansetowns, was included in the union. A difference of views between the various parties to the union began at this time to develop, which caused much tedious negotiation. In general the north of Germany was in favor of imposing import duties on foreign trade for purposes of revenue only, while the south favored protective duties. As each member of the Zollverein had an equal voice in the direction of a common policy it was impossible to adjust these differences so as to satisfy the more powerful states, particularly Prussia. Austria also wished either to be included in the union or to break it up. Matters continued substantially in the same state after the renewal of the treaty from 1 Jan. 1866 to 31 Dec 1867; but the war of 1866 put an end to this agreement and new arrangements were entered into according to the political combinations then formed, Prussia obtaining a preponderating influence in the union of 1867, which included the North German Bund, Bavaria, Würtemberg, Baden, Hesse (south of the Main) and Luxemburg. It was directed by a Zollbundesrath and a Zoll Parliament. The total number of votes in the Zollbundesrath was 58, of which Prussia had 17. This arrangement, formed for 12 years, was also brought to an end prematurely by the formation of the German Empire. By article 33 of the constitution of the empire the territory included in the Zollverein is to coincide with the territories of the empire, with a few exceptions noticed below. The powers of the Zollbundesrath and Zoll Parliament are transferred to the legislative bodies of the empire, and the affairs of the central bureau of the Zollverein are transferred to committees formed by the Federal Council of the empire. The territories of the free ports of Hamburg and Bremen were for some time excluded from the Zollverein and some communes of the grand duchy of Baden and a fragment of Hamburg were still excluded from it; while Luxemburg and the Austrian commune of Jungholz were included in it up to the fall of the empire in November 1918. Consult Ashley, W. L., 'Modern Tariff History: Germany, United States, France' (2d ed., London 1910); 'Cambridge Modern History' (Vols. X, XI, New York 1909); Dittmar, 'Der deutsche Zollverein' (Leipzig 1867); Worms, 'L'Allemagne économique et l'histoire du Zollverein allemand' (Paris 1874). See GERMANY; WAR, EUROPEAN.

ZOLNAY, George Julian, American sculptor: b. Pecs, Hungary, 4 July 1863. Although educated for the diplomatic service, he eventually entered the Royal Art Academy of Bucharest and later the Imperial Academy of Fine Arts of Vienna, graduating with highest honors from both institutions. In 1894, after his work at the Columbian Exposition of Chicago, he settled in New York City where he won national reputation through his Tympanum and Poe bust for the University of Virginia; the Winnie Davis Memorial (Richmond, Va.); decorative figures for the Nashville Centennial; the monuments to General Bartow and McLaws (Savannah, Ga.); the Soldier Monument for Owensboro, Ky.; the Duncan Jacob Memorial for Louisville, Ky., and a large number of portrait busts.

In 1903 he was appointed director of the sculpture exhibit at the World's Fair in Saint Louis and professor of sculpture and perspective at Washington University. He resigned in 1909 to become director of the new University City

Art Academy. There he produced the heroic size granite group for the United States Custom House in San Francisco; the Sam Davis and Soldier Monument for Nashville, Tenn.; the Hayes Memorial for Richmond, Va.; two colossal lions for University City; the Laclede Monument for Saint Louis; portrait busts of Emperor Francis Joseph, Victor Hugo, Gen. Stonewall Jackson, Major Rollins, Clara Hoffman, Walter Sheldon and others. In 1913 he transferred his studio to Washington, D. C., and thereafter produced the Saint Louis Confederate Monument; the great Industrial Monument for New Bedford, Mass.; a large educational frieze for the National Capitol's new high school; the Hoxie Memorial for Arlington Cemetery; and the statue of Sequoyah placed in the Statuary Hall of the Capitol in Washington. He also executed a number of portrait busts and the Dr. Still Monument for Kirksville, Mo. Besides winning numerous bronze, silver, and gold medals, he was decorated by the king of Rumania with the first class of the Ordre Pour le Mérite.

ZOMBA, east central Africa, capital of the Nyasaland Protectorate. It is situated on the lower slopes of Zomba Mountain, some 3,000 feet above sea level, 43 miles northeast of Blantyre. Besides being the headquarters of the administration, the town contains several large mission stations. In the vicinity tobacco, cotton, and other crops are cultivated on a considerable scale. Pop. 3,000.

ZOMBOR, Hungarian form of the name of the Yugoslav town of Sombor (q.v.).

ZONA LIBRE, sō'nä lē'brā, formerly the designation of a strip of country extending along the whole northern frontier of Mexico, 20 kilometers wide, where imported goods were admitted at 10 per cent of the ordinary duties for use within the zone. This zone was first established on the frontier of the state of Tamaulipas alone, in 1858, and was not extended across the whole frontier until 1885. At one time after the American Civil War, the United States authorities claimed that the privileges permitted within the zone encouraged smuggling; the Mexican government claimed that the conditions of retail trade made the zone a necessity; opposition to the zone, however, continued among competing manufacturers in the interior of Mexico, and the zone privileges were at length eliminated.

ZONARAS, zŏn'ä-răs, **Joannes,** Byzantine chronicler and theologian: flourished at Constantinople during the first half of the 12th century. He commanded the imperial guard and held other important offices under Alexius I Comnenus, but when John II Comnenus came to the throne he gave himself up to a religious life as a monk of Saint Basil. During his leisure hours at Mount Athos he employed himself in the compilation of a general history of the world from the creation down to the death of Alexius I Comnenus in 1118. In this work, comprising 18 books (of which an edition was published at Paris in 1686), he followed principally the narrative of Dio Cassius (155?– after 230 A.D.), the Roman historian of whose first 20 books (out of a total of 80) nothing is extant save Zonaras' abstract. As he approaches his own times Zonaras becomes more entitled to attention, as his mistakes arise evidently more from ignorance than design. There is also extant a commentary on the apostolic canons by him.

ZONE, the term applied to any portion of the earth's surface bounded by two parallels of latitude, but more particularly applied to five such zones, the position of which is marked by natural boundaries. These five zones are called the torrid, northern, and southern temperate, and northern and southern frigid zones. The torrid zone extends 23½° north and south of the equator; and twice a year the sun shines vertically on its inhabitants. This zone is bounded, on both sides of the equator, by the two tropics; that is, the circles in which the sun reaches its greatest distance from the equator. As the rays of the sun here are nearly vertical a perpetual summer reigns, and day and night under the equator are always equal; and even at the tropics the difference is scarcely an hour. Owing to the nature and situation, however, of the countries in this zone, the heat is not everywhere the same. The warmest portions are the sandy deserts of Africa and Arabia; in the regions nearer the equator where vegetation prevails the heat is less excessive; in the islands of the South Seas a milder climate prevails; and the highest mountains of Peru and equatorial Africa are covered with perpetual snow. The two temperate zones extend from the tropics to the polar circles. They contain the most populous countries, and the climate is varied. As the distance from the tropics increases the heat under similar conditions diminishes and the difference of the seasons becomes greater; and the days and nights become more unequal until we arrive at a point where once a year the sun does not appear above the horizon during the 24 hours, and once a year does not set for the same time. The circles passing through these points, parallel to the equator and the tropics, form the limits of the temperate zones, and are called the Arctic and Antarctic circles. The distance from the tropics to the polar circles, or the breadth of the temperate zones, both in the Northern and Southern hemispheres, is 43°. All beyond the polar circles to the poles is called the frigid zones. The distance from the polar circles to the poles is 23½°. The characteristic of the frigid zones is, that day and night are more and more unequal the nearer you approach the poles, and for days, weeks, and even months the sun is either constantly above or constantly below the horizon. At the poles the year consists of one day and one night each six months long.

ZONE OF FLOWAGE. See ROCK-FLOWAGE.

ZONE OF FRACTURE. See ROCK-FLOWAGE.

ZOOGEOGRAPHY, the science of mapping out the surface of the earth with reference to its fauna; the study of the distribution of animal life. It has always been obvious to travelers, and even the most superficial students of nature, that the various regions of the earth's surface were characterized, among other differences, by local peculiarities in animals and plants. It is a commonplace of knowledge that the animal life of the tropics is different from that of the Arctic regions; that the birds and mammals and small creatures of Africa differ

almost altogether from those of South America or Australia. Closer examination shows that such differences exist in a greater or less degree between lesser regions, as the east and west sides of a continent, groups of islands separated by a sea space, and so forth. On the other hand, there may be found striking resemblances in the fauna of certain separate regions, or a sameness over an extensive area, as Europe and Asia.

The importance and significance of these facts impressed themselves upon scientific men only within recent times. As long as it was held that each species must have been created, as a general rule, within the geographical area which it now occupies, the most curious facts of distribution could be regarded only with "sterile wonder." But when the idea came to be entertained that allied species have had a common origin, it was obviously implied that they or their ancestors must have had a common birthplace, and consequently, when we find members of a group severed from their nearest kindred, we feel bound to inquire how this came about. Thus, we have to explain how the tapirs are confined to the Malayan region and South America; the camels to the deserts of Asia and the Andes; marsupials to the Australian region and America; how the birds, mammals and reptiles of North America resemble those of Europe more than those of South America, and so on.

Means of Dispersal.—Accepting as a starting point the proposition that the various forms of life originated in some parent-stock or stocks at a particular place or places, the present distribution of their descendants as we know them, must depend mainly upon the powers of dispersion which each possessed, and the character of the physical influences and obstructions which acted as controlling factors or barriers in guiding their dispersal along certain lines and altogether prevented it elsewhere. Theoretically a new stock would spread equally in all directions from its point of origin; actually a very irregular and complicated kind of distribution has ensued in most or all cases. Hence an inquiry as to the means and limitations of dispersion possessed by animals and plants is of first importance.

It is scarcely necessary to draw attention to the facilities for diffusion possessed by animals endowed with great locomotive powers, and especially among land animals, by those having the power of flight (q.v.); but it is important to note that some animals, which in the adult state have only feeble powers of locomotion, are better endowed in this respect when young. Such, for example, is the case with echinoderms, marine mollusks and similar lowly aquatic forms, all of which develop from free-swimming and often far-drifting larvae. (See Deep-Sea Life.) But accidental modes of dispersal must also be taken into account. The carrying power of winds is known to be sufficient to bear along in the air fine dust across seas many hundreds of miles in width, and we have in that agency alone an adequate means of accounting for the dispersion of all plants propagated by minute spores. For that reason the distribution of most cryptogamic plants hardly enters into the problem, since these mosses, fungi, seaweeds and the like are almost universal. What part winds may have played in carrying the seeds of flowering plants is more doubtful; but observations show that even for such seeds, especially when provided with some kind of feathery appendage, winds may occasionally serve as a means of transport for very long distances. See Plant Geography; Plants, Migration of.

But in the case of animals also, winds are a more important means of transport than one might at first suppose. Birds and insects are often blown immense distances out of their course; and to this cause, for instance, is due the arrival every year of American birds on the coasts of Great Britain and France, while European birds almost never reach America—a fact plainly due to the prevalent easterly direction of the winds, and especially the gales in spring and autumn, when birds are migrating. Insects have been caught on ships more than 300 miles from land. Further, there are well-authenticated cases of even crabs, frogs and fishes being carried long distances by storms, and in this way it is possible to account for the transference of fish, etc., from one river system to another. Still more frequently, in all probability, are the eggs of such creatures transported by this means.

Next, marine currents also form, beyond doubt, a highly important means of dispersal both for plants and animals, and that in various ways. First, seeds may float on the surface of the ocean, and be carried by currents hundreds of miles, and become stranded on a distant shore still in a condition fit for germination. The experiments of Darwin to determine the vitality of seeds in sea water first enabled us to appreciate the importance of this factor. Further, marine currents often carry on their surface various kinds of natural rafts, which may transport both plants and animals. In the polar regions icebergs and icefloes may serve this purpose; and elsewhere trunks of trees, and even fragments torn from the land. Such fragments, forming small islands with erect trees upon them, have been seen at a distance of 100 miles from the mouth of the Ganges and other rivers. Wallace points out that ocean waifs of one kind or another are almost the only means we can imagine by which land shells can have acquired the wide distribution for which they are remarkable. Again, locomotive animals are very frequently the means of dispersing both plants and other animals. Seeds may be attached to the fleece or fur of mammals or the plumage of birds, or may be enclosed in clumps of earth clinging to the feet or some other part of bird or beast, even of insects. It seems probable that aquatic birds and water-beetles have been the means of distributing aquatic plants and freshwater mollusks, which are remarkable for their wide diffusion; and the spawn of amphibians and fresh-water fishes may be conveyed from one body of fresh water to another by the same means.

Lastly, man is often unintentionally the means of conveying both plants and animals from one region to another. The foreign plants found growing on ballast heaps near every civilized port are instances of this, and so, also, are the plants which have sprung from seeds introduced with imported grain and

merchandise. The whole coastal region of North America is overrun with European weeds. Whereever European ships have gone the rats and other vermin of the Old World have accompanied them, and hundreds of species of exotic injurious insects are known in all agricultural districts.

Obstacles to Diffusion of Animals.— For all land plants and land animals the most obvious and effective barrier is a wide expanse of ocean; and where the expanse is very wide it is seldom passable except with the aid of man. For land mammals the ocean is an absolutely impassable barrier, and hence native mammals are always absent from oceanic islands (that is, islands that have never been connected with the mainland); and this barrier is almost equally effective for serpents and amphibians, which also are nearly always wanting where there are no native mammals. Lizards are more frequently found indigenous on oceanic islands, though their means of transit from the mainland is unknown. Arms of the sea and broad rivers are likewise generally impassable for the creatures mentioned, though some of them have greater powers of swimming than is generally supposed. The tiger, the jaguar the bear and the bison are capable of swimming the widest rivers; pigs have been known to swim ashore when carried out to sea to a distance of several miles; and even a boa constrictor, it is said, has swum to the island of Saint Vincent from the South American coast — a distance of 200 miles.

Mountains, and especially high mountains, are also frequently effective barriers to the migration of land plants and animals; but in some cases they enable plants and animals of a cold climate to spread along their summits into latitudes where, in the plains, the climate is too hot for them. Again, deserts act as a barrier to the majority of plants and animals; forests are a barrier to the camel, hare, zebra, giraffe, etc.; treeless regions to apes, lemurs and many monkeys; plains to wild goats and sheep. Broad rivers also act occasionally as barriers to distribution, and that, strange to say, even in the case of some species of birds.

Another important barrier is that of climate; but climate merely limits the range of a species or group within a continuous area, for example, through limiting the food supply by restricting vegetation. The range of insects is peculiarly liable to be limited in this way, certain insects being attached to particular species of plants, or at least to genera or families; and for this reason insects, in spite of the exceptional facilities for dispersal which many of them enjoy, are remarkable, as a rule, rather for the restriction of their areas of distribution than for their wide diffusion. Various other minor factors might be mentioned.

But a more generally operative organic barrier consists in the fact of a region being already fully occupied by a native flora and fauna, so that there is no room for newcomers. Hence it happens that seeds may be wafted in plenty from one country to another without a single plant growing from these seeds being able to establish itself; and there may even be, as in South America, a free communication with another region while the fauna remains strikingly distinct, simply because that portion of the American continent is already completely stocked with a fauna perfectly adapted to the physical conditions there prevailing.

The barriers to the spread of marine creatures are not so numerous as in the case of terrestrial forms. The freedom of communication between one part of the ocean and another makes it impossible to mark out any marine zoogeographical regions, though many seas and coasts are distinguished by characteristic fishes and other marine creatures. There is also in the ocean a vertical distribution, the limits of which are determined by depth and its conditions. The principal barriers for fish are temperature and the intervention of land. Thus, the Isthmus of Panama is at present a complete barrier for fishes requiring warm seas.

Geological Evidence.— If all the barriers to migration had existed in all past time as they are now, it would be quite impossible to explain the present distribution of plants and animals on the supposition that kindred groups have had a common birthplace. But the solution of the problems of distribution is to be found in the fact that all the barriers are liable to change. Of changes of sea and land geology supplies us with abundant evidence. Portions of the mainland now continuous were at one time severed by arms of the sea; and islands have been formed by the severance of portions of land that once belonged to the mainland. Such islands are known as continental islands, and the study of their faunæ and floras is one of peculiar interest in connection with geographical distribution. These faunæ and floras show, as might be expected, a greater or less degree of correspondence with those of the mainland from which the islands have been cut off; and the resemblance is the closer the more recently the land connection has been destroyed. The relative date of the disunion is usually approximately indicated by the depth of the sea which now separates island and mainland, shallow seas dividing portions of land that have only recently been disconnected, and deeper seas separating those which have been longer apart.

The most remarkable case of isolation is presented by the Australian region, the fauna and flora of which are the most peculiar in the world. In the widest sense, this region includes not only the vast island of Australia itself, but also New Guinea and all the Malayan and Pacific islands to the east of a deep channel between the islands of Bali and Lombok — a channel the significance of which, as a boundary line for plants and animals, was first pointed out by A. R. Wallace, the great authority on animal distribution, and hence known as Wallace's Line. The great feature of this region (so far as animal distribution is concerned) is "the almost total absence of all the forms of mammalia which abound in the rest of the world, their place being taken by a great variety of marsupials." This presents one of the best examples of what are known as discontinuous areas of distribution, and offers an illustration of the mode in which such discontinuity is usually brought about. The early severance of the Australian region from the Asiatic continent (in the Mesozoic

Age) saved the Australian marsupials from the competition which almost extinguished the group elsewhere.

Changes in the climatic barrier have also had an important influence on geographical distribution; and it is by such changes, combined with changes in the continuity of land in the north polar regions, that the affinities between the floras of Japan and eastern North America must be explained. (See LAND-BRIDGES). When these affinities were first pointed out by Asa Gray, that distinguished botanist divined the true explanation — namely, that in former geological epochs, a genial climate must

The Zoogeographical Regions according to Sclater and Wallace:

Sub-regions of Palæarctic Region —
1. European.
2. Mediterranean.
3. Siberian.
4. Manchurian.

Sub-regions of Ethiopian Region —
1. East African.
2. West African.
3. South African.
4. Malagasy.

Sub-regions of Oriental Region —
1. Indian.
2. Ceylonese.
3. Indo-Chinese.
4. Indo-Malayan.

Sub-regions of Australian Region —
1. Austro-Malayan.
2. Australian.
3. Polynesian.
4. New Zealand.

Sub-regions of Neotropical Region —
1. Chilian.
2. Brazilian.
3. Mexican.
4. Antillean.

Sub-regions of Nearctic Region —
1. Californian.
2. Rocky Mountain.
3. Alleghanian.
4. Canadian.

have prevailed even within the polar circle, so as to allow of the existence of a remarkably uniform flora, suitable to such a climate, all round the pole in very high latitudes; and that as the climate became colder in the North this flora was driven southward, and became differentiated according to the differences of climate in the more southerly latitudes to which it advanced. Hence the eastern parts of America and Asia, as they correspond pretty much in climate, came to correspond also more closely than other tracts in the same latitude in the character of their floras. The soundness of this surmise was afterward confirmed by the discovery of abundant plant remains of the Miocene Age, indicating a warm climate in Greenland, Spitzbergen, and elsewhere. The effects on distribution of the changes of climate belonging to the Glacial Period or Ice Age may only be alluded to here.

Zoogeographical Regions.— As the result of all the processes of dispersal across the various barriers to migration, and of the changes in these barriers, we have the present distribution of plants and animals, which is such as to enable us to divide the terrestrial surface of the globe into more or less well-marked regions. For mammals, the regions adopted by Wallace are nearly the same as those first suggested by Sclater as applicable to the distribution of birds; for, in spite of the exceptional facility which birds have for crossing barriers impassable by mammals, Wallace finds that the distribution of mammals (which afford the best means of marking off zoogeographical regions) corresponds with that of birds to an extent that one would not perhaps have previously anticipated. But with regard to these regions it must be remembered (1) that it is impossible in most cases to draw any very clearly marked boundary line between one region and another; (2) that the degree of divergence between different regions is different in different cases; and (3) that, when any two regions are compared, we have not the same degree of divergence between different groups of the animal kingdom, or between animals and plants belonging to the two regions. Obviously, the degree of correspondence depends largely on the facilities for dispersal, and largely also on the geological age of different groups; and both of these are varying factors. These considerations being premised, we may now state briefly the limits of the six zoological regions adopted by Wallace, as given in his 'Island Life.' In the space to which the present article is necessarily restricted it is impossible to give even the most fragmentary sketch of the

characteristic life of the different regions, for which the reader must be referred to the works cited at the end of the article.

(1) Palæarctic Region, including Europe and north temperate Asia and Africa to the northern borders of the Sahara.

(2) Ethiopian or Palæotropical Region, consisting of all tropical and South Africa, together with Madagascar and the Mascarene Islands.

(3) Oriental Region, comprising all Asia south of the Palæarctic limits, and the Malay Islands as far as the Philippines, Borneo and Java.

(4) Australian Region, the Papuan Islands, Australia, New Zealand, and the islands of Oceanica. Celebes might be referred almost with equal right to this or the previous region. New Zealand is treated by Wallace as a highly peculiar sub-region of this great region.

(5) Nearctic Region, comprising all temperate and arctic North America, including Greenland, and extending on the south to an irregular line running from the Rio Grande del Norte on the east to a point nearly opposite Cape Saint Lucas on the west.

(6) Neotropical Region, the American continent south of this line, together with the West Indian Islands, sometimes called Neogæa.

Heilprin and others advocate the union of the Nearctic and Palæartic regions under the name of Holarctic, and introduce three transitional tracts (the Mediterranean, embracing southern Europe, northern Africa and western Asia, south of the Caspian and west of India, but exclusive of the southern half of Arabia; the Sonoran tract, embracing the northwest of Mexico; and the Austro-Malaysian tract, embracing Celebes and the smaller islands lying between it and New Guinea and Australia). Otherwise his major faunal divisions of the globe are similar to those of Wallace.

On plant distribution the most important German works are those of Engler and Drude. Engler attempts to trace the history of the vegetable kingdom since the Tertiary period, and comes to the conclusion that already in the Tertiary period four «floral elements» (*Florenelemente*) could be distinguished, namely:

(1) The Arcto-tertiary element, characterized by an abundance of conifers and numerous genera of trees and shrubs now prevalent in North America, or in extratropical eastern Asia and in Europe.

(2) The Palæotropical element, characterized by the presence of the families and subfamilies dominant in the tropics of the Old World; and still more by the absence of certain families, groups and genera found in the territory of the Arcto-tertiary element.

(3) The Neotropical or South American element, which, according to Engler, must have had in Tertiary times much the same character as that now possessed by tropical Brazil and the West Indies.

(4) The old Oceanic element, consisting of forms which possessed the power of traversing considerable stretches of ocean and developing further on islands.

The modern provinces of the vegetable kingdom are subordinated by Engler to these great divisions. Drude, in the first place, distinguishes the oceanic (marine) flora from the terrestrial forms, and the latter he divides into three great groups, and these again into 14 floral domains. See PLANT GEOGRAPHY.

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ERNEST INGERSOLL.

ZOOLATRY, the worship of animals. This seems to have passed through three stages: (1) The animal was reverenceed and propitiated as possessing a power greater than that of man. (2) It was regarded as an incarnation of some deity or spirit. (3) It was raised to the position of a tribal ancestor. Zoölatry had its origin in the belief of primitive man that all nature was endowed with life and that many beings were possessed of great and magical powers. Animals were believed to be especially endowed with such powers. They were also thought to have their chiefs and tribal organizations just as man had, and their great magicians who were powerful enough to bring confusion upon their enemies. Hence primitive man attempted to conciliate all the mysterious forces and powers of nature, among them, those of the animal kingdom. Out of this, through successive stages, grew animal worship, with all its attendant ceremonies, forms and incantations. In the early history of the human race zoölatry of some kind was very prevalent. Traces of it appear in the Bible, as in the story of the Golden Calf made by the Israelites (Ex. xxxii). Zoölatry took deep root in the religious life of the ancient Egyptians, and all three forms flourished among that people. Juvenal opens his 15th satire with a scathing invective of Egyptian zoölatry, and detailed accounts of it occur in Herodotus, Plutarch, Strabo and Cicero. In the present day zoölatry survives chiefly in India and among the snake-worshippers of the west coast of Africa. See NATURE WORSHIP.

ZOOLOGICAL GARDENS, or PARKS, places for the keeping and attractive display of living animals, where they may live, as far as possible, in the open air and under natural conditions; a zoological garden thus differs from a menagerie, as that term is now understood, in that in the latter the animals are confined in narrow prison-cages, under cover, and are usually borne from place to place to be displayed for a fee. Collections of captive animals have always been kept by royal and eminent persons, and formed a large element in the sights and amusements of the populace in ancient and mediæval cities. The present conception of zoological collection, as a place where animals shall be maintained in the greatest practicable freedom for the sake of exhibiting their traits to the student, and shall be regarded only secondarily as objects of curiosity, is a modern idea, and one that has been

developed to its highest degree in the United States. Many large cities of the Old World and elsewhere have "zoos," as they are popularly called, notably London, Dublin, Berlin, Paris, Vienna, Amsterdam, Rotterdam, Antwerp, Hamburg, Copenhagen, Hanover, Cologne, Bombay, Calcutta, Tokio, Melbourne and several South American cities, especially Rio de Janeiro and Buenos Aires. All of these are the property of a society or private ownership of some sort except the garden in Berlin, and that attached to the Museum of Natural History at the Jardin des Plantes, in Paris and that in Vienna. They are sustained, therefore, partly by membership subscriptions and partly by gate-receipts, but most or all of them give free days. The sale of animals born and reared within their precincts is a source of revenue with some, as, for instance, the Dublin garden which has supplied a large proportion of all the lions now held in captivity by circus and traveling menageries. The Berlin "zoo" stands third in the number of its animals and general excellence of arrangements; that of London, founded in 1828, is second only to the New York Zoological Park, and the splendid series of volumes constituting the *Proceedings* and *Transactions* of the Zoological Society of London attest the admirable use which has been made of the collection by naturalists from many parts of the world.

Zoological gardens have long existed in the United States, among the oldest being those at Cincinnati and Philadelphia, both privately sustained, and each highly creditable. To these were added collections of living animals in the parks of various cities, maintained by municipal appropriation, among which those in Bronx Park, and Central Park, New York; Highland Park, Pittsburgh; Lincoln Park, Chicago; Belle Isle, Detroit, and Golden Gate Park, San Francisco, are important.

The National Zoological Park at Washington was established in 1889, in a large tract of hilly and forested land along Rock Creek in the outskirts of Washington. Its prime purpose was to gather a representative collection of American animals and possibly preserve from extinction species threatened with racial destruction. It has extensive and highly picturesque grounds, and its collection of animals has remarkably favorable surroundings and is kept in admirable condition. The support of this free park, one-half of which comes from Congress and one-half from the District of Columbia, has not been sufficiently liberal to make its development as rapid as its friends desire.

The latest and foremost American zoological park is that in the northern part of the city of New York, which is under the control of the New York Zoological Society, to which the city granted 264 acres of land in Bronx Park, police protection and various aids and immunities. It is largely financed out of municipal funds and is free to the public five days a week. A large herd of American bison is a notable feature of this park. This is the largest and most suitable space devoted to the care and exhibition of animals anywhere in the world, and since its opening in 1897 it has developed into a most prominent and useful position among the world's institutions of this kind. The society has about 2,000 members, and issues a series of important periodical publications. This park was developed by William T. Hornaday (1854–1937).

Consult *Annual Reports* of the Smithsonian Institution (Washington, D.C.); Bulletins of the Zoological Society of New York (containing many photographs and plans of buildings and enclosures); Loisel, G., *Histoire des Ménageries de l'Antiquité à Nos Jours* 3 vols. (Paris 1912); Boulenger, E. G., *Animals in the Wild and in Captivity* (London 1930); ib., *Zoo Calvacade* (London 1933); Everard, L. C., *Zoological Parks, Aquariums and Botanical Gardens* (American Associations of Museums, Washington, D.C., 1932); Gleeson, G., *Zoological Gardens* (London 1936); Boulenger, E. G., *London Zoo* (New York 1937); Bigalke, R., *Animals and Zoos To-Day* (London 1939); Hediger, H., *Wildtiere in Gefangenschaft* (Basel 1942); and Clark, B., *Who's Who at the Zoo* (American Council of Public Affairs, Washington, D.C., 1946).

ZOOLOGY, the science that deals with animals. This science has quite naturally a number of subdivisions, since animals and groups of animals have many properties. Many of these properties are not restricted to animals, but are possessed in common with other living things. Hence, these subdivisions do not always find

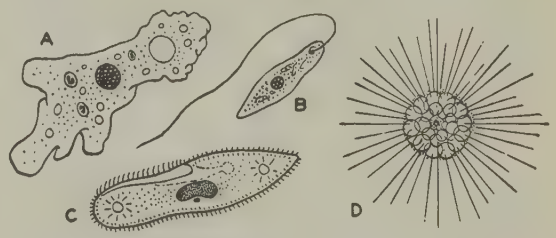


Fig. 1—Phylum Protozoa: A. *Amoeba.* B. *Euglena,* a green flagellate. C. *Paramecium.* D. *Thalassicola,* a "sun animalcule."

their limits within the science of zoology but are parts of the broader subject, biology. The science of genetics, for example, embodies concepts which apply alike to micro-organisms, plants, and animals. Yet a study of the genetics of bacteria is, properly speaking, microbiology; of the genetics

Fig. 2—Phylum Coelenterata: A. Portuguese man-of-war. B. *Obelia,* polyp stage. C. *Obelia,* medusa stage. D. *Hydra.* E. Sea anemone. F. Brain coral. Phylum Ctenophora: G. Sea gooseberry.

of corn, botany; and of the genetics of the fruit fly or of man, zoology.

The aim of zoology is to understand the lives of animals. By animal life is meant the sum total of all of the properties of animals and animal populations. For this reason the subdivisions of zoology overlap one another and serve, only in

the roughest way, to classify the activities of zoologists. The physiologist, for instance, may study the function of the kidney, but in so doing he cannot ignore its structure, which is the proper sphere of study for the anatomist. There is, however, general agreement about the major subdivisions. Morphology or anatomy deals with the form and structure of animals. Such a study may be carried out at a gross or at a microscopic level. In the latter case the investigation may be of groups of cells and be known as histology or may concern the structure of the cell itself, in which event it is called cytology. Physiology is concerned with function and behavior, with the mechanism of whatever processes can be recog-

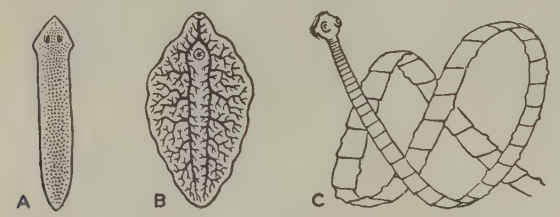


Fig. 3—Phylum Platyhelminthes: A. *Planaria.* B. Liver fluke. C. Tapeworm.

nized in animals. A physiological analysis often proceeds to a chemical or physical level. Investigations of behavior may sometimes properly be termed psychology. Embryology is the science of the development of individuals and may be anatomical or physiological. Genetics is the study of heredity and deals with the way in which characters are passed from individual to individual and, in populations, from generation to generation. Taxonomy or systematics deals with the classification of animals, their nomenclature and, on a broad basis, their family relationships. The study of fossil forms from all points of view is relegated to the science of paleontology. Ecology takes up the relationships existing among animals

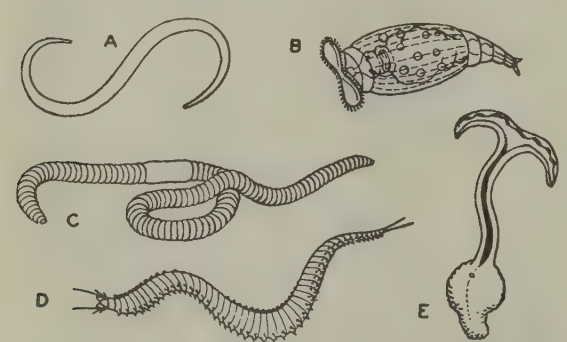


Fig. 4—Phylum Aschelminthes: A. Round worm. B. Rotifer. Phylum Annelida: C. Earthworm. D. Clamworm. Phylum Echiuroidea: E. *Bonellia.*

and between animals and other organisms and their environment. So defined it includes parasitology or the study of animals that live at the expense of other organisms.

During the 19th century the whole of zoology was unified by the theory of evolution. This conception allowed an understanding of how the various animals of present times, with their structures, functions, and interrelationships, may have come about and it offered an explanation of the patterns of similarity. Since that time a main objective of zoologists has been, not only to study how animals maintain themselves, reproduce and develop, but to analyze the historical or evolutionary background of such existing systems. Initially studies on evolution were descriptive in nature and used the observational approach. Especially when such studies involved living animals in their usual habitats they were considered a part of Natural History. Although natural historical investigations continue at the present and have scientific worth and an aesthetic value

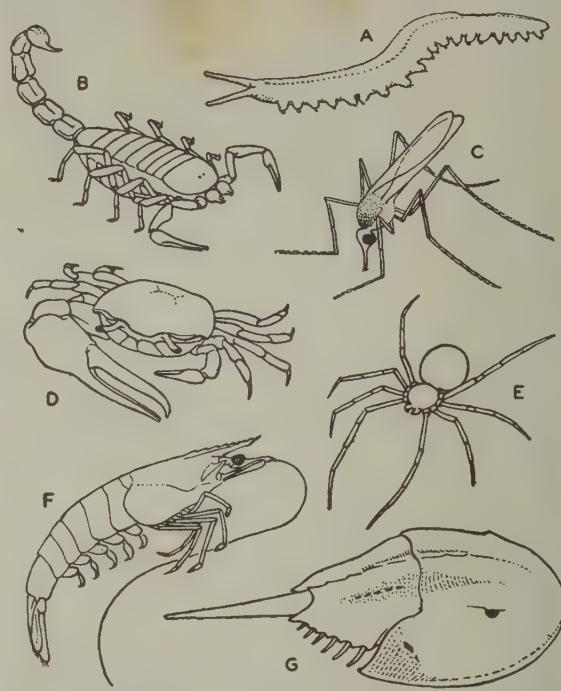


Fig. 5—A. *Peripatus.* Phylum Arthropoda: B. Scorpion. C. Mosquito. D. Fiddler crab. E. Spider. F. Shrimp. G. Horseshoe crab.

of their own, the beginning of the 20th century saw an upsurge of a special type of experimental investigation. These investigations often utilize chemical, physical, and mathematical methods and are usually referred to under the headings of biochemistry, biophysics, and biometrics. These subjects also overlap among themselves and with those already mentioned; there is a biochemistry

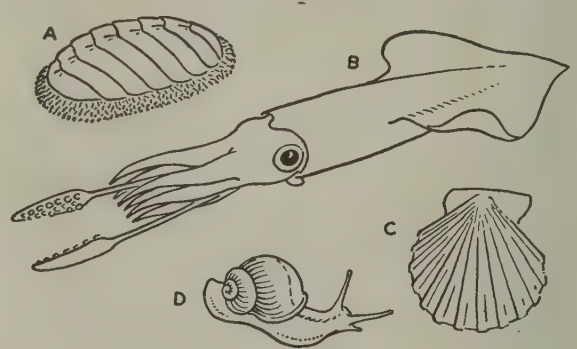


Fig. 6—Phylum Mollusca: A. *Chiton.* B. Squid. C. Scallop. D. Snail.

of development just as there is a biochemistry of muscle function.

The subject matter of zoology is also divisible in terms of the animals being studied. For example, vertebrate zoology is the study of animals with backbones; invertebrate zoology, the study of the remainder of the animal kingdom; ornithology, the study of birds; protozoology, the study of protozoa; etc. It is sometimes hard

to decide whether a protozoan belongs to the animal kingdom, the difficulty residing in the fact that plants and animals were first defined at a time when microorganisms were unknown. Perhaps it is preferable to relegate the protozoa and the protophyta to a separate kingdom, Protista

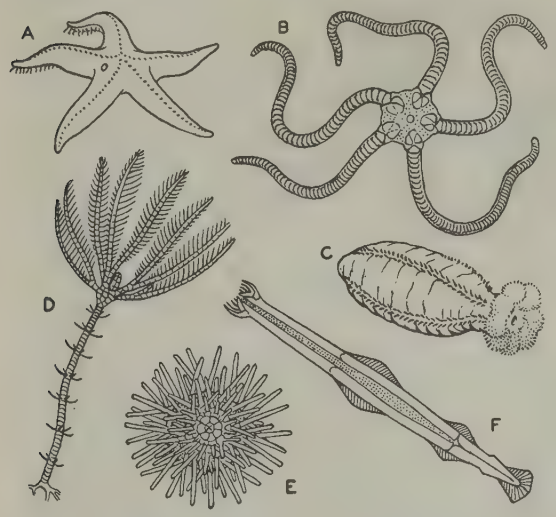


Fig. 7—Phylum Echinodermata: A. Starfish. B. Brittle star. C. Sea cucumber. D. Sea lily. E. Sea urchin. Phylum Chaetognata: F. Arrow worm.

(or Protoctista). Both botanists and zoologists, however, consider these organisms their legitimate subject material.

Historical.—Our knowledge of animals surely had its origin in prehistoric times. The first attempt at a comprehensive classification of animals and their properties, however, was made by Aristotle (384–322 B.C.). Classical antiquity saw many other efforts, the major one probably being Pliny the Elder's (23–79 A.D.) voluminous work on natural history. Galen (131–200 A.D.) was another early authority of great influence. He dissected animals for his works on human anatomy which were in standard use in medicine throughout the Middle Ages. During the Renaissance, Konrad Gesner (1516–1565) compiled an encyclopedic natural history that was characterized by an attitude of scientific scepticism. Leonardo da Vinci (1452–1519) and Andreas Vesalius (1514–1564), imbued with the new spirit of investigation, accumulated through dissection a knowledge of human anatomy far more exact than that which had hithertofore existed. The ideas of Francis Bacon (1516–1565) spread throughout these times and an increasing emphasis was placed on direct observation and experiment.

Fig. 8—Phylum Chordata: A. Man. B. Coyote. C. Duck hawk. D. Lamprey. E. Frog. F. Shark. G. Salmon. H. Snake.

One of the most successful users of the experimental method was William Harvey (1578–1657) who demonstrated the circulation of the blood and the function of the heart, arteries and veins. The invention of the microscope introduced a series of investigations into the fine structure of animals especially by such men as Anton van Leeuwenhoek (1632–1723), Jan Swammerdam (1637–1680) and Marcello Malpighi (1628–1694) who discovered capillary circulation. The researches of Kaspar Friedrich Wolff (1733–1794) in embryology established the fact that the organs of the embryo develop from the relatively indifferent material of the egg and are not preformed in an infinite series. Lazzaro Spallanzani (1729–1799) experimented on the question of spontaneous generation and correctly recognized the basic continuity of life.

A real advance in the classification of animals was made by John Ray (1628–1705) who was consistent in employing structural similarity as a criterion. His work was brought to a culmination by Carolus Linnaeus (1707–1778) who introduced the binomial system of nomenclature (genus and species, e.g. *Homo sapiens*) and whose *Systema Naturae* of 1758 marks the beginning of the modern system of classification. Comparative anatomy and natural history developed rapidly during the 18th century under the impetus of such scholars as Georges Buffon (1707–1788) and Johann Wolfgang von Goethe (1749–1832). The fact of evolution became clear to Erasmus Darwin (1731–1802), Jean Baptiste Lamarck (1744–1829), and others who believed, but could not experimentally demonstrate, that evolution occurred by the inheritance of characters acquired through use or disuse. The great French tradition was carried forward by Georges Cuvier (1769–1832) who extended his morphological studies to fossil forms. Investigations that were to help make Germany the center of zoological research in the 19th century were carried out especially by Karl Ernst von Baer (1792–1876) in comparative embryology and by Karl Gegenbaur (1826–1903) in comparative anatomy.

The seeds of evolutionary theory had been planted and were nourished by the exploration and collection on the part of great naturalists like Alexander von Humboldt (1769–1859) and by Charles Lyell's (1797–1875) demonstration of the principles of geological succession. It was in the intellectual climate thus created that Alfred R. Wallace (1822–1913) and Charles Darwin (1809–1882), themselves competent and traveled naturalists, simultaneously in 1858 proposed theories of evolution based on natural selection. The impact on zoology and other fields of learning was immediate and explosive. General acceptance of the new interpretation was not equally rapid. For example, Richard Owen (1804–1892) and Louis

Agassiz (1807–1873), whose researches in comparative anatomy and in paleontology were later to be of such value to evolutionary theory, rejected it. Nonetheless an intensive period of research into the course of evolution ensued and the great popularizers of this knowledge were Herbert Spencer (1820–1903), Ernst Haeckel (1834–1919) and Thomas H. Huxley (1825–1895). The new spirit spread and vigorous programs in paleontology were initiated in Europe and in the rich collecting areas of western America.

Although the evolutionists of this period were satisfied to explain things in terms of their historical origin, a new group of workers demanded answers in terms of mechanism. For example, in embryology, the comparative approach was amplified by an experimental one, especially through the efforts of Wilhelm His (1831–1904), Wilhelm Roux (1850–1924) and Hans Spemann (1869–1941). This experimental philosophy has been vigorously applied to other fields of zoology throughout the 19th century. Friedrich Wöhler (1800–1882) in his synthesis of urea showed that organic compounds, previously found only in association with living organisms, could be made in the laboratory. Thus they were stripped of their aura of mystery. With similar modern spirit Johannes Müller (1801–1858), Hermann Helmholtz (1821–1894) and Claude Bernard (1813–1878) conducted their physiological researches.

The role of the cell as a unit of structure was recognized as early as 1838 by Matthias Schleiden (1804–1881) and Theodor Schwann (1810–1882) and detailed investigations into cell division, including the behavior of chromosomes, were conducted by Carl Nägeli (1817–1891) and Eduard Strasburger (1844–1912). During this era Virchow (1821–1907) established the science of cellular pathology. The role of the nucleus in fertilization, cell division, and sex determination progressively came to be understood through the efforts of Oskar Hertwig (1849–1922) and his brother Richard von Hertwig (1850–1937), Walther Flemming (1843–1905), Otto Bütschli (1848–1920), Edouard van Beneden (1845–1910), Theodor Boveri (1862–1915), and E. B. Wilson (1856–1939). August Weismann (1834–1914) combined this new cytological knowledge into a comprehensive theory of heredity and evolution based upon natural selection and emphasizing the continuity and independence of the germ plasm. Other important students of heredity and evolution included Francis Galton (1822–1911), who introduced statistical methods to the field, and Wilhelm Ludwig Johannsen (1857–1927), who clearly distinguished the hereditary composition (genotype) from the observable characters (phenotype) of an individual. A major advance in the study of inheritance came with the rediscovery in 1900 of the laws first recognized by Gregor Mendel (1822–1884) about 1865. These laws were further developed by Hugo De Vries (1848–1935), William Bateson (1861–1926), and T. H. Morgan (1866–1945) and his school, who, among other things, were able to show that the bulk of the hereditary units were aggregated in the chromosomes. The generalizations of Mendelian genetics offer the broadest opportunities for the accurate prediction of biological events. In this way they approach the laws of the more highly developed physical sciences.

Throughout the above historical treatment the names of individuals have been singled out for mention. Despite this it should be appreciated that zoology, like any other branch of knowledge, has grown through the concerted efforts of multitudes of unmentioned investigators, some of whose contributions may have been as great as those of the zoologists mentioned above.

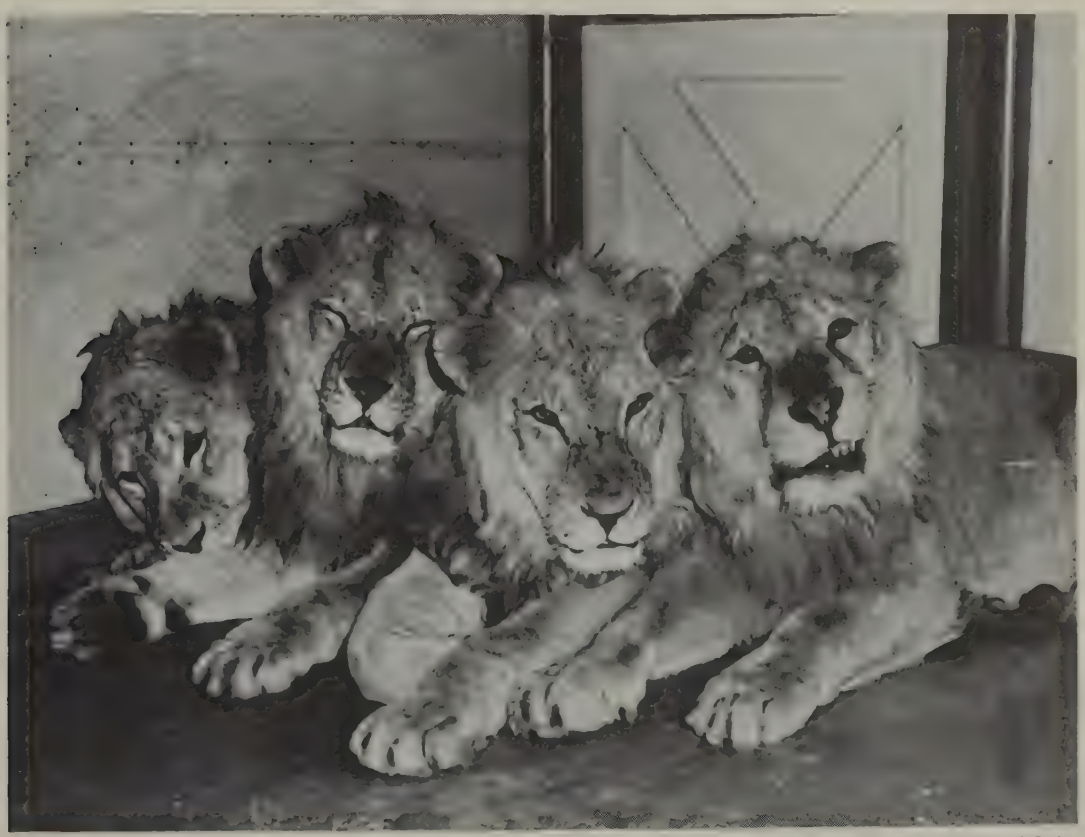
In general, it could be stated that until the 20th century a strong emphasis was placed on differences in structure and function. Hence botany, zoology, and microbiology, and subdivisions within these fields, followed relatively separate developments. With the progressive accumulation of knowledge, especially in cytology, genetics, and biochemistry, the 20th century has seen a reversal of this emphasis. The fundamental similarity of all living things is now quite apparent and information secured about animals is often directly transferable to plants and vice versa. Of course there are differences, but in order to be alive, to maintain one's self and to reproduce, certain common features are required.

Groups of Animals.—Animals inhabit almost all parts of the earth from the equator to the poles, from the depths of the oceans to high mountain summits. They have invaded the soil, the water and the air, and have even become adapted to live within other organisms. Accordingly their diversification of form and function is great. About 800,000 different species of animals have been recognized and it is estimated that the total number might exceed 1,500,000. A species is a group of similar animals which ordinarily interbreed with one another and not with others. Similar species are grouped in a genus and similar genera in a family. Higher categories include, in turn, orders, classes and, finally, phyla which are the major subdivisions of a kingdom. There is not always universal accord among zoologists as to whether a group of animals should be considered one or more species and similar difficulties are encountered with higher categories. Such is a consequence of the fact that the array of animal life reflects the fundamental relationship of forms that have evolved with modification from common ancestors. Nevertheless, a generally satisfactory listing of the major groups of animals is as follows:

Kingdom	Animalia
Phylum	Protozoa
	Mesozoa
	Porifera
	Coelenterata
	Ctenophora
	Platyhelminthes
	Nemertinea
	Aschelminthes
	Sipunculoidea
	Priapuloidea
	Echiuroidea
	Annelida
	Arthropoda
	Mollusca
	Entoprocta
	Ectoprocta
	Phoronida
	Brachiopoda
	Chaetognatha
	Echinodermata
	Chordata

The Protozoa are distinguished by the fact that their bodies are unicellular. Nevertheless they can be exceedingly complex in structure. This is not surprising when one reflects that their microscopic bodies are adapted to carry out all of life's functions. Their organs, like the locomotor apparatus, food canal, nervous, and excretory systems, are differentiations of their protoplasm and not, as in other animals, com-

In the lion compound, Bronx Zoo, New York City, the animals roam in the open under conditions simulating their native habitat. A deep, dry moat keeps them separated from the spectators



New York Zoological Society

Lions.

Rhinoceros iguana, in the New York Zoological Park

New York Zoological Society

Gila monster, in the New York Zoological Park.

posed of cells, each with its own nucleus. There is a nucleus in the protozoan body (sometimes there are several) and its experimental removal and transplantation has demonstrated that it is required for the continued normal function of the protoplasm. In asexual reproduction the nucleus divides as does that of the cells of metazoa (animals whose bodies are composed of cells). Some protozoa undergo sexual reproduction, and, when they do so, nuclear changes take place that are not unlike those occurring in the formation of sperms and eggs and in fertilization of metazoa. As a consequence inheritance in protozoa is fundamentally like that in metazoa for in both cases the majority of the hereditary factors or genes are on the chromosomes of the nucleus. Protozoa have been shown, in some cases, to require the same types of food as does man, that is, amino acids, vitamins, and minerals. In fact the chemistry by which they secure building material and energy from proteins, carbohydrates and fats is not fundamentally different from that of other organisms.

Undoubtedly one of the very earliest states of life on earth consisted of animals built on the protozoan plan. From the Proterozoic era (perhaps a billion years ago) onwards the protozoa have retained this basic plan while modifying it in some respects. In this group there are forms that possess chlorophyll and manufacture their own food from carbon dioxide and water with the energy of sunlight. But even this does not make us sure that they are plants for under certain conditions they can be made to lose their chlorophyll and, provided they are given certain foods, they move about and reproduce like other protozoa. Nevertheless, it seems certain that the plants in evolution arose from green flagellates. Some protozoa live in aggregations, suggesting that from similar aggregates the many-celled plants and animals arose long ago. Others are shelled forms, especially prolific in the seas where their skeletons fall as a constant rain to the ocean floor. In the past similar deposits have been transformed into stone, and since the populations of shelled protozoa varied with time, the microscopic analysis of shale containing protozoan skeletons is a guide to geologists in their search for oil. The largest of these shelled protozoa is a fossil form that was sometimes more than an inch in diameter. Many protozoa have complex life cycles and are parasitic in other organisms. *Plasmodium,* which causes human malaria, passes part of its life in the body of a mosquito.

The bodies of unicellular organisms are nearly always small while the metazoa, or many-celled animals, may grow large. Whenever size is great, the problem of transport of food, waste products and oxygen in and out of the depths of the body becomes increasingly difficult. This problem arises because as size increases there is a proportionately greater increase of volume than of surface. The metazoa solve this problem either by forming thin-branched colonies, or by developing enlarged body cavities, or systems of circulatory vessels. They must also, in growing large, develop some type of skeletal support.

To the phylum Mesozoa belong some microscopic parasitic animals that are interesting phylogenetically because of the primitive aggregation of their cells into a solid body consisting of two layers.

The Porifera or sponges, like the Mesozoa, possess bodies with two layers of cells, but some relatively unorganized cells are located in between. This organization is in fact so plastic that when the cells of a sponge are separated by being squeezed through fine cloth they are able to aggregate to form a new sponge. The body of a sponge is riddled with numerous canals lined by flagellated cells which create a current of water and ingest food particles thus carried in. As sponges increase in size many of them form spicules in the middle layer which afford a type of skeletal support. The siliceous spicules of some fossil sponges form a rock known as flint.

The Coelenterata, or jellyfish, anemones and corals, have a better developed middle layer. They have a mouth but no anus, waste material being ejected through the same opening it entered as food. Some forms increase in size by branching, the result being a colony of zooids connected by a series of stems through which the gut passes. Such polyps or hydroids may have an alternation of generations whereby a jellyfish stage is budded off. These free-swimming medusae form eggs and sperm and the fertilized eggs develop once again into hydroids. Some jellyfish have lost the hydroid generation and their fertilized eggs develop directly into medusae again, while others have only the hydroid stage. Food and oxygen are brought into the thick bodies of jellyfish by canals. Some of these forms possess special stinging cells that are dangerous even for man. Although sea-anemones may also become large their bodies are relatively thin-walled and the gut is divided by septa. The corals are mostly colonial sea-anemones that secrete different sorts of skeletons. They are exclusively marine and sometimes form massive coral reefs and coral atolls, as in the Pacific. Much limestone is composed of fossil coral. All of the coelenterata have bodies that are symmetrical around a central axis. This is called radial symmetry and is also characteristic of the phylum Ctenophora, or the comb-jellies. The latter forms are constructed somewhat like the Coelenterata but have eight rows of paddle-like plates by means of which they swim. Many of them can carry out chemical reactions that produce light and so are luminous when the sea is disturbed on a summer night.

The remaining animals are bilaterally symmetrical or have evolved from such forms. Bilateral symmetry means that division in the vertical plane through the long axis of the body results in halves that are essentially mirror images of one another. Most primitive is the phylum Platyhelminthes which includes free living flatworms and the parasitic flukes and tapeworms. When a gut is present, it is a blind sac opening only through the mouth. The middle layer or mesoderm is well-developed and there is a system of excretory canals whose fluid contents are agitated by cells possessed of a motile bundle of fibers. There is also a well-developed nervous system with some centralization in a ganglion at the head. The Platyhelminthes are usually hermaphroditic. The free living forms, like Planaria, have considerable regenerative power; whole animals can be reformed from small parts. They can also reduce their bodies to a small fraction of original size when starved. The parasitic forms ordinarily have complex life cycles that sometimes involve several intermediate hosts. They are of great medical importance, especially in tropical regions. The

Nemertinea are in some respects like the Platyhelminthes but they have an anus, an eversible proboscis and a rudimentary circulatory system.

The Aschelminthes consist of the rotifers or "wheel animalcules" and the free living and parasitic roundworms. These forms have an anus and spaces in the mesoderm which may represent a primitive body cavity. The nematodes or roundworms are of great medical importance, causing such diseases as hookworm and elephantiasis. The Sipunculoidea, Priapuloidea, and Echiuroidea are worms related to the segmented Annelida. One of the Echiuroids shows an unusually plastic mode of sex determination. The larva, if attracted to and settled on a female, develops into a male. If, however, it settles free on the ocean bottom, it differentiates into a female. The Annelida, a group which includes the earthworm and the leech, have contractile blood vessels and well-formed body cavities from which the excretory organs lead as tubes to the outside. Most of the structures of the body, such as the appendages, muscles, excretory organs, ganglia on the nerve cord, and lateral nerves, and blood vessels, occur in a repeated pattern along its length. This segmentation, commonly called serial homology, is not present in the early embryo, such as the ciliated larva of marine annelids, but segments are added during posterior growth.

The Annelida are believed to be related to the Arthropoda through the existence of an intermediate primitive form known as *Peripatus*. All of these forms are also similar in a number of embryological ways. To the arthropods, or joint-legged animals, belong the crabs, shrimps, barnacles, centipedes, insects, scorpions, spiders, etc. that have been so successful in their invasion of the land, sea, and air. All possess a horny exoskeleton of chitin and, like the annelids, are segmented. The appendages occur as a pair per segment and vary in number among the different groups. The appendages may be modified into walking, swimming or flying structures and, on the anterior segments of the body, become mouth parts. The aquatic crustacea breathe by means of gills but land forms like the insects have a special system of branched tubes (tracheae) that lead air into the deepest tissues. The structure of these animals is extremely complex, the circulatory system may possess a heart, there are glands controlling color, molting, metamorphosis, etc., the nervous system is highly organized and there are specialized sense organs such as compound eyes. This complexity of structure is reflected in the behavior of the arthropods and some groups of insects like the ants and bees have evolved a highly integrated social life. Arthropods are obviously important to man, not only as food, but as agencies for the fertilization of plants, as pests of food crops and as vectors of human disease.

The phylum Mollusca includes the clams, oysters, chitons, snails, whelks, slugs, squids, and octopuses. Usually there is present a calcareous shell and a prominent feature of the body is a muscular locomotory organ known as the foot. In the squid and octopus this has been modified into a series of tentacles with sucking discs. The latter forms are adapted for rapid swimming by the ejection of water from a mantle cavity. In the other mollusca locomotion is achieved by creeping or burrowing. Breathing is by means of gills and there are well-developed, but unsegmented circulatory, excretory, reproductive and nervous systems.

The phyla Entoprocta, Ectoprocta, Phoronida and Brachiopoda consist of tentacled animals (the last mentioned group with a pair of clam-like shells and well represented in fossil fauna) that are of interest as problems for the specialist.

The remaining three phyla of animals are related. The Chaetognatha consist of some marine arrow worms, the Echinodermata of the star fishes, brittle stars, sea urchins, feather stars and sea cucumbers, and the Chordata of animals with a backbone or the stiff rod, the notochord, that precedes it in development. The echinoderms are characterized by the possession of a skeleton of calcareous plates and of a water vascular system that is used for respiration and sometimes adapted to locomotion. The condition of many organs, such as the nervous system, is complex. Echinoderms are unsegmented and show radial symmetry. Their ciliated larvae, however, are bilateral and like those of some primitive chordates. The mode of formation of the body cavities as pouches from the gut is remarkably similar in the two groups. For these and other reasons it is believed that the chordates arose in evolution by diversion of the development of the larva of some animals ancestral to both echinoderms and chordates.

Like the echinoderms, the primitive chordates —sea squirts, sea pork, salps, acorn worms and lancets—are marine organisms. They do not possess vertebrae as a backbone but have in its place a gelatinous rod that stiffens the body but allows the bending movements used in swimming. This rod is found, at least in the embryo, in all chordates including man. When vertebrae form, they do so by growing around and displacing the notochord. All chordates also possess, at least as embryos, gill arches and a dorsal hollow nerve tube. The most primitive living vertebrates, the cyclostomes, have no lower jaws and no paired fins. The cartilaginous and bony fishes have both jaws and paired fins and, in addition, either small sharp toothlike or bony scales. All fishes breathe by means of gills but some also gulp air and breathe with lungs. Amphibia usually breathe with lungs in adult life but a great deal of respiration occurs through their moist skin. Although their four limbs enable them to crawl or hop about on land, amphibia, like the frogs, toads, newts and salamanders, must, with very few exceptions, return to water to breed. Their eggs develop into tadpoles with gills and after variable times these larval forms metamorphose into adults. The reptiles, having a moisture-retaining scaly skin, better lungs, and shelled eggs that will develop on land, are better adapted to land life. The birds are very similar in structure to reptiles, the obvious differences being associated with their adaptation to flight. Like the mammals they have a highly developed nervous system and a constant high body temperature. Some primitive mammals, like the duck-billed platypus, evidence their relation to reptiles not only in many structural features but especially since they lay eggs. Nevertheless, they have hair, feed their young with milk and have many mammalian structural characteristics such as the possession of three ear bones. In other mammals, mostly of the Australian region, the young are born when only a fraction of an inch in length and are nursed in a marsupial pouch on the mother's belly. In the remaining mammals, to which group man belongs, the young, attached

by means of a placenta and an umbilical cord, are retained until birth in the uterus of the mother.

Evolutionary Zoology.—The mammals are at the present time the foremost animals on the earth but this was not always so. In the Mesozoic period (some 60–180 million years ago) the reptiles were predominant. There then existed the dinosaurs and many land, aquatic and flying reptiles of an immense variety of type. The only mammals found in the fossil record of that time are a few small, insectivorous forms. Previous to the Mesozoic there were no mammals, no birds and only a few primitive reptiles. During these early times, about 250 million years ago, when there existed the great bogs and swamps that gave rise to today's oil and coal deposits, the amphibia had already appeared. The earliest of these were very similar in their structure to certain air-breathing fishes living in the ponds of these Carboniferous times. This similarity even extended to their primitive limbs which were not very different from the fins of their fish relatives. Before the Carboniferous there were no true land-living vertebrates and the fishes of the time were either primitive or, if highly specialized, are not represented among the present-day fish fauna. The earliest fishes existed between 300 and 400 million years ago and study of their fossil remains indicates that, although in most cases they had a heavy armor of bone, they were much like the present-day cyclostome fishes. Before the vertebrates appear in the fossil record only invertebrate remains are found and, even earlier, only the skeletons of protozoa.

This succession in the appearance of animal forms is a proof of the fact of evolution and confirms and amplifies the inferences about the course of evolution made from a study of living animals. Since all previously existing animals are not preserved in rock, and, since all so preserved have not yet been found, the fossil record is bound to have gaps. In certain cases, however, the seriation is quite complete. The fossil history of the horses is well known and it can be demonstrated how for about 50 million years there was a gradual increase in size with consequent improvement in speed and a gradual reduction in the number of toes until, at the present, only one remains functional on each foot. The fossil history of man is also quite well known and involves improvement in upright gait and an increase in the size of the brain. When the use of implements was learned man's influence on his environment increased explosively. In tracing such phylogenetic series it is necessary to be constantly on guard against the possibility that parallel evolution has occurred independently in several lines. This is known to have occurred in the evolution of the elephants and especially in the evolution of hoofed mammals.

The order of appearance of the vertebrates, from jawless fishes through the jawed fishes, amphibia and reptiles to birds and mammals, is the order of increasing specialization of many features, such as the nervous system. This order is in a general way followed in the development of certain organ systems such as the heart and blood vessels, or the kidneys and the urinogenital ducts. For example, in human embryonic development at early stages the plan of the circulatory system is fish-like even to the extent of there being vessels that pass through gill arches. Only after modification through further development does the circulatory system differentiate into something characteristically mammalian. In fact, the differences between the different vertebrates become less and less as earlier stages of embryology are compared.

Comparative embryology yields many clues concerning the course of evolution. For example, in the mammalian ear there are three bones, while in the ears of all other land living vertebrates there is only one. The two extra bones in the mammalian ear develop from the same structures as form the jaw articulation in other vertebrates. Thus, in the evolution of mammals a new jaw joint is formed and bones that were once parts of the jaw have come to lie within the ear and function in hearing. These two mammalian ear bones are said to be homologous with the related jaw bones in other vertebrates, the word homology referring to the evolutionary relationship existing among structures that are superficially different yet fundamentally alike. The single bone in the ear of the lower land living vertebrates is homologous with the third bone in the mammalian ear and these, in turn, are homologous with a bone that helps support the jaws of fishes. Again, the fins of fishes and the limbs of land living vertebrates are homologous, but the wings of an insect and a bird are only analogous, having a similar function but dissimilar structure and origin; they are not present in the two groups because of evolutionary relationship.

In the vertebrates developmental changes are brought about by the influence of one tissue on another. For instance, the nervous system is induced to form by the roof of the embryonic gut underlying it. Transplantation of this inducing gut tissue under the skin of a second embryo causes another nervous system to form. Similarly the lens of the eye is induced to form from skin by the embryonic eyeball. By influencing the conduct of these processes the hereditary constitution of various animals ensures development true to type. In some primitive chordates and in many invertebrates development does not involve such a stepwise determination of one tissue by another but the potentialities of the cells formed by cleavage of the egg are fixed at that time. In this case separation of the cleaving egg into two parts results in two incompletely formed monsters rather than in two perfectly formed but miniature embryos as is the case with amphibia. There is an even broader recapitulation of phylogeny to be observed in the progression from a single-celled egg to the cluster of cells formed by cleavage. This becomes a hollow sphere and, by the inward migration of some of the cells, a two-layered structure. The third, mesodermal layer then appears and within it there forms the body cavity.

Many evidences indicate that life arose in the sea. As the rivers bring salts from the eroding soil and rocks into the oceans where water is constantly evaporating, the salt concentration of the sea increases. At the time when animals arose, the sea was more dilute than it is now. The earliest known vertebrates lived in fresh water but had in their blood a concentration of salt similar to that of the sea at the time they left it and to this day roughly that concentration has been retained. The closed blood systems of animals provide watery internal environments for their cells and thereby allow a type of freedom from the outside that has reached its culmination in the higher vertebrates. Here this internal fluid is

well buffered against chemical change and carries antibodies which protect the cells against invading viruses and bacteria; the keynote is constancy. Blood possesses an efficient means of transporting oxygen in the hemoglobin of the red blood cells and carries carbon dioxide from the cells of the body to the lungs. It also transports food from the gut where it is dissolved by the action of enzymes formed in the digestive glands. The waste products secured by the blood from the tissue fluids around the cells are excreted as it passes through the capillaries of the kidney. The blood is moved by the muscular contraction of the heart and arteries and is given direction by the valves of the heart and veins. All of this activity is regulated by the action of the nervous system and the hormones secreted into the blood by the endocrine glands. These two systems control the metabolism of the body, the rate of heart beat and the contraction of skeletal and other muscles. These systems in turn respond to stimuli from within the body and from without as perceived by the sense organs. The entire physiology of the animal is adapted to preserve its pattern, but in time aging sets in which is eventually reflected in failure to function.

The pattern of animal organization is preserved, however, from generation to generation by the reproduction of new individuals, usually by sexual means. When eggs and sperm are formed the number of chromosomes is reduced to one-half of the number normal for the body cells; upon fusion of sperm with egg the normal number is reconstituted. Chromosomes consist of a complex chemical, nucleoprotein, which is capable of existing in an immense number of specific forms. The chromosomes are the hereditary determinants of the cell. For example, the members of one pair of chromosomes in the human male are structurally different from one another and known as X and Y. A human female has two X chromosomes. One of the X's is included in the egg when the chromosome number is halved; when the sperm is formed either the X or the Y is incorporated. An X bearing sperm, by combination with the X containing egg, will result in a female, while Y bearing sperm can only form males.

The chromosome is linearly differentiated into sites known as genes. These are the units of heredity that determine such characteristics as sex, eye color, susceptibility to disease, etc. They do so by influencing the chemical reactions that result in these phenotypic characters. The gene determines the response which the organism can make to the environment in expressing the character. Thus, there is no conflict between heredity and environment; the two mutually interact. Some characters like eye color or blood group type are rather rigidly determined; others like size and intelligence may vary according to the environment within rather broad limits set by heredity. The Mendelian laws governing the transmission of hereditary material are now clearly understood. As a consequence of them sexual reproduction results in recombinations of genes so that no two offspring (except derivatives of the same egg, like identical twins) are exactly alike. This variability is made possible by the fact that genes, although extremely stable, do mutate to new conditions at a rate of about once in a million reproductions. Such mutations occur under the influence of radiation and certain chemicals or for other unknown reasons.

This differentiation among genes, giving rise to variability among offspring, provides the raw material out of which new species are built. With the possible exception of man, who controls his environment more extensively than other animals, no animal species overpopulates the earth. And this despite a reproductive capacity that is frequently tremendous, as in the case of the codfish which lays millions of eggs in a single spawning. Predators, lack of food, disease and a multitude of other factors result in the survival of only a few offspring. The better fitted are those who have a greater chance of surviving and reproducing their kind; genes and combinations of genes having the greatest adaptive value are more likely to be spread in future generations. Thus evolution is brought about by the action of natural selection on hereditary variation. Man with his increasing control over the environment is in a position to influence his own evolution. It should be here borne in mind that, in addition to biological inheritance, social inheritance plays an important role.

There is a common explanation of evolution which is alternative to that involving spontaneous variation and natural selection. It is usually attributed to Jean Baptiste Lamark and states that the temporary adaptations made by an organism in the course of its life are somehow transmitted to the germ cells and eventually to its offspring. Repeated experimental tests of this explanation have disproved it; the inheritance of acquired characters is simply not a fact. An adaptive environmental modification of an individual's body is important for the individual but, since it is not transmitted to its offspring, it is not the cause of evolutionary change. Furthermore, the Lamarkian explanation is not theoretically sufficient, for it fails to account for the appearance of the ability to undergo temporary adaptations such as the browning of human skin in the sun. The only explanation consistent with all we know about evolution is that involving the action of selection on the variation in heritable traits observed in all families.

As the area occupied by a species increases, regional differentiation into races sets in, due both to the nature of the reproductive process and to adaptation to different ecological opportunities. This differentiation may become so extensive as to introduce biological barriers to reproduction between two geographically or ecologically separated races. Among such reproductively isolated groups an exchange of genes is impossible and as a consequence the two groups would be considered to have differentiated into species. From then on they follow genetically independent evolutionary pathways toward further radiation or to extinction in the face of drastic changes in environment or competition with more successful groups.

In such terms as these, which are subject to experimental verification, the high degree of adaptiveness of living things and the pattern of animal life can be understood.

Why should man concern himself with a study of animals? In the first place zoology, like all knowledge, has practical applications. Just as engineering is to physics and chemistry so veterinary medicine, animal breeding, fishery and wild life services, and the control of crop pests stand in relation to zoology. The kind of knowledge which zoologists are interested in discovering is basic knowledge, that is, knowledge that

Baboon in the New York Zoological Park

New York Zoological Society

Wild dog in the New York Zoological Park.

Zebras

New York Zoological Society

White-tailed gnu.

is generally applicable to many animal forms. As a consequence human medicine is especially dependent upon knowledge gained by zoologists. In recognition of this dependence three Nobel prizes in Physiology and Medicine have been given to zoologists, to the German embryologist, Hans Spemann and to the American geneticists, T. H. Morgan and H. J. Muller. But most important of all, we are interested in zoology because we, as animals, want to know ourselves, our relations and our past history.

Information beyond that in this summary can be found under the headings of specialties into which zoology is divided, such as BIOCHEMISTRY; EVOLUTION; RACES, NATURE AND ORIGIN OF; etc. Moreover, there are articles under the headings ANIMAL, and specific groups of animals such as INSECTS, VERTEBRATA, etc.

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ZOOMORPHIC, zō'ô-môr'fĭk, a word derived from the Greek for animal forms. In anthropology and comparative religion it refers to the representation of a god or other supernatural being under the form of one of the lower animals. The zoomorphic element is strong in classic mythology and appears e.g., in the metamorphoses of Jupiter. It predominates in primitive (animistic) religions, being particularly marked in the religion of ancient Egypt. Traces of it may be found among the Hebrews and in the Apocalypse.

ZOOPHYTE, zō'ô-fīt, a term meaning literally animal plants, borrowed from Aristotle by Cuvier, and used by him as a synonym of Radiata. It is often loosely applied as a designation for many plant-like invertebrate animals, as sponges, corals, and sea anemones.

ZORACH, zō'räk, **William**, American sculptor and painter: b. Eurburg, Lithuania (now Soviet Russia), Feb. 28, 1887. Brought as a child to the United States, he settled with his parents in Ohio and worked in a lithographic plant at Cleveland. Taking up art, he studied at New York and Paris, where he embraced cubism. Later he taught at the Art Students' League in New York. Besides doing fine water colors of New England landscapes, he achieved his best work in compact sculptures, which he began to carve of wood in 1922. Equally proficient in stone, his characteristic method is to "liberate" the figure or group from a block, retaining as much of the original form as possible. His works are exhibited in leading U. S. galleries, among them the Whitney Museum and Museum of Modern Art of New York, the Art Institute of Chicago, and the Phillips Memorial Gallery at Washington, D.C. His *Spirit of Dance*, cast of aluminum, is in Radio City Music Hall, New York.

Consult Wingert, P. S., *Sculpture of William Zorach* (New York 1938).

ZORGITE, zôr'gīt, a mineral from Zorge and Tilkerode in the Harz Mountains, Germany. It is a selenide of lead and copper in varying amounts. The color is lead or sometimes yellowish gray with a metallic luster. Its hardness is 2.5, the specific gravity 7–7.5.

ZORILLA or **ZORRILLA**, thôr-ré'lyä, **Manuel Ruiz**, Spanish statesman: b. Burgo de Osma, Soria, Spain, March 22, 1833(?); d. Burgos, Spain, June 13, 1895. An advocate at Madrid, he was chosen to the Cortes in 1856, identifying himself with the Progressive party and vigorously opposing the Conservatives and Carlists. In exile since 1866, he was appointed (1868) by Francisco Serrano, minister of education, commerce and public works. In 1869–1870 he was minister of justice, and later president of the Cortes. A supporter of Duke Amadeus of Aosta for the Spanish throne, he assumed in 1872 the head of a radical ministry, but after Amadeus' abdication retired. Upon the accession of Alfonso XII in 1875 he went to France and for 18 years was the leader of the Spanish Republicans. For his participation in the military revolt of March 1884, he was sentenced to death in absentia. But broken in health and spirits, he at length abandoned his leadership and was permitted to return to Spain in Feb., 1895.

ZORN, sorn, **Anders Leonard**, Swedish painter and etcher: b. Mora, Dalarna province, Sweden, Feb. 18, 1860; d. there, Aug. 22, 1920. After studying sculpture and painting at the Stockholm Academy, he rose to early fame and settled in 1882 in London, where he attained success as a fashionable portrait painter. When he went to Paris in 1889, he joined the impressionist movement. Zorn traveled widely on the Continent, North Africa, and Turkey, and visited also the United States, painting there portraits of Theodore Roosevelt, William Howard Taft and other notables of the period. Equally accurate are his portraits of Ernest Renan, Marcel Proust, and European royalties. During his lifetime he ranked among the leading Swedish artists and was, particularly, esteemed for his vivid landscapes and genre scenes of peasant life. Later he turned to the painting of female nudes. Among his sculptures is a statue of *Gustavus Vasa* at Mora. Though Zorn considered his etchings only a pastime, he is today chiefly remembered for these efforts, which are highly valued by collectors. Some of his canvases are in the great galleries of Europe and America.

ZORN, tsôrn, **Philipp**, German jurist: b. Bayreuth, Bavaria, Jan. 13, 1850; d. Ansbach, Bavaria, Jan. 4, 1928. After study at Munich and Leipzig, and lecturing at Munich, he went in 1875 as professor to Bern, Switzerland. From 1877 he was at Königsberg, and in 1900 took a chair in the law faculty at Bonn. He participated as an expert in the Peace Conference at The Hague (1899). Among his works are *Staat und Kirche in Norwegen bis zum Ende des 13ten Jahrhunderts* (1875); *Staat and Kirche in der Schweiz* (with Gareis, 1877–1878); *Die Beiden Haager Friedenskonferenzen von 1899 und 1907* (1920); *Die Staatsrechtliche Stellung der Handelskammern* (1923); and *Weltunionen* (1925).

ZORNDORF, tsôrn'dôrf (Pol. SARBINOWO, sär-bēn-ô'vô), western Poland, a village formerly of Brandenburg, Prussia, near Küstrin (Pol. Kostrzyn) and about 50 miles northeast of Berlin. It is celebrated for the Prussian victory won here by Frederick the Great over the

Russians under General Fermor, 25 Aug. 1758, the Russians losing 21,529 men and the Prussians about 11,000. See SEVEN YEARS' WAR. Pop. 988.

ZOROASTER, religious reformer of ancient Persia. Termed Zarathustra in the Avesta or primitive Iranian code, and in later Persian Zardusht, its meaning has been variously interpreted — one of its roots is undoubtedly «camel.» Its modern form Zoroaster was adopted from the Greek and Latin. The story of his birth and activities has little authentic basis, although his historic personality is admitted. All details are scanty, and it is impossible to distinguish between legend and fact, as is true in general of old time founders of religions, whose personality and exploits later ages have magnified out of all proportion to their real stature and deeds.

Greek and Roman writers make frequent mention of him as founder of the wisdom of the Magi and tell of his childhood and solitary life. Plato in his 'Alcibiades' (I, p. 122) makes one of the earliest references. Pliny, Plutarch, Dio Chrysostom are explicit in their accounts, which border on the miraculous. No mention is made, as might be expected, in the cuneiform inscriptions of the Achaemenidæ, the ancestral royal line of Persia, although 'Darius and his successors were loyal followers of the prophet. Darmesteter terms Zoroaster a myth, the incarnation of the storm-god. As Dr. Geldner states, however, the French scholar does not distinguish between the Zoroaster of the younger Avesta and of the Gathas, or «songs,» in which the very words of the sage are expressed, his authentic sayings, the last survivals of the sermons which he spoke at the court of King Vishtospa. In these psalms, hymns, or songs, he appears as a man on solid ground, like some later world-prophet, with his alternation of confidence and despair, but with his hold on God firmly retained in all changes of fortune. The Gathas, on the other hand, furnish no precise historical data, merely a number of verses that allude to personal events interwoven with sage reflections and counsel — a kind of modern pastoral admonition. A comparison to the Psalms of David will illustrate this point of literary content to a certain degree.

Admitting, then, his historical personality, what do the Persian traditions tell of his origin? His father bore the title Spitama, indicating a noble line; his mother's name, too, is mentioned. His birthplace was on the hill of the river Darga (Darya). Another legend traces his birth to Ragha in Media, the seat of the imperial hereditary church in Sassanian times. Like others of his type — Mohammed, for example — he had heavenly visions in early years and conversed with archangels and the Highest. At the age of 30 he had a celestial vision on the banks of the river. An angel invited him to a conference with Mazda, or the Highest, a symbol of the new era and religion which he was to found, abolishing the crude notions of his age and environment and developing a loftier ideal of the Supreme and humanity. Sent by Mazda to the court of King Vishtaspa, king of Bactria in epic legend, he suffered indignities at first and was thrown into prison — how familiar these points in the narrative! Then on gaining his liberty, he converted to the new faith the king himself, wife, brother and the two viziers, all of whom became ardent devotees and gave strength to the cause, despite the many severe trials it had to endure. Finally, on an invasion of the kingdom, Zoroaster was slain in his 77th year by a Turanian. His sons and daughters are frequently mentioned. As to the date of Zoroaster, the chronology is obscure. The time of his birth varies from the extravagance of Greek writers who place him 5,000 years before the Trojan War to the Parsee tradition, which puts his birth at 660 B.C. and his death at 583 B.C. Edward Meyer and Duncker give 1000 B.C. as date of his birth, after careful study of available sources.

While the doctrines in general of Zoroastrianism are discussed elsewhere, the personal declarations of its founder as expressed, as before stated, in the Gathas, are eminently quotable. His conviction of his mission and its sacred message is breathed in the words: «I am thy chosen one from the beginning; all others I consider my opponents.» «To thee I cry: Behold, O Lord, and grant me assistance, as a friend grants it to a dear friend,» so sounds his appeal. «Tell me right, O Lord — will the good deeds of men be rewarded already before the best life comes?» is his inspiring question. «Who sustains the earth here below, and the space above, that they do not fall? Who made the waters and the plants? Who has yoked to the winds the storm clouds, the two swiftest of things?» is in the spirit of Job's glorification of the Creator. Consult Jackson. A. V. W., 'Zoroaster, the Prophet of Ancient Iran' (New York 1899); Wadia, A. S. N., 'Message of Zoroaster' (2nd ed. 1930).

ZOROASTRIANISM, the religious system of ancient Persia as founded by Zoroaster, whose religious teachings are preserved in the Avesta, one of the world's oldest sacred books. The character of the Persian religion in pre-zoroastrian times has been a frequent subject of inquiry, but while nothing authentic is known, there is every reason to infer a certain similarity with the ancient faith of the Hindus. Iran and India were not so distant from each other as to make impossible communication one with the other. If we turn to Herodotus as informant (Hist. i, 31ff.) the Persians are said to have worshipped from antiquity the sun, moon and stars, the earth, the waters and the wind, the crassest polytheism. He intimates also that they borrowed some religious notions from Assyria and practised certain rites against which the prophet protested. His account too of the Magian ceremonies indicates that they were not inconsonant with Zoroastrianism. Ed Meyer in the *Reports* of the Prussian Academy (1908) shows how recently discovered Hittite inscriptions have a distinct bearing on the old creed of Iran, upon which the religion of the prophet was based, that Aryan folk-religion, polytheistic in its nature, many of whose divinities, Mitra and the rest, are not strangers in the Indian pantheon, while diversities as well as similarities abound in the theologies of both.

Dualism.— The first characteristic element of Zoroastrianism is its doctrine of dualism,

which personifies the opposing principles of good and evil, and recognizes the universal sway of these hostile forces. Briefly to describe this vital feature, the powers of good are led by Sharamazda or Ormuzd ("the Wise Lord"); those of evil by Ahriman ("the Spiritual Foe"). These opposing hosts, as if trained to combat and command by Oriental despots, have in their return an array of warriors, with the skill and persistency of actual armies. On one side are bands of angels and archangels; on the other companies of demons and archfiends. Under the general name of Amesha Spentas ("Immortal Holy Ones") are grouped the six archangels, who personify fundamental virtues and abstract ideas, and whose Persian names represent "Good Mind," "Perfect Righteousness," "Wished of a Kingdom," "Earthly Harmony," "Salvation," "Immortality." In addition, are a number of angels and lesser divinities, called "Worshipful Ones" who are more eminent than the rest, and include divine personifications of the planets, fire, air, water, the spirits of the righteous ("*fravashis*"), and some abstract notions like religion, glory, victory, Mithra, a divinity who incarnates light and truth. The opposing army, commanded by Ahriman, is less disciplined. Its chief archfiend is the demon Æshma (*Daeva*). A crowd of lesser fiends and demons ("*daeva,*" "*druy*") accompany the six archfiends.

The Millennium.— The world's history is nothing but the story of the contest between good and evil, light and darkness, which shall endure for 12,000 years, divided into four periods of 3,000 years each. The first period is one of spiritual existence. Conscious that Ahriman lives, Ormuzd makes the world a spiritual creation before it assumes the material form. When Ahriman discovers his enemy at work, he arouses to life his army of demons and fiends. In the second Epoch Ormuzd creates the material world, which is invaded by Ahriman and his cohorts. The third period marks the contest for mastery between the rivals and the battle for the human soul until Zoroaster is born. A new Epoch is now commenced, as the fourth and last 3,000 years begins. The prophet and his three sons, to be born in ages to come, the last being the Messiah, liberally "he who will benefit and save the world," preside over the final eon. This dualism is an approach to monotheism, as it teaches the ultimate sway of Ormuzd — its hopeful philosophy of the world's regeneration is not to be overlooked. Throughout the conflict, man is the chief factor, for all depends upon his choice as free agent, of the good. The final aim of Zoroaster's system is to assure world perfection by the individual's adoption of the right path. This will come to pass, with the setting up of the "Good Kingdom," the "Wished for Kingdom" or the "Kingdom of Desire," as the Avesta expresses it. As the world enters the stage of regeneration, Ahriman forms his hosts for a final battle. They are defeated, and good is to reign forever. Accompanying the advent of the Messiah (*Saoshayant*) occur the resurrection of the dead and the judgment of the world, to be.

Code of Ethics.— One sometimes overvalues old-time ethical codes, because we are apt to emphasize their good features. A study of the ethics of Zoroastrianism cannot but arouse admiration for their lofty qualities. They bear the stamp naturally of their environment, but in moral elevation do not yield to standards that we term modern and of which we are justly proud. A fair idea of their character can be gathered from the profession of faith required from converts and preserved in its entirety in the Avesta. These few paragraphs are condensed from Professor Jackson's translation in Ragozin's 'Media' (p. 111): "I forswear henceforth all robbing and stealing of cattle and the plundering and destruction of villages belonging to worshippers of Mazda. I promise householders that they may roam at will and abide unmolested, wherever dwelling with their herds; I swear this with uplifted hands. Nor will I bring plunder or destruction, not even or avenge life and limb. I confess myself a worshipper of Mazda, a follower of Zarathustra. I profess good thoughts, good words, good deeds" — which last phrase is the motto of the religion of Zoroaster and is found throughout his sayings and injunctions. Each day man must preserve the purity of body and soul. Earth, air and water are to be kept free from defilement. To speak the truth and act honestly are fundamental; to be kind and generous the highest duty. To till the field and raise cattle, are part of one's religious requirements. Marriage is insisted upon, even among kindred. The deed, the action, is the only source of salvation. God is manifested in virtuous thoughts, words, deeds.

Ritual.— In the Gathas, which, as before stated, is the scanty source of Zoroastrian personal teaching, there is little, if any, mention of ritual or ceremonials. He is less the lawgiver there than the prophet, it has been aptly stated. Yet a full ceremonial worship developed, the priesthood was at the head and its office was hereditary, with the Mobeds and Herveds, the Levites and Kohanim of Zoroastrianism. The Magi were of Median origin. Annual sacrifices were originally offered but were less and less insisted upon as praise and thanskgivings took their place with oblations of consecrated milk, water and bread. Lengthy litanies accompanied these rites, which were of special significance in connection with the preparation of "haoma," the sacred drink, like the Indian "Soma." A curious practice arose in the disposal of the dead. No bodies could be burnt, buried, or thrown into the water, as thereby defilement to the elements would be caused, they were consigned to high places, to be devoured by dogs and birds, a custom still in vogue among the Parsees and Gabars in their so-called "Towers of Silence." Practices of abstinence and asceticism, what is termed "mortification of the flesh" are not encouraged but are condemned as foolish and wicked and as strengthening the arch enemy's hands. The excessive reverence paid to Fire, which won for the Zoroastrians the name of "Fire-worshippers," was a later development as were numerous forms of incantation and purification.

Resemblances to Judaism and Christianity.— These are many and striking. Ahuramazda, supreme Ruler, with the attributes of

omniscience, omnipresence and eternity, with creative power which he employs through his Spenta Mainya, or "Holy Spirit," with the best of angels and archangels in his train, suggests unmistakably the Old Testament Yahveh, especially in certain books, written under later influences, and which appeared more magnified in the Gospels. So Ahriman, Ormuzd's adversary, reminds one of Satan in later epochs, and whose future end is similar; these, too, are almost parallel ideas as to the world's regeneration the Messiah, the resurrection of the dead and everlasting life. Zoroaster receives his law from Aheramazda on the "Mountain of the Two Holy Communing Ones," as does Moses on Sinai. There are six periods of creation in the Avesta like the six days in Genesis, and a single pair, Moshya and Moshyana, like Adam and Eve. The deluge of the Bible is paralleled by the devastating winter. Shem, Ham and Japhet are recalled by the three sons in the Avesta. Similarities in ritual details are many and have been studied at length. Here as is usual the critics disagree. The larger number trace these analogies to the influence exerted on Judiaism by Zoroastrianism during their period of the Exile, if not earlier. On the other hand, the contrary view, advocated by James Darmesteter, is held by some — that early Persian thought was influenced by Judaism, and that Neoplatonism, through Philo, left also its mark on the Avesta. It is impossible at present to decide definitely the point at issue; one must await fresh discoveries and identifications in the East, to give us more exact knowledge. Perhaps a common influence was at the root of both Jewish and Persian ideas.

Historical Growth.— While Zoroastrianism was the national religion of Persia, it was accepted by Turamans as well as Iromons, and spread to Armenia, Cappodocia and the entire near East. With the Sassanides, the national church was restored, and the priesthood became strongly organized with unlimited power and an authoritative religious lawbook. The head of the hierarchy, with his seat at Rai in Media, was next in power to the king. New sects now began to arise, but the Mohammedan onset in 636 with the persecutions that followed, spelled overthrow to the religion of Zoroaster. Today only a few followers of the prophet are found even in Persia. In and around Bombay the Parsees, limited in number, profess allegiance to him and his religion, but the creed has developed into a pure monotheism.

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ZORRILLA Y MORAL, José, hō-sā' thōr-rēl'yä ē mō-räl', Spanish poet: b. Valladolid, 21 Feb. 1817; d. Madrid, 23 Jan. 1893. He studied for the law at Toledo and Valladolid, but turned to literature. His attempts in politics showed him to be unfitted for such a career. From 1855 to 1866 he was in Mexico, latterly at the court of Maximilian. His plays, of which 'Don Juan Tenorio' is now the best known and is still a great favorite in Spain. Others are 'El zapatera y el rey'; 'Traidor, inconfeso y mártir'; 'El Alcalde Rouquillo' and 'El Rey loco.' The plays were hastily written and are without finish, but have continued effective through their strong appeal to national patriotism, and their adaptability to theatrical requisites. His 'Leyenda de Alhamar,' 'Granada' and 'Leyenda del Cid' were picturesque presentations of national legends in the general manner of Scott, and very popular. Zorrilla was not a careful artist, but an improvisator of great readiness and skill, both lyrical and dramatic. He suffered bitter poverty in 1871–83, for, although his plays were still highly successful, they were not protected by copyright. He later received a government pension of 30,000 reales; was awarded the gold medal of the Spanish Academy in 1885, and in 1889 was crowned national laureate at Granada. A bronze memorial was erected to him in Madrid in 1900. An account of him may be found in the autobiographic 'Recuerdos del Tiempo Viejo' (Old-Time Memories, 1880–83), which work, however, is not wholly dependable. His collected works were published (Madrid, 4 vols., 1895; 1905).

ZOSIMUS, zŏs'ĭ-mŭs (Gr. Ζώσίμος), Greek historian of the 5th century A.D. He lived at Constantinople and wrote a history of the empire in six books, the 'New History,' which is frequently referred to by Gibbon. He begins with the change of constitution introduced by Augustus, and his first book brings him to the reign of Diocletian, 305 A.D.; in the second, third and fourth books the history of the 4th century is given with more detail; the fifth and sixth books are occupied with the period from 395 to 410. From internal evidence the work must have been written about 450–502. Zosimus was a pagan, and severely criticized the Christian emperors, making the change of religion largely responsible for the decline of the empire. His work is on the whole trustworthy, but his pagan bias in some instances leads him to various misinterpretations of the acts of the Christians. The best editions are those of Bekker (1837) and Mendelssohn (1887).

ZOSTERA, a genus of marine plants. See EEL-GRASS.

ZOTAL. See MESCAL.

ZOUAVE, zoo-äv, a soldier in the French army. Zouaves were organized in 1831 and were originally mercenaries belonging to a Kabyle tribe. The Zouaves in the pay of the dey of Algiers were, when Algeria became a French possession, incorporated with the French army there, preserving their Arab dress. Ultimately the native element was eliminated, and the Zouaves became French soldiers in the picturesque Arab costume. As such they distinguished themselves in the Crimea, which was their first European service, and the Franco-Italian War of 1859. There were several regiments of Zouaves among the volunteer Federal troops in the American Civil War, so-called because of their wearing an adaptation of the costume of the French Zouaves. The

Papal or Pontifical Zouaves were recruited from French soldiers at Rome in 1860 and under General Louis Christophe L. J. de Lamoricière, a former commander in Algeria, defended the temporal sovereignty of the pope. They were unsuccessful against the Italian troops at Rome in 1870, and after serving in France against the Germans and the Commune they were disbanded in 1871.

ZOUCHE, zo͞osh, **Richard,** English legal authority on civil law: b. Ansty, Wiltshire, England, 1590; d. London, March 1, 1661. He was educated at New College, Oxford; in 1617 he was admitted an advocate of Doctors' Commons, and in 1620 became regius professor of civil law at Oxford. In addition to his university duties he had a large practice in London. In 1641 he was made judge of the high court of admiralty. He was a Royalist, though not a pronounced one, at the civil war; and, although replaced in the judgeship in 1649, was nevertheless appointed by Oliver Cromwell to a special commission of oyer and terminer, and retained his academic appointments. He was regarded with some suspicion by both political parties; but after the Restoration he was appointed to the commission which reinstated the professors and fellows of Oxford who had been removed under the protectorate of Cromwell. On Feb. 4, 1661 he was restored to the bench.

His writings include a descriptive poem, *The Dove, or Passages of Cosmography* (1613); a comedy, *The Sophister* (1639), and many works of a professional sort, most important of which are *Elementa jurisprudentiae* (1629), a general system of legal science, and *Juris et Judicii Fecialis,... Explicatio* (1650), regarded by critics as the first treatise containing a systematized arrangement of what is now known as international law.

ZOUG. See Zug.

ZRENJANIN or **ZRENYANIN,** zrĕn'yä-nĭn, city, Yugoslavia, in Vojvodina, northern Serbia, 26 miles east-northeast of Novi Sad. It is a rail center on the Belgrade-Kikinda Railroad, and a port on the canalized Begej River. Manufactures include dried beet pulp, sugar, agricultural machinery, molasses, and dairy products. Other industries are flour milling, brewing, carpet making, and vegetable canning.

The city was called Veliki Beckerek or Veliki Bechkerek until the 1930's, and Petrovgrad until about 1947. Pop. (1948) 40,517.

ZRINYI, zrĭ'nyĭ, **Miklós** or **Nicholas,** Hungarian soldier: b. 1508; d. Szigetvár, Sept. 7, 1566. He distinguished himself in Charles V's siege of Vienna, and in the campaigns against John Zápolya and Sultan Suleiman I. As ban of Croatia from 1542, he defended that territory against the Turks, and became famous for his defense of Szigetvár (or Sziget) in 1566. His garrison of scarcely 3,000 was reduced to 600, and on September 5 the enemy succeeded in firing the outer fortifications. Zrinyi retreated to the inner fortress, but this also was soon on fire. He thereupon ordered the gates to be opened, and after firing a mortar filled with broken iron into the midst of the Turks, who were surging along a narrow approach to the castle, led a sally of the garrison. He fell, mortally wounded, and the defenders were forced back, but a slow match ignited 3,000 pounds of gunpowder stored within, and great carnage among the Turks ensued. The catastrophe was made the subject of *Zrinyi: Ein Trauerspiel* by Karl Theodor Körner.

ZSCHOKKE, chôk'ĕ, **Johann Heinrich Daniel,** German author: b. Magdeburg, Germany, March 22, 1771; d. Aarau, Switzerland, June 27, 1848. He left his native place in 1788, and for some time wandered about the country as playwriter to a strolling company of actors, but afterward studied at the University of Frankfort-on-the-Oder. In 1792 he began life there as a private teacher, and produced several pieces for the stage. He subsequently settled down in the canton of the Grisons and became director of an academy at Reichenau, where he wrote a history of the Grisons (1798). He then became head of the department of public instruction at Aarau, and was soon afterward sent by the Helvetic executive directory to Unterwalden as government commissioner, for the purpose of restoring tranquility. He acquitted himself so satisfactorily that his powers as commissioner were extended to the cantons of Uri, Schwyz and Zug. In 1800 he was appointed commissioner for the organization of the Italian territories of Switzerland. In 1804 he became a member of the board of mines and forests.

Through the greater part of his life Zschokke appeared as one of the most distinguished and energetic public men in Switzerland, but he found time to cultivate his favorite literary pursuits, and it is chiefly by his numerous writings, historical and fictitious, that he is known to the world at large. Among his works may be mentioned *Des Schweizerlandes Geschichte* (1822), one of the best of his works, and *Bilder aus der Schweiz*, 5 vols. (1825–26). As a writer of tales he possesses a European reputation, and among them we may refer more especially to *Der Creole, Alamontade,* and *Das Goldmacherdorf.* The work, however, which has had the most extended circulation is his *Stunden der Andacht* (*Hours of Meditation*), 8 vols. (1809–16; 27 editions in his lifetime), which, though rationalistic, has yet, from the pious feeling pervading it, found admirers among all classes of readers.

ZSIGMONDY, zhĭg'mŏn-dē, **Richard,** German chemist: b. Vienna, Austria, April 1, 1865; d. Göttingen, Germany, Sept. 24, 1929. A graduate of the University of Munich, he began researches on the colors produced by the presence of metallic oxides or metals in glass and this lead to his study of colloid chemistry. In 1903, in collaboration with Professor H. F. W. Siedentopf, he invented an ultramicroscope through which colloidal particles, previously invisible, could be seen. In 1908 he was appointed director of the Institute of Inorganic Chemistry, which, under his able direction, became a school for the study of colloid chemistry. In 1922 he invented the ultrafine filter. Zsigmondy was awarded the 1925 Nobel Prize for chemistry in recognition of his outstanding work in the field of colloid chemistry.

ZUBLY, John Joachim, American Independent Presbyterian clergyman: b. Saint Gall, Switzerland, 1725; d. Savannah, Ga., July 23, 1781. The date of his arrival in America is

unknown, but in 1760 he became the first regular pastor of the Independent Presbyterian Church in Savannah, coming thither, according to the church record, from Wando Neck, S. C., where he was located prior to 1758. In 1775, at the provincial congress of 4 July, he was one of five delegates elected to represent Georgia in the Continental Congress, and was selected to draft a petition to the king regarding the «unhappy situation of affairs.» In a letter of 3 Sept. 1775 to the Earl of Dartmouth, he denounced the suggestions made in England of arming the slaves to bring the Southern provinces to obedience. He took part in the adjourned session of the Continental Congress assembled 13 Sept. 1775. When he discovered the intention of the Congress to declare the independence of the United States, he revealed to Sir James Wright, royal governor of Georgia, the plans being made. One of the letters was seized, and Samuel Chase, of Maryland, referred to the fact on the floor of Congress. Zubly hastily withdrew, and in Georgia openly made common cause with the Tories. In 1777 he was banished, and half of his estate seized. He remained in South Carolina until the royal government was re-established in 1779. He then resumed his work as a pastor and continued it until his death, which occurred before the end of the war. He was an eloquent and learned preacher. Consult Jones, C. C., 'History of Georgia.' Vol. II (1883).

ZUCCARELLI, dzoo-kä-rĕl'lē, or **ZUCCHERELLI, Francesco,** Italian painter: b. Pitigliano, Tuscany, 1702; d. Florence, 30 Dec. 1788. He studied painting at Florence and Rome, and after gaining some success in decorative landscape, worked for five years in London decorating the Opera-House and executing views of the Thames. He returned to England in 1752 and became well known in London, where he was patronized by the royal family, especially the Prince of Wales, and the aristocracy. He was one of the original members of the Royal Academy in 1768. After 1773 he lived in his native country. He painted landscapes principally, his work inclining to the classic, the best examples of it ranking with that of his leading contemporaries; but he also executed much of an inferior quality. He frequently painted a tiny pumpkin as a signature, his name meaning «little pumpkin.» Numerous examples of his art are in Venice, the Palazzo Reale containing 21. A large number, too, are in Windsor Castle, and he is also represented in Glasgow, Edinburgh, Paris (Louvre), Petrograd (Hermitage), Milan (Brera), and other cities.

ZUCCARO, dzook-kä'rō, or **ZUCCHERO, Federigo,** Italian painter: b. Sant' Agnolo in Vado (Urbino) 1543; d. Ancona, 1609. He studied under his brother Taddeo in Rome, and was employed by Gregory XIII to paint the vault of the Cappella Paolina in the Vatican, but having quarreled with some papal officials and painted a scurrilous picture he fled to France and ultimately reached England in 1574. There he painted portraits of Queen Elizabeth, the Earl of Leicester and other distinguished persons (21 were exhibited in 1866), and afterward worked in Venice until he returned to Rome to complete his work in the Cappella Paolina. On the invitation of Philip II he went to Madrid in 1586 to paint for the Escorial, and on his return to Rome he founded the Accademia San Luca, of which he became the first president. Many portraits of English personages in the Elizabethan era are wrongly ascribed to him, but some genuine works from his brush are extant. He was also something of an architect and sculptor. His frescoes, painted on an enormous scale and crowded with figures, gave him a great reputation during his lifetime; but modern criticism places his easel paintings far above them. Among his easel-works are 'Deposition from the Cross' (Palazzo Borghese, Rome); 'Descent of Christ into Limbo' (Brera, Milan)); 'Sir Walter Raleigh' (Kensington Gallery); 'The Resurrection' (Borghese).

ZUCCHI, dzook'kē, **Antonio Pietro,** Italian painter: b. Venice, 1726; d. Rome, 25 Dec. 1795. In 1754 he accompanied the English architect Robert Adam on his journeys in Italy and Dalmatia, and on Adam's invitation he went to England in 1766. He decorated the interiors of several of the mansions built or altered by Adam, such as Caen Wood (Hampstead), Luton House (Bedfordshire), Osterley House (near Brentford), and Sion House (Middlesex). In 1770 he was elected an associate of the recently established Royal Academy. He married M. A. C. Kauffman (q.v.), better known as «Angelica Kauffman,» in 1781 and afterward lived in Rome.

ZUCHETTO, tsůk-kĕt'tŏ, or **ZUCHETTA,** the skull cap of a Roman Catholic ecclesiastic covering the tonsure. That of a priest is black, of a bishop or monsignor purple, of a cardinal red, and of the pope white.

ZUEBLIN, Charles, American sociologist: b. Pendleton, Ind., 4 May 1866. He studied at the University of Pennsylvania, was graduated at Northwestern University in 1887 and at Yale in 1889, later studying at Leipzig. He became an instructor in sociology at the University of Chicago in 1892; was assistant professor in 1895; associate professor from 1895 to 1902; and was professor of sociology there in 1902–08. He edited the *Twentieth Century Magazine* in 1911–12. He was well known as a lecturer and magazine contributor. Author of 'American Municipal Progress' (1902); 'A Decade of Civic Development' (1905); 'Religion and a Democrat' (1905); 'Democracy and the Overman' (1911), etc. He died, Switzerland, 14 Sept. 1924.

ZUG, tsoog or zoog, Switzerland; (1) The capital of the canton of the same name, on the northeast shore of Lake Zug, 12 miles by rail northeast of Lucerne. It is popular as a pleasure resort and has fine scenery although it is located in the hilly rather than the mountainous part of Switzerland. The earliest mention of the town is in 1240. It has splendid old mansions and strong watch-towers; several interesting churches; a Capuchin monastery and a convent; a cantonal government building in Renaissance style; a fine town-house in late Gothic style, with a museum of antiquities; an arsenal; manufactures of cottons, enamel-ware, metal goods, tobacco, cigars, soap, etc. In 1435, 1594 and 1887 portions of the town sank into the lake. Pop. about 10,000. (2) A central and the smallest undivided canton

of Switzerland, bounded by Zurich, Schwyz, Lucerne, and Aargau. The surface, which is generally mountainous in the southeast and south, where the Rossberg occupies the frontier, slopes gradually north and west till it becomes comparatively flat. The portion of Lake Zug (Zuger See) within its borders occupies 10 square miles; while Lake Ageri (Ageri See), wholly within its borders, is two and three-quarters square miles in area. The climate, rigorous in the mountainous districts, is mild on the lower southern slopes. The province has a total area of 93 square miles, of which some 75 square miles are under cultivation. The principal exports are cattle, dairy products, and fruit. The town of Zug and some of the neighboring districts were under Habsburg rule from 1273 till 1352, when they entered the Swiss Confederation, though the Habsburgs only formally renounced their claims in 1389. The inhabitants of the province, predominantly of German stock, adhere to the Roman Catholic faith. Pop. (1941) 36,643. (3) a lake (Zuger See) chiefly in the canton of Zug, but partly also in Lucerne and Schwyz. Situated 1,368 feet above sea level, it has an area of 15 square miles; the length, from north to south, is 12 miles, and the breadth varies from three miles to one mile at the center. The shores are low in all directions except the south and southeast. In the former direction the Rigi, with Mount Pilatus towering behind it, and in the latter the Rossberg (5,195 feet), rise in abrupt and lofty precipices, presenting scenery of the grandest description. At the foot of the Rossberg the depth of the lake is not less than 650 feet. Steamers ply upon it, and the fishing, principally of pike and carp, is very productive.

ZUIDER ZEE, zī′dĕr zā′ (Du. zoi′dĕr zā), or **IJSSELMEER,** īs′ĕl-mār, Netherlands, a large shallow gulf penetrating deeply between the provinces of Friesland, Overijssel, Gelderland, Utrecht, and Noord Holland. Until reclamation was undertaken, the length was about 80 miles and the greatest breadth 45 miles. The islands Texel, Vlieland, Terschelling, Ameland, and several smaller islands separate it from the North Sea, with which it communicates by several channels, the principal being Marsdiep (between Den Helder and Texel) and the Vlie Stroom (between Vlieland and Terschelling). Originally it contained the islands of Wieringen, Marken, Urk, and Schokland, and numerous sandbanks, especially in its northern portion. Generally shallow, and only navigable by vessels of small draft, much of its area was only three feet in depth; its maximum depth, in the southern portion, was only 19 feet. The Zuider Zee is of modern origin, having been formed chiefly during the 12–14th centuries by successive irruptions of the sea onto forested land. In earlier times there were here only a lake and marshes, the lake being called Flevo by Pliny and Tacitus. Reclamation of the greater portion of the Zuider Zee has long been a major project in The Netherlands, the first plans having been formulated in the 17th century. A vast scheme for expelling the sea water was drafted in 1886, but financial considerations stood in the way for many years. It was not until 1920, therefore, that work was commenced on a project to reclaim 523,000 acres comprised in four separate areas (termed polders) between which was to be a fresh-water lake known as Ijsselmeer. A short dike joining Noord Holland to Wieringen was constructed in 1925, and a longer one, Afsluit Dijk (18 miles long), was finished in 1933. The northwest and northeast polders were completed and, after draining, prepared for cultivation; and at the time of the German invasion of The Netherlands in 1940, during World War II, work was proceeding on the southwest and southeast polders. Much damage was wrought to the reclamation scheme in the last stages of the war when the Germans, in order to delay the Allied advance, breached the dikes and flooded much of the newly regained land.

ZULIA, sōōl′yä, Venezuela, the most northwestern state of the republic, surrounding Lake Maracaibo (q.v.), bounded on the west by Colombia and on the east by Falcón. It was formerly united with Falcón, but is now politically independent. Lake Maracaibo is surrounded by low lands, but a great part of the rest of the province is mountainous. Agriculture is the chief industry; coffee, sugar and cacao are raised. Area, 24,969 square miles; pop. (1941) 345,667. Zulia is also the name of a famous trade route connecting northeastern Colombia with the Venezuelan port of Maracaibo. The Zulia River forms a part of this route. The navigation of the latter river has often been the subject of international controversy between Colombia and Venezuela.

ZULOAGA, sōō′lō-ä′gä, **Félix,** Mexican soldier and statesman: b. Alamos, Chihuahua, 1814; d. Mexico, 1876. Having entered the national guard as a lieutenant, he fought against the Yucatan secessionists in 1842–43, on the conclusion of which he was promoted to the rank of lieutenant-colonel. In preparation for the war with the United States he directed the fortification of Monterey, Saltillo, and the southerly approaches of the capital. From 1848 to 1853 he was not in active service. In the latter year he was promoted colonel, and subsequently variously employed. On Dec. 17, 1857 he conspired against the Liberal government, and finally on Jan. 11, 1858 the brigade of which he was the commander declared Ignacio Comonfort (q.v.) deposed and Zuloaga president. Zuloaga entered on the office January 23, and the "War of Reform" began, the Liberals being under the leadership of Benito Pablo Juárez (q.v.). In December the garrison deposed Zuloaga, who finally resigned, and appointed as a successor Miguel Miramón (q.v.), who assumed office February 2. In 1860 Zuloaga published a manifesto proclaiming himself constitutional president, but subsequently he came to an agreement with Miramón. When the French invaded Mexico in 1862, he withdrew, but in 1864 he returned and submitted to the empire and promised fealty to Maximilian (q.v.). This promise he broke and attempted, in 1865, to overthrow Maximilian; but he was unsuccessful.

ZULOAGA, thōō′lō-ä′gä, **Ignacio,** Spanish painter: b. Eibar, Guipúzcoa, July 26, 1870; d. Madrid, Oct. 31, 1945. He was descended from a family of artistic craftsmen, his father, Placida Zuloaga, having been a noted damascener; his uncle, Daniel Zuloaga reviving the art potteries at Segovia; and his great-grandfather being the organizer and director of the royal armory at Madrid. Abandoning an early intention of becoming a mining engineer, with his father's per-

mission he went to Rome to study architecture, but stayed there only a few months. Turning to painting he spent five years in Paris, where he devoted himself to study of the old Spanish masters and, in 1890, exhibited his first original work at the Salon. Zuloaga then returned to his native country and, after a long struggle for recognition, rose to the foremost rank as a truly representative Spanish artist. A prolific painter, he was noted chiefly for his portraits and his realistic portrayals of such Spanish types as gypsies, beggars, and bull fighters. He modeled his work on the style of the old Spanish masters, painting directly without preliminary drawings, with strong sure lines and fine imagination. The colors used were generally somber, occasionally heightened by bright contrasting hues. His treatment of a subject was intensely realistic, often brutal in its impassioned sincerity. Yet his work always made, through its imaginative quality, a certain spiritual, almost mystic, esthetic appeal. The choice of detail was deliberate and careful; and the subject matter well conceived and arranged. Collections of his works were exhibited on several occasions in the United States, and at the time he visited that country in 1924 it was estimated that he had completed more than 500 paintings. The Hispanic Society, New York City, acquired *The Gypsy Bull Fighter's Family* and *Mlle. Lucienne Bréval as Carmen.* Zuloaga's notable works also include: *Daniel Zuloaga and His Daughters* and *Doña Mercedes* (in the Luxembourg, Paris); *Market Scene* (at Ghent); *Promenade After the Bull Fight* (at Leipzig); *Watching the Races* (at Brussels); and *Amies* (at Barcelona). An amateur bull fighter of note, he was an ardent admirer of all that was Spanish in life and thought.

ZULULAND, zōō'lōō-lănd, Union of South Africa, northeastern area of the province of Natal. The area of 10,427 square miles includes, besides the former Zulu kingdom, several small territories, including Amatongaland, 600 square miles in area, which, in 1898, was incorporated in the Ingwavuma District, a strip 65 miles long and 30 miles in width lying immediately south of Mozambique. From the Zululand coast at Cape St. Lucia the Lebombo range of mountains runs northward nearly parallel to the coast, separating the country into two regions. The coast region, averaging about 400 feet above sea level, is malarial during the summer but fertile, supporting large numbers of native cattle; the inland region, rising in a succession of plateaus to an elevation of 5,000 feet, is very productive. The principal rivers are the Tugela, on the boundary of Natal proper, with its left tributary the Buffalo; the Umfolozi, which flows into the Indian Ocean immediately north of Cape St. Lucia; and the Umkuzi, which enters Lake St. Lucia, further northward. Gold, asbestos, and nickel have been found in several places, and high quality zircons in alluvial deposits 15 miles north of Eshowe, administrative headquarters of Zululand. In limited areas of the country thrown open for white settlement sugarcane is grown on a considerable scale; stockraising is the principal industry in the native reserves. A railroad runs southward through Zululand from Ingwavuma to the Umfolozi River, thence following the coastline to the port of Durban.

The Zulus, who speak a language of Bantu (q.v.) origin, are well-proportioned, muscular, and warlike. Primarily a pastoral people, millet and other grains cultivated by the women constitute a staple of their diet. They live in beehive-shaped huts built of poles, and thatched and plastered, which surround a communal cattle pound; each group of such huts, termed a *kraal,* is presided over by a petty chief, or village headman. The Zulus are polygamous, wives being purchased in exchange for cattle. Under their terrible chief Chaka, the Zulus were most formidable early in the 19th century, when the first white men arrived in Natal (q.v.), great numbers of peaceful tribesmen being slaughtered in the constant Zulu raids west of the Tugela River. Chaka was assassinated in 1828 by his brother Dingaan (q.v.), who treacherously massacred some 600 Dutch migrants from Capetown and was himself killed soon after his signal defeat on Dec. 16, 1838. The next great Zulu chief was Mpande (or Panda), a relatively moderate man who ruled until his death in 1872. Cetewayo, his successor, became involved in boundary disputes with the Dutch administration in the Transvaal, and with the British, and troops of the latter invaded the country early in 1879. The Zulus overwhelmed the British forces at Isandhlwana on January 22, but were in turn defeated at Ulundi on July 4, 1879. Soon thereafter Cetewayo was captured and exiled, his kingdom being divided among a number of minor chieftains under British suzerainty. The British repatriated and reinstated Cetewayo in 1883, but his enemies rose against him and he died a fugitive the next year. Dinizulu, son of Cetewayo, was aided by Transvaalers in defeating his rivals and securing the throne for himself, and in reward the Dutchmen received cession of much of central Zululand, which they constituted the "New Republic." This short-lived state, much reduced in size, was absorbed into the South African Republic (Transvaal) in 1888, a year after Zululand had been annexed by Great Britain. Dinizulu rebelled and, in 1889, was exiled to St. Helena, but was allowed to return to his country in 1898. Meanwhile, in 1897, Zululand had been incorporated into the colony of Natal (q.v.), and thereafter its history was uneventful with the exception of a brief rising in 1906. Blame for this was attributed to Dinizulu, who was imprisoned until 1910; he died in the Transvaal in 1913. Consult Bird, J., *The Annals of Natal, 1495–1845,* 2 vols., (Maritzburg 1888); Stuart, J., *A History of the Zulu Rebellion* (London 1904, new ed. 1913); Walker, Eric A., *A History of South Africa* (London 1928); Krige, E. J., *Social System of the Zulus* (London 1936); Birkby, C., *Zulu Journey* (London 1937); De Kiewiet, Cornelius, *A History of South Africa* (New York 1941); Tatlow, A. H., *Natal Province* (London and Durham, published annually).

ZUMALACARREGUI, sōō'mä-läkär'rĕ-gē, **Tomás,** Spanish military officer: b. Ormaiztegui, Navarre, Dec. 29, 1788; d. Segama, Navarre, June 24, 1835. He fought against Napoleon in the war of independence, and subsequently reached the rank of colonel in the regular army. Ferdinand VII made him governor of El Ferrol, but the prime minister removed him in 1832 because of his suspected affiliation with Don Carlos de Bourbón (q.v.). Soon after the death of the king in 1833 Don Carlos appointed him commander of the forces of the Carlists (q.v.) in the Basque provinces and Navarre. With great

ability he organized these troops into a really formidable force, and wielded them with remarkable success against such generals as Valdés, Quesada and Rodil. Finally, when the constitutional army had been signally outfought Don Carlos, against Zumalacárregui's advice, determined to attack Bilboa. Zumalacárregui's plan was to march upon Madrid by way of Vitoria and Burgos, and he regarded the siege of Bilbao as a waste of time. It was during the operations there that he received the wound from which he eventually died. He was the most able figure of the first Carlist War. Consult Henningsen, 'Twelve Months of Campaign with Zumala-Cárreguy' (London 1836).

ZUMARRAGA, Juan de, thoo-mär'rä-gä, Spanish prelate in America: b. Durango (Biscay), 1468; d. Mexico, 3 June 1548. He was for many years guardian of the convent of Abrojo in Spain, and in December 1527 was appointed bishop of the newly established see of Mexico. He greatly developed the Mexican missions, but directed considerable misguided zeal against Aztec manuscripts, which he gathered together all over Mexico and publicly burned. Only comparatively few escaped this destruction. His see was elevated to an archbishopric in 1548. He left many letters and other literary remains. Consult 'Cartas de Indias' (Madrid 1877); Monograph of United States Catholic Historical Society (1928).

ZUMBO, South Africa, a town of Portuguese East Africa, near the confluence of the Loangwa with the Zambesi, and on the frontier line of North Rhodesia, 450 miles from the mouth of the Zambesi. It marks the western point of the Portuguese territories on the Zambesi, and was formerly the seat of an important trade, but its trade declined. In recent years the development of the territory adjacent and the general improvement of Portuguese East Africa has given a new impetus to Zumbo which has, in some measure, restored its commercial activity.

ZUMPT, tsoompt, **August Wilhelm,** German classical philologist: b. Königsberg, 4 Dec. 1815; d. Berlin, 23 April 1877. He was nephew of Karl Gottlob Zumpt (q.v.). He was a professor in the Friedrich-Wilhelms gymnasium of Berlin from 1851 to his death. Among his publicans are editions of 'Rutilius Namatianus' (1840) and the 'Monumentum Ancyranum' (1845); 'Commentationes Epigraphicæ ad Antiquitates Romanas Pertinentes' (1850–54); and 'Studia Romana' (1859); 'Das kriminalrecht der Römischen Republik (1865–69); 'De Monumento Ancyrano Supplendo' (1869); and 'Der kriminalprozess der römischen Republik' (1871). The larger part of the last two volumes of the German edition of Ihne's 'History of Rome' is the work of Zumpt.

ZUMPT, Karl Gottlob, German philologist: b. Berlin, 20 March 1792; d. Karlsbad, 25 June 1849. Educated at Heidelberg and Berlin, he was, in 1827, appointed professor at the latter, where he did much effective work toward the improvement of instruction in the Latin language. Among his writings were a Latin grammar (1818; 13th ed. 1874); editions of Quintilian (1831); Curtius (1826; 1846), Cicero's orations against Verres (1831) and the 'De Officiis' (1838); 'Ueber den Stand der Bevölkerung und die Volksvermehrung im Altertum (1841); 'Ueber die bauliche Einrichtung des römischen Wohnhauses' (1842); 'Ueber den Bestand der philosophischen Schulen in Athen und die Succession der Scholiarchen' (1843); and several treatises, such as 'Die Religion der Römer' (1845). An abbreviation of the grammar (1824) reached a 9th edition in 1866.

ZUÑI, zoo ñē, N. Mex., Pueblo village about 40 miles southeast of Fort Wingate, near the western boundary of the state. The residents constitute a distinct linguistic stock and call themselves Ashivi. They are the descendants of the people of Cibola, recorded by the Spaniards. The Spaniards first visited them in 1539 and were driven away, but Spanish missionaries later gained considerable influence among them. In 1680 the Pueblos revolted against the Spaniards, and for 12 years they remained free from their authority. The villagers retain their ancient beliefs and ceremonials and are peaceful agriculturalists, weavers and pottery makers. With the Hopi they are regarded as the most truly typical of the Pueblo tribes.

ZUÑI MOUNTAINS, a detached range in Valencia County, N. Mex. The general trend is from southeast to northwest; length, 45 miles. The mountains do not rise more than 10,000 feet above sea-level, and this is only from 3,000 to 4,000 feet above the surrounding plateau. The range is heavily timbered. It is of geological interest on account of its isolation and the simplicity of the stratification.

ZUÑI SALT LAKE. This lake is in a large crater-like cavity in the plain 40 miles south of the Zuñi Indian pueblo in western New Mexico. The lake is encrusted with salt which is an important source of local supply. The Indians have used the salt for many centuries and regard the lake as sacred. Its diameter is less than a half-mile and on its shores rise two recent volcanic cones, one with a deep crater. The hole in which these features occur is a mile in diameter, 200 feet deep and rimmed by a low encircling ridge of scoria and rock fragments ejected from the hole, doubtless by a volcanic explosion.

ZUNIAN, or **ZUNYAN,** a Pueblo Indian stock of the New Mexico-Arizona region. Their tribal emblem is "the sacred water-spider," from the Indian name of which they are often called Shi-wi-nas. They are of the greatest interest to the ethnographer and student because they still retain to a great extent their primitive condition and culture. They are skilled in pottery-burning. They cultivate the arid regions and plant wheat, barley and corn in fields. Cattle, horses, sheep and pigs are kept. The language has a superior grammatical structure and traces of an earlier language, now dead, are to be found. The dances, festivals and other tribal customs differ little from other Indians of the pueblos. They have always practised monogamy. The ravages of smallpox and other diseases have reduced their numbers to below 2,000. See PUEBLO INDIANS.

ZÚÑIGA, thoon-yē'gä, **Alvaro Manrique de,** Spanish viceroy of Mexico: b. Seville, about 1530; d. Madrid, about 1600. He entered Mexico in October 1585 as viceroy, and his adminis-

tration was, according to the historian, Juan de Torquemada, one of prudence and wisdom. A dispute with the audiencia of Guadalajara, however, on a point of jurisdiction, nearly precipitated civil war upon the colony. Philip II, on the basis of reports circulated by his foes, finally removed him in 1589, and directed Pedro Romano, the bishop of Tlaxcala, to investigate Zúñiga's government. Romano persecuted Zúñiga with great cruelty until 1596, when the latter sailed for Spain, where he was successful in getting revoked the sentence of confiscation pronounced against him.

ZÜÑIGA, Dionisio de, Central American missionary: b. Guatemala, about 1550; d. Chiapa (now in southern Mexico), about 1620. He became a Dominican in Chiapa province, and for the greater part of his life was a missionary among the Quiche Indians. He wrote a grammar of the Quiche language and prepared also in Quiche a volume of sermons and several religious treatises, besides translating Francisco Viana's works, originally written in the dialect of Vera Paz.

ZÜÑIGA Y AZEVEDO, ē ä-thā-vā'thō, **Gaspar de,** COUNT OF MONTEREY, Spanish viceroy in America: b. Andalusía, about 1540; d. Lima, Peru, 10 Feb. 1606. He took vice-royal charge of Mexico, 5 Nov. 1595, and in 1596 sent an expedition in command of Sebastian Vizcaino for the exploration and occupation of Lower California. Vizcaino was hampered by lack of provisions, and returned after accomplishing little. By royal order, he was again sent out by Zúñiga in 1602, when he explored the coast of Upper California. In 1597 Zúñiga drove out William Park, an English pirate who had taken possession of Campeche. Among other expeditions organized by him was one commanded by De Oñate (see ONATE, JUAN DE) and Zaldívar to take New Mexico. During his administration in Mexico he was a benefactor of the natives. In 1603 he became viceroy of Peru, though he did not enter Lima until 1604.

ZUNZ, tsunts, **Leopold,** German Jewish scholar: b. Detmold, Germany, 10 Aug. 1794; d. Berlin, 17 March 1886. He studied at the university, to 1839 he was in Prague as preacher at the synagogue of Berlin; and in 1824–32 was editor of the *Spenersche Zeitung*. From 1835 to 1839 he was in Prague as preacher at the synagogue there, but in 1839 returned to Berlin to become director of the normal seminary, a position he held until 1850. In 1845 he was made a member of the board of commissioners for the promotion of the educational interests of the Jews. His writings are remarkable, in their age, for their broad view, their grasp of the subject, their clearness of presentation and their charm of language. He was the first to take up the scientific study of the Jews' rabbinical literature in his 'Etwas über die rabbinische Litteratur,' published in 1818; and his 'Die gottesdienstlichen Vorträge der Juden' (1832) is considered the authoritative work on the biblical exegesis and the homiletics of the rabbinical writings. Among his other works are 'Die Namen der Juden' (1836); 'Die synagogale Poesie des Mittellaters'; and 'Litteraturgeschichte der synagogalen Poesie' (1865).

ZURBARAN, thoor-bä-rän', **Francisco de,** Spanish painter: b. Fuente de Cantos, Estremadura, 7 Nov. 1598; d. Seville, 1662. He was educated in the school of Juan de Roélas in Seville, and early formed his style on that of Caravaggio. He is thence frequently known as the Spanish Caravaggio. He first brought himself into notice by a series of pictures for the chapel of Saint Peter in the cathedral of Seville, illustrating the life of the titular apostle; and about 1625 he executed his celebrated picture of 'The Glory of Saint Thomas Aquinas' (Seville Museum), which is esteemed his masterpiece, and one of the finest works in Spain. Another famous series is his 11 pictures illustrative of the life of Saint Jerome painted for the monastery of Guadalupe. No less famous is his series of three pictures in the monastery of Santa Mariá de los Cuevas, in Seville, which were produced on his return from Guadalupe. These pictures, which are now in the Seville Museum, represent the "Virgin Extending her Mantel over a Group of Carthusian Monks'; 'Saint Hugo Surprising the Monks at a Secret Feast in the Refectory'; and 'Saint Bruno in Conversation with Pope Urban II.' His 'Crucifixion' (1527) in the church of San Pablo is a notable picture. As early as 1633 he signed himself painter to the king. In 1650 he executed for the palace of Buen Retiro the 'Labors of Hercules' in 10 pictures, now in the Madrid Museum. From this time on he seems to have been a great favorite at the court, though he continued to paint monks and church dignitaries with great spirit and faithfulness to truth, which have gained for him the position of one of the three greatest of Spanish painters. Though he painted several large compositions, he preferred small and simple ones, generally religious in subject. He especially made studies of the Spanish friar. His works are to be seen in some private collections, and in the galleries of Saint Petersburg, Pesth, Munich, Paris and London. Consult Bermudez, 'Diccionario de los más ilustres profesores' (1800); and Lefort, 'La peinture espagnole' (1894).

ZURICH, zoo'rĭk, Switzerland; (1) a city, capital of the canton of the same name, situated at the northeast extremity of the lake of the same name. It is divided by the Limmat into unequal parts, forming an upper and lower town, connected with their suburbs by several bridges. The streets in the oldest quarters are narrow, crooked and dark, but have undergone considerable improvement. The principal buildings are the cathedral or Grosse Münster, on a hill near the right bank of the Limmat, a heavy massive structure in the Byzantine style; the Fraumünster, on the left bank of the river; Saint Peter's Church, with a fine tower and clock; the town-house; the town library, containing 130,000 volumes; the museum, with a collection of home and foreign periodicals, and a rich library; the university; the new Swiss Polytechnic School; the arsenal; the music buildings; the railway station; the theatre and the post office. Two public promenades add to the attractions of the city, besides a botanical garden and many smaller parks and walks connected with a variety of institutions, public and private. Manufactures of silk and cotton, including dyeing and calico-printing, are

extensive; those of candles, soap, tobacco, paper, leather and machinery are also considerable. Besides the university, founded in 1832 and having a professional staff of 150, and over 1,300 students in theology, law, medicine and philosophy, there are the Polytechnic School which is maintained by the government and in 1917 had a teaching staff of 262, Schools of medicine and of arts, secondary and elementary schools of all kinds, deaf and dumb and blind asylums, orphan and several other hospitals. Learned and other societies of various descriptions abound. Zürich is of great antiquity and early became a Roman station. In 1219 it was declared a free imperial city. The preaching of Zwingli in the cathedral made it the centre of the Swiss Reformation. Here, in 1443, the Swiss defeated the Austrians, and here also, in 1799, the Russians were defeated by the French. The Treaty of Zürich, signed here 10 Nov. 1859 by the plenipotentiaries of France and Austria, closed the Franco-Italian war by Austria's abandonment of her right to Lombardy. Pop. (1933) estimated 312,600. (2) A northern canton bounded north by Schaffhausen and the grand duchy of Baden, west by Aargau, south by Zug and Schwyz, and east by Saint Gall and Thurgau; area, 666 square miles. Though not properly mountainous, it has on its south and southeast frontiers several lofty ridges, remarkable for their parallelism. Except the Lägern and adjoining heights, they have their longer axis from southeast to northwest and form a succession of terraces lowering gradually toward the north. The general slope is toward the left bank of the Hornli and the Schauenberg, both in the east. The general slope is toward the left bank of the Rhine, which drains part of it directly and part indirectly, by the Thur, Töss, Glatt and Limmat. Of the lakes, about 40 in all, the most important are those of Zürich, Greiffen, Pfeffikon, Türler and Katzen. The climate is on the whole temperate, but mists are prevalent, particularly on the lower grounds. In some parts the prevailing rock is the Jura limestone, but a more recent formation, consisting chiefly of marl and sandstone in almost horizontal strata, is still more largely developed. One remarkable feature is the immense number and magnitude of the granite boulders which cover the surface. The minerals are few and of little value. The soil, with the exception of a few favored spots, is far from fertile and hence, though the arable land is comparatively large and carefully cultivated, the corn produced falls short of the consumption. In some districts a wine of tolerable quality is produced. Wood seldom forms forests, but occupies many scattered patches and hedgerows. Game is scarce, fish almost superabundant. In no canton have manufactures made more progress. The great staples are silk and cotton goods. The inhabitants are almost all Protestants, and education is very generally diffused. Zürich was admitted into the Swiss Confederation in 1351 and readmitted in 1450, after a 10 years' alliance with Austria. The government, formerly somewhat aristocratic, became decidedly democratic in 1831. A new democratic constitution was adopted in 1869. Zürich holds the first place in the Swiss Confederation. Pop. about 625,000. (3) One of the principal lakes of Switzerland, chiefly in the canton of Zürich, but partly also in Schwyz. It forms a long irregular curve, bending round from southeast to northwest, convex on the south and concave on the north side; greatest length, about 27 miles; greatest breadth, two and one-half miles; greatest depth, 469 feet. Its scenery is distinguished not so much for grandeur as for beauty. The mountains around, nowhere exceeding 1,700 feet above the lake, which is itself 1,342 feet above sea-level, commence in wooded heights and descend to the water's edge in gentle slopes, covered with vineyards, orchards, gardens, cultivated fields and verdant meadows, and studded over with country-seats and smiling villages. A considerable traffic is carried on upon the lake by means of sailing vessels and numbers of steamers. It is well supplied with fish. Its chief feeder is the Linth Canal (completed in 1816), communicating with the Wallenstätter-see. It discharges itself at the town of Zürich by the Limmat.

ZURITA Y CASTRO, thoo-rē'tä ē kăs-trō, **Geronimo,** Spanish historian: b. Saragossa, 4 Dec. 1512; d. 3 Nov. 1580. He was educated at Alcalá, and in 1543, he was sent to Germany on a diplomatic mission to Charles V by the inquisitor-general of Aragón. Subsequently he was made councillor of state and secretary to Philip II. Appointed chronicler of Aragón, he traveled in quest of data through Spain, Sicily and Italy, and finally in 1562–80 published in six volumes his 'Anales de la Corona de Aragón' (continued by Argensola and Blasco-Lanuza 1622). He also made important corrections, in, and additions to, Lopez de Ayala's (see AYALA, LOPEZ DE) 'Crónicas de los Reyes de Castillas.' For a biographical sketch and some correspondence, consult Dormer, 'Progressos de la Historia en Aragon' (1860). The 'Anales' was looked upon as a work of very great importance during more than a century after its publication, and several editions of it have been issued, notably in 1558, 1610 and 1669, and annotated editions of it have been published within the past 25 years.

ZUTPHEN, züt'fĕn, Netherlands, a former fortified town in the province of Gelderland, 27 miles northeast of Arnhem on the right bank of the river Yssel, where it is joined by the Berkel. Its chief edifice is the 12th century church of Saint Walpurgis. The town was at one time a member of the Hanseatic League, and had a considerable foreign trade. It still has an active home trade, more especially in sending grain and timber, both rough and prepared, down the Yssel. Pop. about 21,000.

ZUYDER ZEE. See ZUIDER-ZEE.

ZWEIBRUCKEN, tsvī'brük-ĕn (Latin, *Bipontium;* French, *Deux-Ponts,* "Two Bridges"), Germany, a town in the Rhine-Palatinate, on the Schwarzbach River, 54 miles southwest of Mannheim. It was the capital of the mediæval Duchy of Zweibrüchen, until the end of the 18th century. It is well built and has Protestant and Roman Catholic churches and a synagogue; gymnasium, a *realschule* and several other schools; courts and public offices occupying the former ducal palace; an orphanage and hospitals; manufactories of silk plush, machinery, chicory, tacks, chains, leather etc.,

and a trade in corn and cattle. The edition of the classics known by the name of 'Bipont' was published here in 1779 and subsequent years. Pop. about 15,250.

ZWEMER, Samuel Marinus, American missionary: b. 12 Aug. 1867 at Vriesland, Mich. He graduated at Hope College, Holland, Mich., A.B. 1887; B.D., New Brunswick Theological Seminary 1890. He was ordained a minister of the Reformed Church in America 1890, and became a missionary at Basra, Bahrein and other stations in Arabia 1891–1912, afterward residing in Cairo, Egypt. He traveled extensively in Moslem lands. He became professor of religion and Christian missions, Princeton Theological Seminary. He is the author of 'Arabia the Cradle of Islam' (1892); 'Topsy Turvy Land' (1902); 'Raymond Lull' (1904); 'Influence of Animism on Islam' (1920); 'A Moslem Seeker After God' (1920); 'Call to Prayer' (1923); 'Law of Apostacy in Islam' (1924); 'The Unoccupied Mission Fields' (1910); 'Zig-zag Journeys in the Camel Country' (1912); 'Childhood in the Moslem World' (1915); 'Mohammed or Christ' (1915); 'Life of William Borden' (1916); 'Across the World of Islam' (1928). He is editor of *The Moslem World,* a quarterly review, New York.

ZWICKAU, tsvĭk'ow, Germany, a town of Saxony, on the west bank of the Mulde, 60 miles west-southwest of Dresden. It has several interesting churches, among them two ancient Gothic types recently restored, that of Saint Mary, dating from the 15th century; a gymnasium with a library; a town hall built in 1581, which has archives dating from the 13th century, and an old castle converted into a penitentiary. The chief source of its wealth is the rich coal beds in the vicinity, employing 8,000 miners, and yielding annually 2,500,000 tons of coal. The mines were known as early as 1348 but have been worked only since 1826. There are also manufactures of linen and cotton goods, dyes and chemical products, numerous tanneries, dye-works, bleach-fields, oil, saw and other mills, and a considerable transit and general trade. It was the birthplace of Robert Schumann, the composer. See ANABAPTISTS for the «Prophets of Zwickau.» Pop. (1933) 84,701.

ZWINGER, tsvĭng'ĕr, **Theodor,** Swiss scholar: b. Basel, 2 Aug. 1533; d. there, 10 March 1588. He studied at Basel and at Paris, and after a course in medicine at Padua, became a member of the Basel medical faculty. He lectured there on Greek in 1565–71 and subsequently on ethics, and from 1580 was professor of the theory of medicine. Zwinger was a type of the universal scholarship of that time, and wrote a 'Theatrum Vitæ Humanæ' (1565), a kind of general encyclopædia, then regarded as a marvel, but now having only a bibliographical interest. His 'Methodus Apodemica' (1578), contains material valuable for local history. Consult 'Athenæ Rauricæ' (1778), which contains a list of his writings.

ZWINGER, The, a public building in Dresden, containing a valuable collection of works of art and scientific treasures. The word Zwinger is a general name for a prison or any confined place.

ZWINGLI, zwĭng'lē, Ger. tsvĭng'lē, or **ZUINGLIUS ULRICH,** a celebrated Swiss reformer, was a contemporary of Luther (q.v.), and was born at Wildhaus, canton of Saint Gall, on 1 Jan. 1484; d. Kappel, 11 Oct. 1531. Ulrich was the third of eight sons of the bailiff of that place. He studied at an early age in Basel and Bern, and continued his studies in Vienna, where he occupied himself with philosophy, and again in Basel, where he devoted his attention to theology, under the direction of Wyttenbach. In 1506 Zwingli became parish priest at Glarus, and here employed his time, as Luther had done in the Augustine monastery at Erfurt, in the diligent reading of the Holy Scriptures. He copied the epistles of Saint Paul in the original Greek, and even learned them by heart —an acquisition which afterward proved of great service to him in his public discussions. He accompanied the forces of Glarus during the campaigns of 1512, 1513 and 1515, in Lombardy, in the cause of the Pope against the French, in the capacity of chaplain, and was rewarded for this service by the grant of a pension from the Pope. In 1516 he became preacher in the convent of Einsiedeln, then a celebrated place of pilgrimage. Here he began to make known publicly his ideas of reform, preaching against the pilgrimage of Einsiedeln, which he termed an abuse and a corruption of the doctrine of the Christian Church, and calling upon the bishops of Sion and Constance to promote a reformation of religious doctrines, upon those points in which Zwingli considered that the Church had departed from the primitive teaching. Up to this time, however, his ideas of innovation excited no rebuke upon the part of the authorities, and he was, not long after, invited to Zürich, and entered on his office of preacher in the cathedral 1 Jan. 1519, with a discourse in which he declared himself for the use of the simple Scriptures without regard to the prescribed texts and lessons. At Zürich Zwingli delivered a series of sermons on the Holy Scriptures; and these discourses in which he inveighed against what he declared to be the errors and superstition of the times, laid the foundation for his future work of reformation. The occasion which launched him on his career was similar to that which had aroused Luther. In 1518 Bernadin Samson, a Franciscan monk of Milan, appeared in Switzerland to preach the indulgence proclaimed by Leo X to all who should subscribe alms to the building of Saint Peter's Church at Rome. Zwingli, who was then preaching at Einsiedeln, opposed him there, and afterward in Zürich, with all the power of his eloquence, and brought the indulgences into so much odium that Samson was not even permitted to enter Zürich; and the Council of Zürich finally obtained from the Papal Nuncio the recall of Samson to render an account of his mission at Rome. From this time Zwingli gradually went further in his plans, supported by the Zürichers. In Zürich his innovations were so far promoted by the government that in 1520 a decree was issued ordering that the Holy Scriptures should be taught «without human additions.» In 1522 the reformation was extended to external ceremonies. In this year Zwingli was forbidden to preach by the bishop of Constance In it also he wrote his first work against the fasts of the Church and began the

study of Hebrew. In 1523 the government in Zürich invited all theologians to a public conference in Zürich, to convict, if possible, Zwingli of an error in doctrine. About 600 persons, clergy and laymen, were present at this disputation. Zwingli exhibited his opinions in the form of 67 propositions, which were to form the subject of discussion. The celebrated John Faber, the vicar-general of the bishop of Constance, refused to discuss any of Zwingli's propositions save the last one, which denied the supreme authority of the Church, whereupon the Council of Zürich decreed that Zwingli had not been convicted of error or heresy, and «might continue to freely announce the holy gospel and the Word of God according to the new order.» In a second dispute Zwingli urged his objections to images and the mass and the former were soon afterward removed from the churches by order of the council and the latter abolished. In 1524 Zwingli married Anna Reinhard, a widow, and the next year published his commentary on «True and False Religion.» The Reformation in Switzerland was now fixed upon a firm base; and Zwingli continued the work with undiminished zeal, warmly supported by the cantons which espoused the Protestant cause. The religious orders were suppressed and all questions of marriage were placed under the jurisdiction of the civil tribunals, as well as the administration of the Church revenues. In general, Zwingli agreed in his opinions with the German reformers; like them he assumed the Bible as the only rule of faith, rejected the Papacy, attacked the authority of the priesthood and declared that his object was to restore the Church to the simplicity of primitive times. His views differed on some points from those of Luther, particularly in regard to the real presence, and on some less important matters relative to the liturgy. In order to remove this wall of partition from between the two parties which adopted the new doctrines, a meeting between the Saxon and Swiss reformers was held at Marburg (1–3 Oct. 1529) at the suggestion of Philip, the Landgrave of Hesse. The former were represented by Luther and Melanchthon, the latter by Zwingli and Œcolampadius. Although a complete union was not effected, yet a convention was agreed upon, the first 13 articles of which, containing the most important matters of religious faith, were recognized by both parties; and the 14th declared that, though they could not agree as to the real presence of Christ in the eucharist, they would behave reciprocally in the spirit of Christian charity. In 1531 an open war broke out between Zürich on the one side and the Catholic cantons of Lucerne, Schwyz, Uri, Unterwalden and Zug on the other; and Zwingli was commanded to take the field, bearing the banner of the canton, which it had been usual for an ecclesiastic to support. A battle ensued at Kappel, on 11th October. But the enemy were more than twice as strong as the Zürichers and under better officers; the latter were, therefore, defeated and Zwingli was among the slain. The spot where he fell is marked by a monument. The Reformed Church in Switzerland afterward received from the hands of Calvin (q.v.) its present organization. The collected works of Zwingli were published at Zürich in 1545. A complete collection of Zwingli's writings was also published at Zürich in eight volumes in 1828. E. Zeller has attempted to deduce Zwingli's doctrines from his writings, 'Das theologische System Zwinglis dargestellt' (Tübingen 1853). There are numerous biographies of this reformer, for example, 'Huldreich Zwingli, sein Leben und Wirken' (1895–97) by Stähelin. Consult also Jannsen, 'History of the German People' (1903).

GEORGE E. RINES.

ZWOLLE, zwŏl'lĕ, Netherlands, capital of the province of Overyssel on the Zwarte Water, 60 miles northeast of Amsterdam. Formerly it was a member of the Hanseatic League and was a strong fortress with 11 bastions and three forts. It is a well-built city, with handsome boulevards on the site of its ancient ramparts, and three fine suburbs. Its corn market is one of the best in Holland. Its chief buildings are Saint Michael's Church, dating from the 15th century, a large and splendid building with a famous organ; the government buildings with the provincial archives; the town-hall, dating from 1448, but since remodeled; and the courts of justice. The town has a Latin school, a school of navigation, an industrial school, a public library with rare works on geography and local history, a museum of natural history, a theatre, etc. Zwolle has communication with the sea by means of the Willemsvaart Canal and is the centre of the northern and eastern canal systems of the Netherlands. It manufactures oil, spirits, iron goods and linens, carries on shipbuilding and a trade in corn and cattle. In a monastery in the neighborhood Thomas à Kempis lived and died. Pop. (1937) 43,458.

ZYLONITE, XYLONITE, same as celluloid. See CELLULOID.

ZYLONITE, a material made by treating cellulose or vegetable fibre with nitric and sulphuric acids, dissolving the resulting pulp in camphor and then drying it. In its liquid state, collodion, it was used in surgical operations as early as 1848; in 1855 zylonite was manufactured by Alexander Parkes of Birmingham, England, and put on the market as parkesine. About the same time several factories for the manufacture of zylonite were established in France and Germany, England and the United States. In 1869 celluloid (q.v.), a kind of zylonite, was first manufactured and has entirely superseded all other forms of zylonite.

ZYMOTIC DISEASE, any disease caused and continued by a living germ introduced from without into the body and there multiplied. The term was formerly applied to epidemic and endemic contagious diseases because they were supposed to be produced by some morbific principle acting on the system like a ferment (Greek *ζύμη*). The chief of such diseases include measles, scarlet fever, smallpox, typhus, diphtheria, whooping-cough, croup and erysipelas (qq.v.). With the development of present theories and scientific knowledge of infectious disease, the term zymotic has been almost abandoned. See BACTERIOLOGY; DISEASE, GERM THEORY OF; MALARIA; NOSOLOGY.

Arctic
ELLESMERE I.
Baffin Bay
GREENLAND
WRANGEL I.
VICTORIA I.
BAFFIN I.
USSR
SIBERIA
ALASKA
Nome
Godthaab
Hudson Bay
Bering Sea
Juneau
North
KAMCHATKA PENIN.
CANADA
ALEUTIAN IS.
Vancouver
Montreal
Ottawa
Toronto
Quebec
St. John's
North Pacific
Chicago
Atlantic
UNITED STATES
New York
San Francisco
Denver
Washington
AZORES
Ocean
Los Angeles
New Orleans
Houston
BERMUDA
Ocean
MIDWAY IS.
Gulf of Mexico
MEXICO
BAHAMAS
Havana
Honolulu
HAWAII
Mexico City
CUBA
HAITI
WAKE I.
BR.HON.
VIRGIN IS.
DOM.REP.
PUERTO RICO
GUATEMALA
HON.
Caribbean
NIC.
Sea
EL SALVADOR
Caracas
MARSHALL IS.
CLIPPERTON
COSTA RICA
VENEZUELA
PANAMA
COLOMBIA
Bogotá
GUIANAS
GILBERT IS.
EQUATOR
GALÁPAGOS IS.
Quito
ECUADOR
SOLOMON IS.
ELLICE IS.
MARQUESAS IS.
PERU
BRAZIL
SAMOA
Lima
La Paz
NEW HEBRIDES
TUAMOTU ARCH.
BOLIVIA
FIJI IS.
Sucre
Rio de Janeiro
PARAGUAY
NEW CALEDONIA
SOCIETY IS.
Asunción
São Paulo
PITCAIRN I.
CHILE
South Pacific
Santiago
URUGUAY
Buenos Aires
Montevideo
Tasman Sea
NEW ZEALAND
Wellington
ARGENTINA
Ocean
FALKLAND IS.
N
TIERRA del FUEGO
S. GEORGIA
S. ORKNEY IS.
S. SHETLAND IS.
PALMER PENINSULA
Weddell Sea
ANTARCTICA
MARIE BYRD LAND

THE WORLD

ENCYCLOPEDIA AMERICANA MAP

BY HAROLD K. FAYE